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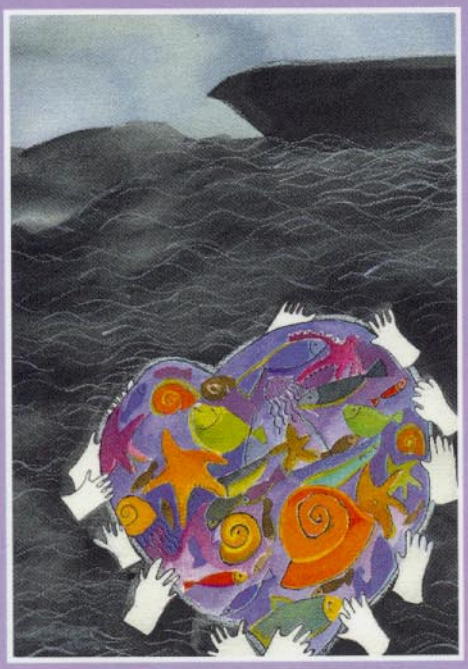
EFECTOS ECONÓMICOS, SOCIAIS E AMBIENTAIS DA MAREA NEGRA DO "PRESTIGE"



ECONOMIC, SOCIAL AND ENVIRONMENTAL EFFECTS OF THE "PRESTIGE" SPILL

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CONSELLO
DA CULTURA
GALEGA

SECCIÓN DE CIENCIA, TÉCNICA E SOCIEDADE

EFECTOS ECONÓMICOS, SOCIAIS E AMBIENTAIS DA MAREA NEGRA DO "PRESTIGE"

ECONOMIC, SOCIAL AND ENVIRONMENTAL EFFECTS OF THE "PRESTIGE" OIL SPILL

SEMINARIO CIENTÍFICO INTERNACIONAL
SANTIAGO 7-8 DE MARZO DE 2003

INTERNATIONAL SCIENTIFIC SEMINAR
SANTIAGO, MARCH 7-8TH, 2003

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AERNA

SECCIÓN DE CIENCIA, TÉCNICA E SOCIEDADE

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PRESENTACIÓN

O Consello da Cultura Galega é unha entidade propia da Autonomía de Galicia que, como se define e considera no seu Estatuto, ten como funcións primordiais a de realizar estudios e a de emitir informes para o Parlamento e a Xunta de Galicia no ámbito da cultura, entendida esta nun senso amplo e integrador.

Desde a súa creación, hai agora xa vinte anos, o concepto de cultura que se tivo en conta tentaba superar a visión tradicional de considerar só como tal o mundo das artes e das letras e, por iso, entre as súas seccións iniciais estaba a de Patrimonio Natural. De todos os xeitos, as interaccións entre as diferentes seccións, sobre todo cando se consideraban as que se podían establecer entre a cultura científico-técnica e as outras culturas, eran practicamente inexistentes. Por iso, recentemente (hai agora catro anos) creouse a Sección de Ciencia, Técnica e Sociedade cunha vocación declarada de tentar establecer un diálogo, e polo tanto un achegamento, entre as ciencias e a sociedade en xeral. Deste xeito, todos aqueles contornos onde as ciencias sociais e as físico-naturais entraban en interacción foron os seus temas de elección e, por iso,

PRESENTATION

The Consello da Cultura Galega (Galician Council for Culture) is an organisation pertaining to the Autonomous Government of Galicia, which, as defined and established in its Statutes, has as its principal task the preparation of studies and publication of reports for the Parliament and the Xunta (Autonomous Government) of Galicia on the field of culture, taken in a broad and comprehensive sense.

Since its creation twenty years ago, the concept of culture that informs the work of the Council has attempted to go beyond that traditional vision which concerns solely with the world of arts and letters, and for that reason one of its initial departments was allocated to Natural Heritage. In any case, interaction between the different departments, particularly when considering relations that could be established between scientific-technical culture and other cultures, was practically non-existent. For that reason recently, four years ago, the Department of “Science, Technology and Society” was created, with the explicit purpose of attempting to establish a dialogue, and thus a closer relationship, between sciences and society in general. Thus, all those areas in which social and physical and natural sciences interacted

tamén esta Sección foi a encargada de colaborar na organización deste Seminario.

A catástrofe do petroleiro *Prestige*, con múltiples implicacións nos eidos das ciencias físico-naturais e sociais, foi desde o primeiro momento un motivo de fonda preocupación desta Sección e mesmo de todo o Consello da Cultura Galega. Sobre todo, se se consideraba o extraordinario impacto que supuxo non só para os recursos naturais e a economía de Galicia, senón para a conciencia colectiva do país. Por iso, ó coincidir nos obxectivos e mesmo nos valores postos en cuestión coa Asociación Hispano-Portuguesa de Economía de los Recursos Naturales y Ambientales, considerouse xa, desde os primeiros días da catástrofe, a conveniencia de sumar esforzos e artellar un seminario de estudio con esta temática.

Os obxectivos semellaban claros: coñecer de mans dos expertos internacionais e nacionais xa experimentados nestas tarefas as metodoloxías máis axeitadas para avaliar os impactos económicos desta catástrofe. Ben entendido que o concepto de valor económico considerado non era só o definido polos mercados, senón que na lóxica da que se coñece como "economía ambiental" había outros máis que se debían ter moi en conta, o que inauguraba unha nova contabilidade da natureza.

Hai trinta anos non existía a penas conciencia ambiental. A partir do Cumio da Terra en Estocolmo no ano 1972 comezou a espallarse polo mundo enteiro unha nova sensibi-

were its chosen subjects of study, and so this department was also given the task of participating in the organisation of this seminar.

The catastrophe of the oil tanker *Prestige*, with its multiple implications in the fields of the physical, natural and social sciences, was from the first moment a profound cause for concern for this department and for the entire Consello da Cultura Galega. Particularly considering the extraordinary impact that it had not only on Galicia's economy and natural resources, but also on the country's collective consciousness. So, given the agreement in terms of objectives and of the values at stake with the Asociación Hispano Portuguesa de Economía de los Recursos Naturales y Ambientales (Hispano-Portuguese Association of Natural Resource and Environmental Economics), from the earliest days of the catastrophe, it was considered appropriate to join forces to prepare a study seminar on this issue.

The objectives seemed clear: to learn from international and national experts with experience in this work about the methods best suited to evaluate the economic impacts of the catastrophe. With the understanding that the concept of economic value to be examined was not only that defined by the market, but rather, following the logic of what is known as "environmental economy", that there were other concepts to be taken into account, which initiated a new green accounting.

Thirty years ago environmental awareness scarcely existed. Starting with the Earth Summit in Stockholm

lidade cara á conservación dos recursos naturais e a defensa da calidade do medio. E hoxe, sobre todo na parte máis desenvolvida do planeta, está a xurdir o que ben se pode definir xa como unha nova cultura: unha cultura ambiental. Por iso, este Consello, atento a todas as novidades culturais que poidan xurdir e que teñan unha fonda implicación sobre a realidade galega, ten que felicitarse por esta iniciativa que agora bota a andar.

Francisco Díaz-Fierros
Consello da Cultura Galega

in the year 1972, a new sensitivity to the need for conservation of natural resources and the defence of environmental quality began to spread throughout the world. Today, particularly in the most developed part of the planet, something is emerging which might well be defined as a new culture: an environmental culture. Thus this Consello, alert to any new cultural developments that might emerge and have a profound significance for the reality of Galicia, can do no less than congratulate itself on this new initiative that now has its beginning.

Francisco Díaz-Fierros
Consello da Cultura Galega

PRESENTACIÓN

As ciencias sociais foron postergadas pola administración pública española á hora de se realizaren os estudios das consecuencias dos vertidos catastróficos sobre a vida salvaxe e as riquezas naturais dos lugares afectados. Pero non é sorprendente este proceder dos gobernos nunha sociedade como a española aínda marcada pola, ata hai poucos anos, escaseza de case todo. Os problemas ambientais non son unha das maiores preocupacións dos españois, e, en consecuencia, os gobernantes, sexan dunha ou doutra ideoloxía, actúan en coherencia co sentir e co comportamento dos cidadáns nas urnas cando votan.

Espérase de calquera sociedade complexa que os gobernos tomen decisións sobre *asuntos de Estado* sen sometelas á opinión dos cidadáns na *arena electoral* ou no Parlamento. Neste sentido, considerando as *catástrofes ambientais* como *cuestións de Estado*, debe atribuírse a responsabilidade principal da ausencia de participación das ciencias sociais na análise (e as medidas conseguintes ó dano ambiental) á pasividade dos gobernos español e da Unión Europea, que non abordaron ata o momento solucións que mitiguen os desastres ambientais do transporte de mercadorías

PRESENTATION

Social sciences have been passed over by the Spanish public administration when doing studies on the consequences of the catastrophic oil spills on the wildlife and natural wealth of the affected areas. But this behaviour is not surprising in the governments of a society like Spain which is still marked by the effects of what was, up to a few years ago, a shortage of almost everything. Environmental problems are not one of the major preoccupations for Spaniards, and as a result, government officials of whatever ideology, act in a way that is consistent with the feelings and behaviour of citizens, as reflected in their vote.

It is to be expected in any complex society, governments will make decisions on *matters of state* without submitting them to the opinion of citizens in the *electoral arena* or in parliament. In this sense, considering *environmental catastrophes* as *matters of state*, the main responsibility for the absence of participation of social sciences in the analysis and subsequent measures for dealing with environmental damage must be ascri to the passivity of the Spanish government and the European Union, which have not, up to the present moment, confronted the solutions that would mitigate the effects of environmental disasters occasioned by the

perigosas e que obriguen ós causantes dos danos a indemnizar os afectados.

Malia a feble preocupación ambiental que manifestan a sociedade civil e a administración pública española, tamén existiron razóns no propio seo da ciencia económica que contribuíron a esta carencia, atribuíbles tanto á dificultade que no pasado a ciencia económica atopou para desenvolver métodos de valoración de beneficios e danos ambientais (non comerciais) como ás controversias filosóficas e políticas entre as diversas correntes de economistas[1].

A valoración dos danos non comerciais avanzou extraordinariamente na última década. O caso da marea negra do petroleiro *Exxon Valdez* (1989) ha de recoñecerse que foi protagonista dos avances máis significativos na aceptación dos resultados da valoración ambiental por consenso entre a empresa propietaria e a administración ambiental estadounidense, e tamén polo recoñecemento do método de valoración continxente por parte de insignes economistas laureados co premio Nobel de Economía. Pero ha de sinalarse que o reto principal ó que se enfronta a valoración ambiental é a súa aceptación nas demandas xudiciais de compensación, e moi especialmente nos casos dos danos ós usos pasivos,

1. Neste último caso destaca a frecuencia coa que aínda moitos economistas reducen as súas análises económicas ó ámbito dos bens e dos servicios comerciais e ó orzamento público, ó tempo que ignoran os efectos das actividades comerciais sobre os bens e os servicios ambientais económicos.

transport of dangerous merchandise and that would oblige those causing the damage to compensate those affected.

Despite the lukewarm environmental concern that can be observed in Spanish civil society and public administration, reasons have also existed in the very heart of economic science itself that have contributed to this relative indifference, attributable both to the difficulty that in the past economic science has met with in attempting to develop methods for valuation of (non-commercial) benefits and environmental damages and to the philosophical and political controversies between different schools of thought among economists[1].

The valuation of non-commercial damages has seen extraordinary advances in the last ten years. The case of the *oil slick* caused by the tanker *Exxon Valdez* (1989) must be recognised as the origin of the most significant advances in the acceptance of the results of an environmental valuation by consensus between the owner company and the United States' environmental authority and also for the recognition of the contingent valuation method by distinguished economists, winners of the Nobel Prize for Economics. But it should be pointed out that the principal challenge environmental valuation confronts is its

1. In this last case what stands out is the frequency with which many economists still reduce their economic analyses to the sphere of commercial goods and services and to the public budget, while they ignore effects of commercial activities on environmental economic goods and services.

como é o caso do dano ós ecosistemas naturais salvaxes[2].

As controversias entre os economistas sobre a robustez teórica das valoracións ambientais gañou terreo a favor das normalizacións das técnicas que faciliten a súa incorporación á lexislación futura das indemnizacións por danos ambientais e no cálculo da renda nacional ampliada ós bens e ós servicios ambientais.

Neste último caso a economía ambiental pode realizar unha decisiva contribución á mediación da renda nacional e incorporar os servicios ambientais autoconsumidos polos propietarios privados dos ecosistemas naturais. Este autoconsumo ambiental do propietario alcanzou en moitos ecosistemas naturais unha importancia moi notable. O valor capital do autoconsumo ambiental é *interiorizado* polo mercado, é dicir, é unha mercadoría, e como tal mercadoría económica o seu fluxo de renda ten de formar parte da renda nacional medida polo actual sistema normalizado[3]. En estudios recentes desenvolvéronse forma-

acceptance in legal suits for compensations and particularly in cases of damage to passive uses, as is the case with damage to wild natural ecosystems[2].

In the controversies between economists on the theoretical robustness of environmental valuations terrain has been won in favour of the normalisation of the techniques that facilitate their incorporation in future legislation on compensation for environmental damages and in the calculation of expanded national income to include environmental goods and services.

In this last case environmental economics can make a decisive contribution to the measurement of national income by incorporating environmental services self-supplied by private owners of natural ecosystems. This environmental self-supply of the owner has in many natural ecosystems attained considerable importance. The capital value of environmental self-supply is interiorised by the market, in other words, it is a marketed good, and as economic marketed good its income flow most be included in national income measured by the current normalised system[3]. In recent studies, for-

2. En España, coma na Unión Europea, non existe un marco legal específico que contemple a indemnización ós particulares e á sociedade no seu conxunto polos danos causados ós valores naturais e ambientais consumidos polo público en forma de libre acceso.

3. A lexislación española sobre a valoración de propiedades rústicas recoñece a *interiorización* polo mercado dos servicios "paisaxísticos" e "ecolóxicos" (que nesta presentación se denominan "servicios ambientais autoconsumidos") na estimación do prezo do mercado polo método analítico na valoración das propiedades rústicas (BOE, 1994: 37.503, apartado 5.7).

2. In Spain, as in the European Union, there does not exist a specific legal framework that provides for compensation to individuals and to the society as a whole for damages caused to natural and environmental values to which the public has free access.

3. Spanish legislation on valuation of country property recognises the interiorisation by the market of "landscape" and "ecological" services (which in this presentation are called self-supplied environmental services) in the estimation of the market price by the analytical method in the valuation of country properties (BOE, 1994: 37.503, section 5.7).

tos axeitados para as enquisas de valoración continxente que permiten ofrecer unha cuantificación sistemática e obxectiva do autoconsumo ambiental dos propietarios integrado na contabilidade nacional.

A pesar de producirse notables avances nas dificultades sinaladas para posibilitar a valoración de danos e beneficios ambientais, ha de constatarse a ausencia aínda da incorporación da valoración ambiental nos sistemas normalizados que se aplican da contabilidade nacional e, con maior insistencia, ha de sinalarse a falta dun marco legal significativo que incorpore a compensación por danos ambientais pasivos, aínda que se van producindo avances legais limitados como a *Oil Pollution Act* (1990) da NOAA en Estados Unidos[4] e o *autoconsumo ambiental* na taxación de propiedades rústicas en España[5].

Neste contexto xeral de avance da economía ambiental fóronse constituíndo no mundo numerosas asociacións científicas co propósito de promover o avance do coñecemats for contingent valuation surveys have been developed that make it possible to offer a systematic and objective quantification of environmental self-consumption of owners, integrated into national accounts.

In spite of having procured notable advances with regard to the difficulties mentioned in making possible the valuation of environmental damages and benefits, it is necessary to point to the absence of any incorporation of environmental valuation in normalised systems applied to national accounting, and with greater insistence it is necessary to indicate the lack of a significant legal framework that includes compensation for passive environmental damages, though limited legal advances are being made, such as the *Oil Pollution Act* (1990) of the NOAA in the United States[4] and *environmental self-consumption* in the taxation of country property in Spain[5].

In this general context and as a step forward in environmental economics, a number of scientific associations has been founded throughout the world with the objective of promoting progress

4. National Oceanic and Atmospheric Administration (NOAA), (1993): *Advance notice of proposed rulemaking, extension of commentperiod and release of contingent valuation methodology report* (15 CFR Charper IX). Federal Register do Department of Commerce (DOC), vol. 58, n.º 10, Natural Resource Damage Assessments Under the Oil Pollution Act of 1990, 58 FR 4601, Date: Friday, January 15, 1993.

5. Boletín Oficial del Estado (BOE), 1994. Orde 27.365, do 30 de novembro de 1994, sobre *normas de valoración de bienes inmuebles para determinadas entidades financieras*. Boletín Oficial del Estado, n.º 297, do 13 de decembro de 1994: 37.489-37.512.

4. National Oceanic and Atmospheric Administration (NOAA), 1993: *Advance notice of proposed rulemaking, extension of comment period and release of contingent valuation methodology report* (15 CFR Chapter IX). Federal Register of the Department of Commerce (DOC), Vol. 58, number 10, Natural Resource Damage Assessments Under the Oil Pollution Act of 1990, 58 FR 4601, Date: Friday, January 15, 1993.

5. Official Gazette of the Spanish State (BOE), 1994. Order 27365 of 30 November, 1994, on *norms of valuation on real assets for specific financial institutions*. *BOE*, number 297 of 13 December, 1994: 37489-37512.

mento das relacións entre a economía e o ambiente e influír nos gobernos, nos axentes económicos e noutros grupos sociais para acabar coa destrucción das riquezas naturais e ambientais, e para contribuír á mellora da renda e do benestar das poboacións que sofren polo esgotamento dos recursos naturais e polos danos materiais que lles afectan.

Na Península Ibérica creouse hai un ano a Asociación Hispano-Portuguesa de Economía de los Recursos Naturales y Ambientales (AERNA) e, como primeiro acto público, en colaboración co Consello da Cultura Galega, organiza este Seminario científico internacional sobre os efectos económicos, sociais e ambientais da marea negra do *Prestige*. AERNA é consciente de que, nestes momentos, necesita despregar todo o esforzo que lle sexa posible para estudiar, na súa enteira complexidade e durante o tempo que sexa preciso, os danos comerciais e ambientais da marea negra do *Prestige*, que por desgracia, e dada a natureza do desastre ocorrido, requirirá moito tempo, ata que poidan chegar a ser coñecidos os seus efectos con rigor científico.

Esta obra presenta, por tanto, a primeira actuación de AERNA en forma de *seminario científico internacional*, que con toda seguridade vai convencer os lectores da necesidade de que existan asociacións como AERNA para prover de información veraz e sistemática sobre o presente e o futuro dos efectos da marea negra do *Prestige*.

Os científicos dispoñen dun capital de coñecementos valioso, pero moi pouco con-

in knowledge of the relations between economics and the environment and of influencing governments, economic agents and other social groups to mitigate the destruction of natural and environmental wealth and to contribute to improvements in the income and welfare of the populations that suffer from the exhaustion of natural resources and from the environmental damages that affects them.

On the Iberian peninsula the *Spanish-Portuguese Association of Natural Resource and Environmental Economics* (AERNA) was created a year ago, and as its first public event it organised, in cooperation with the *Consello da Cultura Galega*, this *International Scientific Seminar* on the economic, social and environmental effects of the *Prestige oil slick*. AERNA is aware that, at this time, it needs to make every possible effort to study, in all its complexity and during the period of time that might be necessary, the commercial and environmental damage caused by the *Prestige oil slick*, which unhappily and given the nature of the disaster that occurred, will take a long time, until the effects can be understood with full scientific rigor.

This work thus presents AERNA's first action in the form of an *International Scientific Seminar*, which is undoubtedly going to convince its readers of the need for associations like AERNA to exist, in order to provide reliable and systematic information on the present and the future of the effects of the *Prestige oil slick*.

Scientists have a valuable capital of knowledge, but this knowledge would contribute very little to the improvement of knowledge of reality if there

tribuiría este capital á mellora do coñecemento da realidade se non houbese outras institucións dedicadas a achegar os recursos financeiros que fan posible a organización dunha reunión científica altamente especializada, como esta que deu lugar á presente publicación. AERNA quere agradecerlle ó Consello da Cultura Galega o apoio financeiro e loxístico, ambos os dous indispensables, que brindou para a celebración e publicación das conferencias presentadas no seminario.

Como os lectores teñen nesta obra todos os traballos do seminario, non se mencionarán agora todos os contidos por razón de facer máis breve esta presentación. Unicamente parece oportuno advertir sobre o contexto e o instante en que ve a luz esta publicación, para que se saiba desculpar a ausencia de valoracións económicas precisas e verdadeiras sobre a realidade presente e futura dos efectos comerciais e ambientais provocados polo vertido de fuel do *Prestige*. Necesítanse moitas investigacións novas, que deben realizarse durante os próximos anos, para ofrecer os resultados científicos que AERNA espera acadar co traballo dos seus membros e coa colaboración doutros científicos nacionais e estranxeiros.

Pablo Campos Palacín
Presidente de AERNA

were not other institutions devoted to providing the financial resources that make possible the organisation of a highly specialised scientific meeting such as this one, which has resulted in the present publication. AERNA wishes to thank the *Consello da Cultura Galega* for the indispensable financial and logistical support it has provided for holding the meeting and for the publication of the papers presented at the Seminar.

Since readers have all the work of the Seminar available in this book, we will not go on to discuss its contents here, in order to shorten this presentation. It does, however, seem appropriate only to remind them of the context and moment when this publication came out, so that they will understand the need to excuse the absence of precise, real economic valuations on the present and future reality of the commercial and environmental effects caused by the *Prestige* spill of fuel oil. Much new research work, which should be done over the coming years, is necessary in order to offer the scientific results that AERNA hopes to be able to provide through the work of its members and the cooperation of other scientists here and abroad.

Pablo Campos Palacín
President of AERNA

PRESENTACIÓN DOS COORDINADORES

Este libro é froito da xenerosidade e da sensibilidade social de moitas persoas. Cando nos últimos días do mes de novembro de 2002 recibimos unha proposta intelectual, para enfrontarnos ás consecuencias das mareas negras que rachaban aquel inverno, por parte do coordinador da Sección de Ciencia, Técnica e Sociedade do Consello da Cultura Galega, abríronse doada e paseniñamente unha chea de portas –inzadas todas de intelixencia e experiencia sobre problemas ambientais– que fixeron posible celebrar axiña (7-8 de marzo de 2003) un *Seminario Internacional sobre os Efectos Económicos, Sociais e Ambientais da Marea Negra do Prestige*. De tal Seminario o lector ten nas súas mans a versión impresa e bilingüe de todas as comunicacións escritas xunto coas conclusións.

A primeira porta en abrirse foi a de Pablo Campos, presidente de AERNA, que entendeu de inmediato a magnitude e dificultade –científica e institucional– de facer fronte a tal desastre. Logo viñeron as do resto de investigadores convocados que, en máis dun caso, tomaran eles mesmos a iniciativa de ofrecer a súa axuda e pórse á nosa disposición. Dende

PRESENTATION BY THE COORDINATORS

This book is the result of many people's generosity and social sensitivity. It was in the last days of November 2002 when we faced the intellectual challenge of assessing the consequences of the black tides arriving in that dark winter. The proposal came from Director of the Section of Science, Technology and Society of Consello da Cultura Galega. Many doors opened without any doubts or questions– a lot of people with broad experience in similar environmental problems made it possible to organize in a short time the International Seminar about the *Economic, Social and Environmental Effects of the Prestige Oil Spill* (March 7th-8th, 2003). The printed and bilingual version of the conferences, and the main conclusions of that seminar are compiled in this book.

The first opened door was that of Pablo Campos, AERNA's President. He inmediately understood the importance and difficulty – both scientific and institutional – of trying to enlighten the effects of the disaster. Then many other researchers appeared, and most of them took the iniciative and offered us their help and knowledge. From very distant places (California or Alaska), from our neighbours in

lugares ben distantes (California ou Alasca) ata a veciña Bretaña, e dende o País Vasco a Madrid, pasando polo máis que veciño Portugal. Ninguén se desculpou, ninguén tiña outra cousa máis importante que facer... e mesmo houbo que deixar capacidades fóra para outras ocasións –algunhas das cales, nas datas en que isto se escribe, afortunadamente, están xa en marcha[1]–.

Pero o empeño non era só académico senón tamén social. O presidente e o secretario do Consello Económico e Social de Galicia impulsaron a participación dos axentes que aglutinan, e os medios de comunicación[2] (é obrigado recoñecer en especial as entrevistas que fixeron Juan Capeáns, Xosé Hermida e Tino Santiago) permitíronnos chegar ó público xeral que estaba daquela a buscar criterios, información veraz e esperanza para o futuro. Houbo amigos que nos axudaron dende Carnota-Muros (Manolo Sendón e Carme Monteagudo) ou dende Camariñas (Marisol Soneira) a mesturar a xente de fóra coa xente e o problema de aquí. Especial agradecemento debemos amosarlles ó alcalde de Carnota e á Confraría de Mariñeiros de Lira, que nos ofreceron a súa visión e amosaron un sincero

1. Curso de Verán na Universidade Internacional Menéndez Pelayo en Pontevedra *Os custos sociais, económicos e ambientais das mareas negras*, Pontevedra, 22-26 de setembro de 2003.

2. Algunhas das imaxes e mapas deste libro foron tiradas de *La Voz de Galicia*, que fixo naquelas datas un excelente traballo.

Britanny, the Vask Country, Madrid, and also from Portugal – even closer than a neighbour. Nobody apologized, nobody had anything more important to do... even we must leave out interesting possibilities – some of them are now fortunately joining other events taking place[1]–.

But the attempt was not only scientific but also social. The President and the Secretary of the *Social and Economic Galician Council* promoted the participation of the social agents they represent, and the media[2] (specially, we must thank the interviews done by Juan Capeáns, Xosé Hermida and Tino Santiago) allowed us to reach the overall population, which at that time were looking for criteria, thrustful information and hope for the future. There were good friends from Carnota-Muros (Manolo Sendón and Carme Monteagudo) and from Camariñas (Marisol Soneira) that guide us to find the perfect mixture among people coming from outside with the inside problem. Also the Major from Carnota and the secretary of the fishermen association (Confraría) of Lira deserve an special gratitude, because they offered us their view and they showed a sincere interest about the information that

1. Summer Course of the Universidad Internacional Menéndez Pelayo in Pontevedra *The social, economic and environmental costs of black tides*, Pontevedra, September 22nd-26th, 2003.

2. Some of the images and maps of this book were obtained from *La Voz de Galicia* (Galician journal).

interese por todo o que nesta xuntanza se ía discutir.

E houbo moitos compañeiros do Departamento de Economía Aplicada da Universidade de Vigo (profesores –Tuco, Arantza, Calu, Olga, Xavier, Ana, Mario, Marcos...–), sen os que o empeño non tería sido posible. Logo viñeron todos os inscritos –membros de AERNA, investigadores, alumnos, políticos, sindicalistas, empresarios, etc.–, que nos agasallaron co seu interese e participación, sempre indo a máis. Ánxeles Ferrer cedeunos unha acuarela feita co corazón, Panatrade S.L. traballou nas traduccións, Teresa Pérez –do Consello da Cultura– foi imprescindible en todos os momentos, antes, durante e despois do seminario. Tamén nisto a sociedade estivo á altura das graves circunstancias do país; todos nós non fomos máis que a póla dunha inxente mobilización social.

Este libro é por iso unha obra estrictamente colectiva. Mais o libro debe tamén explicarse por el mesmo. Nese senso, para explicar como se elixiron os temas e o enfoque destes, paga a pena contestar –dende o punto de vista dos coordinadores– brevemente a dúas preguntas: ¿que pezas do quebracabezas... se reclamaron dos diversos autores?, ¿e con que criterio?

A marea negra do *Exxon Valdez* de 1989 en Alasca (de menor contía e toxicidade cá do *Prestige*) marcou un antes e un despois nestes temas nos EE.UU. Os cambios legais internos e a saída do FIDAC por parte de EE.UU. como consecuencia deste accidente tiveron

was going to be presented in the meeting.

Also, the result would not have been possible without the support of a lot of workmates from the Department of Applied Economics of the University of Vigo (professors –Tuco, Arantza, Calu, Olga, Xavier, Ana, Mario, Marcos... –). The people registered for the seminar – members of AERNA, researchers, students, politicians, syndicalists, businessmen, etc. – offered us their interest and were and active audience. Anxeles Ferrer kindly donated a watercolour painted with her heart, Panatrade SL worked in the translations, Teresa Pérez –from Consello da Cultura– was always esential, before, during and after the seminar. Society was up to the serious circumstances; all of us were only a small branch of the big tree, the strong social reaction to the disaster.

Therefore, this book is a colective work. But the book may also be explainable by itself. To understand how the topics were chosen and how were they focused, the coordinators of the seminar and of this book, must answer two essential questions: what pieces of the puzzle were asked to the authors?... and why we choose them?

The black tide of 1989 in Alaska caused by the *Exxon Valdez* (of crude, less toxic than fuel, and with less tons spilt than in the *Prestige*) implied major changes in maritime tranport safety in the US. The purpose of the change in the US legal framework and the leaving of the IFOP system after this accident was to make prevention the optimum strategy for firms related to maritime tranport of oil. And this could only be

un norte: facer rendible a prevención dos desastres, pola vía de converter en ilimitados os custos para o responsable de facerlle fronte, en caso de acontecer, ó desastre.

E non só foi o caso de Alasca un exemplo polos 2000 millóns de dólares que a Exxon tivo que gastar na limpeza do litoral, ou a cifra aínda maior que se preitea nos tribunais para pagar á poboación local... senón tamén polos 1000 millóns que houbo que pagar ó Estado de Alasca para paliar e restaurar os danos ó patrimonio natural colectivo. Richard Carson dirixiu un estudio de referencia mundial que, por vez primeira, puxo enriba da mesa estimacións destes danos públicos e colectivos, e Molly MacCammon leva xa máis de dez anos xestionando o Fondo Público que cos 1000 millóns se constituíu como indemnización por estas perdas colectivas e se dedicou a conservar a biodiversidade en Prince William Sound; e aínda falou en Compostela do moito traballo que queda por facer. Dende o primeiro momento en que o fuel emporcou boa parte da nosa costa, os 170 millóns de euros cos que contaba o FIDAC para todo o desastre deixaban ás claras tanto a nova estafa social que se aveciñaba como a ineficacia do marco lexislativo europeo para evitar esta e outras mareas negras.

Claro que do marco europeo e do actual FIDAC levan os colegas franceses laiándose dende hai décadas e comprobando (dende o *Amoco Cadiz* no 1978 ata o *Erika* no 1999) a súa ineficacia como instrumento tanto compensatorio como disuasorio. F. Bonnieux e P. achieved with unlimited liability ex post (after the spill).

Alaska was the model to follow not only due to the 2 billion $ that Exxon had to pay for the cleanup of the coast, or by the even higher demand of money to compensate local population, that is still on court... but also by the one billion $ that Exxon paid to the State of Alaska for the loss of colective non-use values. Richard Carson directed a pioneering and reference study that put over the table economic estimates of these public and colective losses, and Molly MacCammon has managed, since then, the public fund created with this money to preserve and enhance biodiversity in Prince William Sound. And as she told in Compostela, there is still a lot of work to be done. Since the first arrival of fuel to the Galician coast, it was obvious that the IFOP system, with 170 million euros available for compensations, was a new social fraud and that the legal framework was inefficent to prevent disasters like that.

But our French colleagues have been complaining for decades about the European legislation and the IFOP system and proving (since the *Amoco Cadiz* in 1978 to the *Erika* in 1999) its inefficiency as a compensatory and dissuasive instrument. F. Bonnieux e P. Rainelli have two decades of research effort behind them, a broad experience in economic assessment of damages (public and private, on fisheries, tourism and recreation) from black tides, and always with the same conclusion (summarized by O. Thebaud, D. Bailly, J. Hay and J. Pérez): the liability fund our countries

Rainelli teñen ás costas dúas décadas de esforzos en poñer enriba da mesa a avaliación económica de todos os danos (públicos e privados, na pesca, no turismo e no lecer) nesas mareas negras, e sempre cun mesmo corolario (do que establecen un sumario O. Thebaud, D. Bailly, J. Hay e J. Pérez): o Fondo de responsabilidade ó que pertencemos os europeos non foi –nin é– garante da conservación dos nosos mares e da prevención das mareas negras. Taxativamente: emporcar é barato, non facelo é mais caro.

Nesta situación estabamos e, inexorablemente, despois do *Erika* chegou o *Prestige*. Claro que España sendo Europa non é Francia, nin había aquí Total-Fina-Elf. De como se entenden as crises ambientais nas nosas latitudes tiñamos un exemplo de manual na riada tóxica de Doñana no 1998, por iso o traballo de J. López Linage era neste punto crucial. As diferencias na xestión da crise e no seguimento e reclamación de danos cos enfoques foráneos máis avanzados resituábannos nun esperpéntico *celtiberia show* que se volvía reproducir no caso do *Prestige*. ¿Sairemos galegos, españois, bretóns, franceses... europeos, da rede temeraria da que si o fixeron os norteamericanos?

Para facelo era preciso, inicialmente, situar esta nova marea negra por vez primeira na fronteira do que se levaba aprendido no mundo para evitalas. Ese é o sentido da introducción que asinamos M. Varela e os coodinadores do Seminario. Tamén era necesaria a presentación da axenda de traballo futuro que se ía realizar –que asinamos nós mesmos– en custos de limpeza e restauración, danos turísbelong to, has not been– and it is not yet – any guarantee of sea conservation and prevention of oil spills. Polluting is cheap, and not to do it is more expensive.

We were in this situation and, unavoidably, after the *Erika* the *Prestige* accident occured. And Spain is Europe but it is not like France, and in this case there was not Total-Fina-Elf. To understand the typical reaction to a serious environmental problem in our country it may be very informative the example of the toxic flood in Doñana, in 1998. So, we consider the work of J. López Linage as crucial to explain the management of the crisis and the compensation claims compared with similar foreign events, a kind of iberian show that is happening again with the *Prestige*. Will Galicia, Spain, Britanny, France, … europeans go out of the reckless system as the americans did?.

To solve our challenge, the first step was to place this new oil spill in the frontier of what the world had learned to avoid these problems. This is the sense of the introduction signed by M. Varela and the coordinators of the seminar. It was also necessary the presentation of the agenda for future work – signed also by us – related to the cleanup and restoration costs, damages related to recreation and tourism, to nature and the direct and indirect damages to sea products –signed by J.C. Surís and M.D. Garza–. The previous experience with the *Aegean Sea* that M.C. García summarized in the Seminar must also be taken into account.

tico-recreativos, ó patrimonio natural, e mais os directos e indirectos ós recursos e productos do mar –que asinan J. C. Surís e M. D. Garza–. A experiencia previa no *Aegean Sea* que M. C. García presentou no Seminario debemos tela tamén en conta.

Das interaccións de todas estas achegas tiña que xurdir unha axenda de traballo colectivo que se ía executar nos vindeiros dous anos. Necesariamente colectivo –dun equipo amplo e multidisciplinar– e académico, pero tamén un exercicio de compromiso social dende a comunidade científica.

Albino Prada Blanco
Mª. Xosé Vázquez Rodríguez

Finally, a timetable for the colective research to be done in the following two years arised from the interactions among all the contributions. It must necessarily be a collective work – with a broad and interdisciplinary team – and academic, but also an exercise of social compromise from the scientific community.

Albino Prada Blanco
Mª. Xosé Vázquez Rodríguez

INTRODUCCIŒN
INTRODUCTION

EFECTOS ECONÓMICOS DA CATÁSTROFE DO *PRESTIGE*. UN AVANCE

ECONOMIC EFFECTS OF THE *PRESTIGE* CATASTROPHE. AN ADVANCE

María Xosé Vázquez, Manuel Varela, Albino Prada

Universidade de Vigo / University of Vigo

1 INTRODUCCIÓN

Na tarde do 13 de novembro do 2002, un dos 1.400 petroleiros que anualmente navegan fronte ás costas de Galicia (mapa 1), con nome especialmente burlesco –*Prestige*–, fixo unha vía de auga a 30 millas ó oeste de Fisterra. O buque monocasco, de 25 anos de idade, transportaba 77.000 toneladas de fuel pesado dende Lituania con destino indeterminado. Abandeirado en Bahamas, o seu armador era grego e o fretador anglo-suízo.

Obviando calquera reflexión sobre os motivos, a partir dese momento os únicos feitos obxectivos son o remolque do buque durante os primeiros días seguindo unha traxectoria noroeste, e posteriormente ó sudoeste ata que o barco parte en dous e afunde, a 140 millas ó oeste das illas Cíes. Ata este momento (febreiro de 2003), estimacións oficiais indican que o petroleiro verte ó redor de 30.000 toneladas de hidrocarburo.

A fin de semana do 16 e 17, antes do afundimento, a Costa da Morte sofre a primeira marea negra (mapa 2), que afecta aproximadamente a 200 km de costa, entre Fisterra e A Coruña. De seguido, e sen acou-

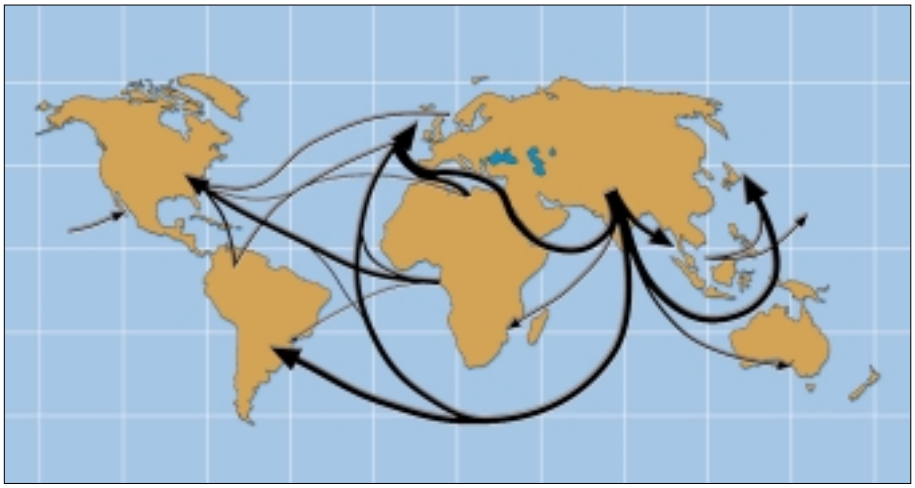
1 INTRODUCTION

In the afternoon of November 13, 2002, one of the 1,400 oil tankers that annually navigate off the coasts of Galicia (map 1), this one with a particularly inappropriate name – the *Prestige* – sprung a leak 30 miles west of Fisterra. The 25-year-old single-hull ship was transporting 77,000 tons of heavy fuel oil from Lithuania to an undetermined destination. Under a Bahamian flag, it was owned by a Greek shipping company and the charterer was Anglo-Swiss.

Leaving aside any consideration of motives, starting from this moment the only objective facts are the towing of the ship during the 14th and 15th, following a north-west course and subsequently going southwest until the vessel broke in half and sunk 140 miles west of the Cíes Isles. Up to this moment (February, 2003), official estimates indicate that the tanker has spilled in the neighbourhood of 30,000 tons of fuel oil.

On the weekend of the 16th and 17th, before the ship sank, the “Costa da Morte” (DEATH COAST) suffered the first oil slick, which affected approximately 200 km. of coastline, between Fisterra and A Coruña. After that, the

Mapa / Map 1
Principais rutas de tráfico mundial de hidrocarburos
Principal routes of world hydrocarbon traffic

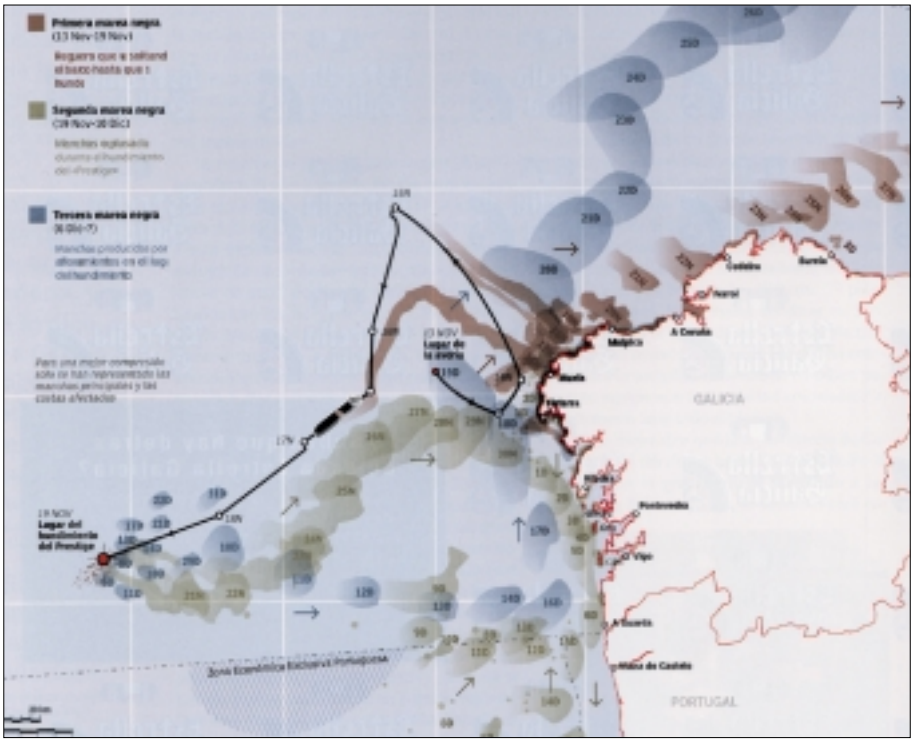


Fonte: COM (2000) 142 final / Source: COM (2000) 142 end.

go, a marea negra segue a golpear diferentes puntos da costa galega. Sen esquecerse nunca da Costa da Morte, expándese cara ó sur, alcanzando o Parque Nacional das Illas Atlánticas, que funcionou como muralla protectora das rías de Arousa, Pontevedra e Vigo. Nas semanas posteriores a chegada de fuel continua (mapa 2), e o cambio na dirección dos ventos dominantes fai que o chapapote alcance a costa cantábrica e mesmo a da Bretaña francesa. Por riba, dos tanques do barco afundido, a 3.600 metros de profundidade, continúan aflorando manchas de fuel que manteñen a ameaza mesmo varios meses despois do inicio da catástrofe.

oil slick continued incessantly to hit different points on the coast of Galicia. Besides the Costa da Morte, the slick extended toward the south, reaching the Islas Atlánticas National Park which served as a protective wall for the rías of Arousa, Pontevedra and Vigo. In subsequent weeks fuel oil continued to reach the coast (Map 2), and the change in the direction of the prevailing winds brought the oil spills to the coast of Cantabria and even Brittany, in France. In addition, from the tanks of the submerged vessel, at a depth of 3,600 metres, fuel oil slicks continue to appear on the surface, maintaining the threat several months after the beginning of the catastrophe.

Mapa / Map 2
Sucesivas mareas negras do *Prestige*
Successive *Prestige* Oil Slicks



Fonte/Source: *La Voz de Galicia-Los héroes del 13-N*, p. 12.

Este relato é consecuencia terrible e visible do risco que supón que o setenta por centro do tráfico de hidrocarburos que viaxa cara ó centro e norte de Europa ten como paso obrigado o corredor de Fisterra (COM 2000) (mapa 1). A lei de probabilidades é inexorable e a costa galega recibiu máis do dez por cento dos vertidos marítimos de petróleo do mundo.

This story is the terrible and visible consequence of the fact that seventy percent of hydrocarbon traffic to central and northern Europe is obliged to pass through the shipping corridor of Finisterre (COM 2000) (Map 1). The law of probability is inexorable and the coast of Galicia has received more than ten per cent of the world's maritime oil spills.

En consecuencia, tanto pola localización xeográfica das áreas implicadas, como polo alcance transfronteirizo dos efectos, estamos diante dun problema de alcance europeo e, polo tanto, centrarémonos a continuación en situar a visión económica dos efectos dunha marea negra, logo veremos como estes son incorporados dentro do marco lexislativo europeo actual, para rematar con algunhas reflexións sobre o futuro.

2 A VISIÓN ECONÓMICA DOS EFECTOS

Os efectos económicos dunha marea negra transcenden o evidente. En concreto, a economía ambiental considera como perdas todas as diminucións de benestar derivadas do vertido. Isto, que a primeira vista semella razoable, leva consigo unha visión máis ampla cá que se admite nos procesos de indemnizacións e no marco institucional vixente.

En primeiro lugar, os labores de limpeza e restauración das áreas alcanzadas polo fuel teñen uns custos claros e inmediatos, habitualmente asumidos polos gobernos con cargo ós orzamentos públicos. En segundo lugar, os colectivos que sofren as consecuencias máis evidentes son os que viven directamente do recurso, é dicir, os sectores da pesca, marisqueo, acuicultura e turismo (incluídos os sectores de hostalería e restauración). Ademais existen efectos indirectos para aqueles sectores que dependen dos anteriores ou da imaxe de marca do recurso. Aquí englóbase a transformación, o transporte, a distri-

Consequently, due both to the geographical location of the areas involved and to the cross-frontier range of the effects, we face a problem of European scope, and thus we will focus below on describing the economic vision of these effects and how they fit into the currently European legislative framework, closing with some thoughts on the future.

2 THE ECONOMIC VISION OF THE EFFECTS

The economic effects of an oil slick go beyond the obvious. Specifically, environmental economy considers as losses all the decrease in welfare resulting from the spill. This, which at first sight seems reasonable, is a broader vision than that the of processes for compensations and in the institutional framework now in force.

First, the work of cleaning and restoration of the areas affected by the fuel oil have costs that are clear and immediate, which are usually accepted by governments and paid for with public funds. Second, the groups of people who suffer the most evident consequences are those who make their living directly from the affected resource, in other words the fishing, shellfish production, aquiculture and tourism (including hotels and restaurants sectors). In addition there are indirect effects on sectors that are dependent on those cited above or on the brand image of the resource. This group includes processing, transport, distribution, shipbuilding, etc. Finally, we have the loss of benefits that cannot be dealt with in terms of market values,

bución, a construcción naval, etc. E, finalmente, temos a perda de beneficios non intercambiados nos mercados, como son os beneficios recreativos e paisaxísticos para a poboación así como os valores culturais e naturais que proporciona o patrimonio natural.

De entre os efectos descritos podemos distinguir aqueles que son facilmente xustificables e, como veremos, indemnizables no réxime actual. Estes son os derivados da limpeza e do cesamento da extracción e, consecuentemente, de ingresos para os colectivos directamente afectados (sector extractivo e turístico). No caso do *Erika*, no ano 1999, estes danos ascenderon a 840 millóns de euros, cun sector pesqueiro e marisqueiro non comparable ó galego (CES de la Loire, 2000). No caso do *Exxon Valdez*, dez anos antes, só o custo dos labores de limpeza ascendeu a 2.100 millóns de euros (Exxon Valdez Oil Spill Trustee Council). No caso do *Prestige*, o goberno estima que só os gastos en labores de limpeza –ata o momento– alcanzan os 1.000 millóns de euros.

A continuación existen danos que son cuantificables pero actualmente non indemnizables no marco lexislativo europeo. Estes danos son consecuencia do efecto expansivo da paralización do sector extractivo nos sectores da transformación, transporte e comercialización, pero tamén os relativos ó patrimonio natural danado. Este patrimonio natural, especialmente rico en biodiversidade e ecosistemas no caso galego, fornece valores de uso, como é o caso do gozo da paisaxe e

such as recreational and landscape related benefits, as well as for the cultural and natural values provided by the natural heritage.

Among the effects we have described we can distinguish those that are easily justified and, as we will see, eligible for compensation under current regulations. These are effects relating to cleaning and to the cessation of harvesting and, consequently, to the income loss for directly affected groups (fisheries, shellfish harvesting and tourism). In the case of the *Erika*, in the year 1999, this damage amounted to 840 million euros, with a fishery and shellfish sector that was not comparable to that of Galicia (CES de la Loire, 2000). In the case of the *Exxon Valdez*, ten years before, the cost of the cleaning work alone amounted to 2,100 million euros (Exxon Valdez Oil Spill Trustee Council). In the case of the *Prestige*, the government estimates that cleaning costs alone –up to the moment– have reached 1,000 million euros.

Subsequently there are damages that are quantifiable but at present not subject to compensation in the framework of European legislation. These damages are consequences of the expansionary effect of the paralysis of the harvesting sector on processing, transport and marketing sectors, but are also related to the damaged natural heritage. This natural heritage, particularly rich in biodiversity and ecosystems in the case of Galicia, provides use values, such as the enjoyment of the landscape and recreational activities in nature areas, that either cease to exist or remain with lower levels of

das actividades recreativas en áreas naturais, que ou ben se deixan de realizar ou ben se manteñen pero cun menor nivel de gozo. Mais tamén existen valores de tipo cultural ou ecolóxico, non vencellados co uso activo das áreas naturais danadas senón co valor que teñen como patrimonio de todos, como ben público. O mantemento do litoral e da súa riqueza paisaxística e biolóxica é patrimonio de todos, e, como tal, todos saímos prexudicados cando este se ve ameazado.

A avaliación de danos derivada do *Exxon Valdez*, realizada a comezos dos anos 90 nos Estados Unidos, foi pioneira na incorporación da perda de valores colectivos ás cifras de danos derivadas do accidente. Así, tan só con base nesta tipoloxía de danos, a petroleira Exxon aceptou pagar 1000 millones de dólares, que foron investidos no financiamento de estudios de avaliación e programas de restauración –tanto estatais como locais –para volver os ecosistemas danados a un estado o máis semellante posible ó que amosaban antes do accidente. E isto foi necesario para un vertido de cru menos contaminante que o fuel pesado e de menos da metade de toneladas que o caso do *Prestige*.

A filosofía que dá fundamento á protección dos beneficios públicos do patrimonio natural parte da idea de que os gobernos dos países afectados e as institucións europeas deberan funcionar como defensoras e protectoras dos bens colectivos. Estes bens, por ese carácter público que os caracteriza, fan de seu unha tipoloxía de recursos con valor social pero sen benefit. But there also are values of cultural or ecological character that are not related to the active use of the damaged natural areas but rather with the intrinsic value that they have as a heritage that belongs to everyone, as public goods. The maintenance of the coastline, its biological wealth and the beauty of its landscape, is a heritage that belongs to everyone, and as such, we all suffer damage when it is threatened.

The evaluation of damages caused by the *Exxon Valdez* incident, done in the early 90s in the United States, was a pioneer in including the loss of collective values in the figures for damages resulting from the accident. Thus, solely on the basis of this criterion for damages, the Exxon oil company agreed to pay 1 billion dollars which were invested in the financing of evaluation studies and restoration programmes – on both state and local levels – aimed at returning the damaged ecosystems to conditions as close as possible to those prevailing before the accident. And this was necessary for a spill involving crude, which is less pollutant than heavy fuel oil, and of less than half the number of tons than in the case of the *Prestige*.

The philosophy that supports the protection of public benefits of the natural heritage takes as its starting point the idea that the governments of affected member countries and European institutions should function as defenders and protectors of collective goods. These goods, given their public nature, form a type of resource with social value but without

prezo de mercado, o que implica que as perdas destes non son xustificables como o serían os recursos que se intercambian nos mercados. Xa que logo, é preciso estimar o seu valor mediante outro tipo de metodoloxías, e que as institucións públicas actúen como responsables ou administradores –non propietarios– dun patrimonio que lles foi legado ás xeracións actuais e que debera selo, nas mellores condicións de conservación posibles, ás xeracións futuras.

O precedente está sentado. Só resta que estes valores se fagan co suficiente peso na conciencia colectiva para ser considerados e incorporados nas lexislacións en que se enmarcan as indemnizacións por danos derivados da contaminación por vertidos de hidrocarburos. Sen embargo, e como veremos de contado, esta situación desexable fica moi lonxe da realidade institucional do noso contorno máis próximo: o da responsabilidade ambiental no marco da Unión Europea.

3 O MARCO INSTITUCIONAL ACTUAL NA UNIÓN EUROPEA

O marco institucional vixente da Unión Europea é anacronicamente limitado. Normalmente o armador limita a súa responsabilidade no contrato de seguro en función do arqueo do buque utilizado no transporte. Así, actualmente o límite máximo de responsabilidade está en 180 millóns de euros, pero isto considerando conxuntamente os importes establecidos pola aseguradora do barco e o FIDAC, ou Fondo Internacional de Indemnización de Danos

market price, which implies that the losses suffered would not be justifiably liable to compensation as would those resources that are bought and sold on the market. Hence it is necessary to assess their value using a different sort of methodology, and public institutions must act as trustees or administrators – not as owners – of a heritage that is a legacy to present generations and that should be handed down, in the best possible state of conservation, to future generations.

The precedent has been set. All that is left now is for these value to acquire sufficient weight in the public mind to be covered by and incorporated into legislations which pose the framework for compensations from hydrocarbon spills. Nonetheless, as we will see below, this situation, which is to be desired, is far from the institutional reality of our immediate surroundings: environmental liability within the framework of the European Union.

3 CURRENT INSTITUTIONAL FRAMEWORK IN THE EUROPEAN UNION

The institutional framework in force in the European Union is anachronistically limited. Normally the ship owner limits the liability stipulated in the insurance contract depending on the tonnage of the vessel used for transport. Thus at present the maximum liability is 180 million euros, but this considers together the amounts established by the insurer of the vessel and the IOPC Funds or The

Debidos á Contaminación por Hidrocarburos[1]. Este Fondo foi creado en 1992 por 74 estados, ó abeiro da OMI (Organización Marítima Internacional), e está dotado con contribucións das empresas receptoras de hidrocarburos, normalmente petroleiras. O seu obxectivo é complementar as contías aboadas polo asegurador do buque, en caso de que estas fosen insuficientes para cubrir os danos causados[2].

As partidas indemnizables, tanto pola aseguradora coma polo FIDAC, previa xustificación mediante facturas ou estados de contas, son os custos derivados das labores de limpeza e as perdas en actividades extractivas e turísticas (FIDAC, 2002). Ten sentido, neste punto, lembrar que tan só o custo derivado dos labores de limpeza, estimado polo goberno español ata o momento, xa ascende a 1.000 millóns de euros.

Ante o anterior, queda claro que a responsabilidade en Europa para os vertidos de petróleo derivados do transporte marítimo non só é limitada senón que tamén é difusa. A intervención do Fondo implica realmente que é o sector petroleiro no seu conxunto o que se fai cargo dos danos dos vertidos, diluíndo a responsabilidade de xeito que a parte alícuota da indemnización que paga o verdadeiro responsable directo é ridícula en

1. Está previsto aumentar a dotación do fondo a 270 millóns de euros o 1 de novembro de 2003.

2. En xeral, o procedemento habitual é que aseguradora e FIDAC abran oficinas conxuntas para recibir as solicitudes de indemnización en caso de accidente.

International Oil Pollution Compensation Funds[1]. This fund was created in 1992 by 74 states, under the auspices of the IMO (International Maritime Organisation) and is endowed with contributions from companies receiving hydrocarbons, normally oil companies. Its objective is to supplement the funds paid by the ship's insurer, in the event that these funds are not sufficient to cover the damage sustained[2].

The items eligible for compensation, both from the insurer and from the IOPC Funds, following justification through invoices or bank statements, are the costs resulting from the work of cleaning and losses in fishing, shellfish harvesting and tourism (IOPC Funds, 2002). It is worth remembering, at this point, that just the costs cleaning as estimated by the Spanish government up to this time, amounts to 1,000 million euros.

Given the above, it is clear that responsibility in Europe for oil spills occurring in maritime transport is not only limited but also unclear. The intervention of the fund implies that in fact it is the petroleum sector as a whole that meets the cost of the damage caused by the spills, diffusing liability so that the proportional part of the compensation paid by the party that is directly and genuinely responsible is ridiculous in comparison with the damage caused. For example,

1. The fund's contribution is expected to be increased to 270 million euros on November 1, 2003.

2. In general, the usual procedure is that the IOPC Funds and the insurer open jointly run offices to handle claims for compensation when an accident occurs.

comparación cos danos ocasionados. Para exemplo, os pagos efectuados polo FIDAC como indemnizacións diante 120 sinistros nos que ten intervido estímanse en aproximadamente 630 millóns de euros (FIDAC, 2002)

Como estratexia contraposta, a raíz do accidente no 1989 do petroleiro *Exxon Valdez* nas costas de Alasca, en 1990 os Estados Unidos aprobaron a Oil Pollution Act (OPA). Esta lexislación incide nos principios de responsabilidade clara e ilimitada pois establece que non existe límite á responsabilidade en caso de accidente. Os armadores deben fornecer unha garantía de 1.000 millóns de euros e, ademais, nomear un representante no seu territorio a quen esixir responsabilidades civís en caso de accidente. Como indicador de que o que contamina debe pagar e moito –e entendendo isto como o instrumento máis efectivo de prevención– nas costas de Estados Unidos non houbo máis vertidos de petróleo desta magnitude. É no momento de contratar unha póliza de seguro ilimitado para navegar polas súas augas cando o armador terá que demostrar que o seu barco, as súas revisións, a súa tripulación, a súa carga, a súa ruta, etc., van cumprir as máximas –non as mínimas– medidas de seguridade. Se non fose así, o custo da póliza de seguro sería moi elevado.

4 O FUTURO

A Unión Europea, xa dende o accidente do *ERIKA* nas costas de Francia no ano 1999, comezou a elaborar novas normativas para mellorar a seguridade marítima no corredor

payments made by IOPC Funds in compensations for 120 incidents in which it intervened are estimated at approximately 630 million euros (IOPC Funds, 2002).

In contrast, as a result of the 1989 *Exxon Valdez* oil tanker accident off the coast of Alaska, in 1990 the United States passed the Oil Pollution Act (OPA). This legislation has a bearing on the principles of clear and unlimited liability, since it establishes that there is no limit to liability in case of accident. Ship owners must provide a guarantee of 1,000 million euros and, in addition, name a representative in their territory from whom civil liability can be claimed in case of accident. As an indicator that the polluter must pay, and pay a lot – taking this as the most effective instrument of prevention – there have not been any more oil spillages of these dimensions on the coasts of the United States. It is at the moment of contracting an unlimited insurance policy for navigation in its waters when the ship owner has to show that his vessel, inspection, crew, cargo, course etc. comply with maximum – not minimum – safety standards. If they do not, the cost of the policy will be very high.

4 THE FUTURE

With the *Erika* accident off the coast of France in 1999, the European Union began to prepare new packages of regulations designed to improve maritime safety in the European Atlantic corridor. From these efforts there emerged the ERIKA I and ERIKA II measures. The ERIKA I pac-

atlántico europeo. Deste esforzo xurdiron as medidas ERIKA I e ERIKA II. O paquete ERIKA I foi aprobado pola UE en decembro de 2001, e debe ser trasposto ó regulamento interno dos estados membros en xuño do 2003 como máximo. Esta nova lexislación contempla o incremento de inspeccións ós buques, novos requisitos para a autorización de sociedades de clasificación e a esixencia do dobre casco ós buques petroleiros a partir do ano 2015. Sen embargo, non establece medidas para clarificar e incrementar a responsabilidade do contaminador.

Esta última cuestión abórdase no paquete de medidas ERIKA II. Nel contémplase a creación da Axencia de Seguridade Marítima e a entrada en vigor de novos sistemas automáticos de control do tráfico marítimo. Ademais, propón dotar un Fondo para indemnizacións (o Fondo COPE) con mil millóns de euros (proposta de Regulamento 2000/0326 COD). As primeiras dúas medidas foron aprobadas en xuño de 2002.

Non obstante, no relativo ás indemnizacións, a Unión Europea, en acordo do Consello en Copenhaguen (COM 2002), agarda a que o FIDAC aumente o seu límite de responsabilidade actual en maio de 2003 por considerar que un marco internacional é o máis axeitado e, en caso de que este aumento non acade os obxectivos previstos, pensarase entón na creación dun sistema de responsabilidade e compensación propios.

A reflexión que xorde do anterior é que a reacción da Unión Europea diante dos accikage was approved by the EU in December, 2001, and should be integrated into the internal regulations of the member states in June, 2003, at the latest. This new legislation covers increased inspections on vessels, new requisites for the authorisation of classification societies and the requirement for the double hull on oil tankers from the year 2015. However, it does not establish measures for clarifying and extending the liability of the polluter.

This latter question is dealt with in the ERIKA II package. It covers the creation of the Maritime Safety Agency, and the coming into force of new automatic systems of maritime traffic control. In addition, it proposes to endow a fund for compensations (the COPE Fund) with 1,000 million euros (proposal for Regulation 2000/0326 COD). The first two measures were approved in June, 2002.

Nonetheless, with regard to compensations the European Union, in accordance with the Council in Copenhagen (COM 2002), is waiting for IOPC Funds to increase its current liability limit in May of 2003, in the belief that an international framework is the most appropriate way to deal with this question; and in the event that this increase does not reach the expected objectives, the EU will consider the creation of its own system of liability and compensation.

The consideration that emerges is that the European Union's response to accidents with spills is much less firm than that of the United States, giving up a unilateral strategy that affects the polluter's liability. Under

dentes con vertidos é moito menos decidida que a dos Estados Unidos, renunciando a unha estratexia unilateral que incida sobre a responsabilidade do contaminador. En ningún caso, aínda no escenario máis optimista para a lexislación comunitaria, a responsabilidade é ilimitada –aínda que se aumenta considerablemente–, e o sistema segue diluíndo a responsabilidade nun Fondo conxunto, coa única diferencia de que será dotado internacionalmente se o FIDAC acaba sendo a opción, ou por petroleiras europeas se finalmente se opta por crear o Fondo COPE. E isto en contra do establecido pola propia Comisión Europea no Libro Branco sobre Responsabilidade Ambiental (COM 2000), que recoñece que a figura do Fondo establece un conflicto co principio de "quen contamina, paga" e, por riba, non crea incentivos eficientes para a prevención.

A política de seguridade que se adiviña nos paquetes ERIKA non é máis que un reflexo do interese da Unión en permanecer nun sistema avalado pola Organización Marítima Internacional, que semella loitar por acadar un equilibrio entre aumentar o fondo o necesario para mitigar as protestas dos damnificados, pero non o suficiente para evitar que os accidentes de petróleo entren nos cálculos das empresas como custo asumible da súa actividade. Neste sentido, a política de seguridade marítima da UE favorece en primeira instancia os poderosos lobbys petroleiros e sociedades relacionadas co tráfico de hidrocarburos.

A posición da Unión Europea ante os paquetes ERIKA é coherente coa defendida no

no circumstances, even in the most optimistic view of prospects for community legislation is unlimited liability – though it is considerably increased – and the system continues to dilute liability in a joint fund, the only difference being that it will be funded internationally if IOPC Funds ends up as the option and by European oil companies if it is finally decided to create the COPE Fund. And this in contrast to what was established by the European Commission itself in the White Paper on Environmental Liability (COM 2000), which recognises that the figure of the fund is in conflict with the "polluter pays principle" and also does not create efficient incentives for prevention.

The safety policy that can be perceived in the ERIKA packages is no more than a reflection of the Union's interest in remaining within a system backed by the International Maritime Organisation, which appears to be working to establish a balance between increasing the fund to the extent necessary in order to meet the demands of the affected parties, but not enough to avoid oil accidents entering into oil companies' calculations as an acceptable cost of their activity. In this sense, the EU's maritime safety policy initially favours the powerful oil lobbies and companies connected with hydrocarbon traffic.

The position of the European Union with regard to the ERIKA packages is consistent with the position defended within the Commission as the "Proposal for a Directive on Environmental Liability with regard

seo da Comisión como "Proposta de Directiva sobre responsabilidade ambiental en relación coa prevención e reparación de danos ambientais" (2002/0021 COD). Nesta proposta de directiva exclúese explicitamente toda "[...] responsabilidade civil por danos causados pola contaminación por hidrocarburos (art. 3.3.)". Esta posición é o resultado de atender as suxestións achegadas polos interesados na rolda de consultas previa á elaboración da directiva, e entre os cales se atopan desigualmente representados empresas e damnificados. Así, a propia UE incorpora as opinións do *Comité Marítime Internacional* (Londres), *International Association of Independent Tanker Owners* (Oslo), *International Association of Oil and Gas Producers* (Bruxelas), *International Oil Pollution Compensation Fund* (Londres), *International Tanker Owners Pollution Federation Ltd.* (Londres) ou *Oil Companies International Marine Forum* (Londres). Estes grupos empresariais en todo momento requiren da UE que nada se incorpore, relativo ó transporte marítimo de hidrocarburos, á directiva sobre responsabilidade ambiental "[...] que entre en conflicto ou afecte o réxime existente de responsabilidade e compensación", e aseguran que este sistema proporciona compensacións "razoables", pero en ningún momento completas ou totais dos danos causados[3].

to the prevention and mitigation of environmental damage" (2002/0021 COD). This proposal for a directive explicitly excludes all "[...] civil liability for oil pollution damage" (Art. 3.3.). This position is also the result of accepting suggestions contributed by interested parties in the round of consultations prior to the drafting of the directive, in which companies and those affected by accidents were unequally represented. Thus the EU itself incorporates the opinions of the *International Maritime Committee* (London), *International Association of Independent Tanker Owners* (Oslo), *International Association of Oil and Gas Producers* (Brussels), *International Oil Pollution Compensation Fund* (London), *International Tanker Owners Pollution Federation Ltd.* (London) and *Oil Companies International Marine Forum* (London). These business groups consistently call on the EU not to include anything related to maritime transport of hydrocarbons in the directive for environmental liability "[...] that would conflict with or affect existing regulations on liability and compensation" and insist that this system provides "reasonable" but never complete or total compensations for the damage caused[3].

3. http://europa.eu.int/comm/environment/liability/wrkdoc.htm

3. http://europa.eu.int/comm/environment/liability/wrkdoc.htm

5 CONCLUSIÓNS

1. Na implantación dos paquetes ERIKA I e ERIKA II e na elaboración da Directiva sobre Responsabilidade Ambiental semella tomar corpo o intento de aprazar a solución máis eficiente ó problema. Dende a perspectiva económica deberíanse introducir os incentivos axeitados para que a estratexia óptima das empresas sexa a prevención de accidentes; para isto sería necesario:

- Basear calquera medida no principio de quen contamina paga. Isto implica clarificar e personalizar a responsabilidade civil, superando a estratexia baseada nos fondos colectivos. E, no mesmo sentido, profundar no principio anterior cara a unha responsabilidade ilimitada real. É dicir, que se paguen todos os danos, o que funcionaría como medida disuasoria real tendo como consecuencia que a estratexia máis rendible para as empresas fose a prevención.
- Desenvolver un marco sobre responsabilidade ambiental a nivel europeo, que considere que os bens públicos requiren de maior protección gobernamental pois o mercado non proporciona indicadores das súas perdas nin, polo tanto, incentivos correctos para a súa conservación.

2. Se, malia a mellora da prevención, ocorren catástrofes como as do *Prestige*, a análise económica debera afrontar necesariamente dúas tarefas: avaliar todos os danos e propor

5 CONCLUSIONS

1. In the adoption of the ERIKA I and ERIKA II packages and in the preparation and passage of the Directive for Environmental Liability we find an attempt to postpone the most effective solution to the problem. From an economic point of view adequate incentives ought to be introduced to make accident prevention the best policy for the companies involved. To do that it would be necessary:

- To base all measures on the "polluter pays principle". This implies clarifying and personalising civil liability and going beyond the strategy based on collective funds. And, along the same line, going more deeply into this principle in the direction of a genuine unlimited liability. In other words, all damages must be paid for, which would act as a real deterrent and would consequently make prevention the optimum company strategy.
- To open up a new framework for environmental liability on a European level, one which would consider that public goods require more and better governmental protection, since the market does not provide loss indicators nor correct incentives for their conservation.

2. If, in spite of prevention, catastrophes like that of the *Prestige* occur, the economic analysis must necessarily confront two tasks: to evaluate damage and to propose programs for

programas de recuperación económica e ambiental.

- A tarefa de avaliación de danos é complexa pero necesaria. É complexa porque debe referirse non só a bens e servicios que son obxecto de transaccións no mercado (productos da pesca, marisqueo, turismo, na mediada en que queden afectados, ademais dos custos de limpeza) senón tamén a beneficios que percibimos os cidadáns sen mediar transaccións comerciais (recreativos e paisaxísticos) pero que na medida en que se deterioran representan perdas de benestar. Ademais debemos valorar a variación no estado do patrimonio natural, a economía dótase nestes casos de métodos específicos, como a valoración continxente.

  A tarefa é ademais necesaria porque axuda a fixar a magnitude das responsabilidades nunha catástrofe e será sen dúbida unha información substantiva para o proceso futuro dos programas de prevención.

- A economía debe avaliar tamén os programas de recuperación económica para zonas e sectores especialmente afectados. É importante, neste sentido, que de producirse se midan axeitadamente os cambios resultantes, así como que se avalíen con precisión os proxectos, incluídos os de prevención e control das catástrofes.

economic and environmental recovery.

- The task of evaluating the damage is complex but necessary. Complex because it must refer not just to goods and services that are the object of transactions on the market (fishing and shellfish products, tourism etc. insofar as they are affected, in addition to cleaning costs) but also to benefits citizens receive without the intervention of commercial transactions (recreation and enjoyment of landscape and nature) but whose alteration represents a loss of welfare. In addition, we must evaluate the change in the natural heritage, for which the economy has specific methods, such as contingent valuation.
  This task is also necessary because it helps to determine the magnitude of the catastrophe and the liabilities, and will doubtless be fundamental information for the future process of prevention programmes.
- The economy must also evaluate programmes for economic recovery of areas and sectors particularly affected. It is important, in this sense, that when they occur the resulting changes are measured correctly and the subsequent projects adequately evaluated, including projects for prevention and control of catastrophes.

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PRIMEIRA PARTE. AS EXPERIENCIAS PREVIAS
FIRST PART. PREVIOUS EXPERIENCES

A VALORACIÓN CONTINXENTE E A PERDA DOS USOS PASIVOS: DANOS DA MAREA NEGRA DO *EXXON VALDEZ*[*]

CONTINGENT VALUATION AND LOST PASSIVE USE: DAMAGES FROM THE *EXXON VALDEZ* OIL SPILL*

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1 INTRODUCCIÓN

Na noite do 24 de marzo de 1989, o petroleiro *Exxon Valdez* zarpou do porto de Valdez (Alasca) e navegaba polo estreito de Valdez cara a mar aberto na baía de Prince William. O petroleiro desviouse das rutas de navegación normais para evitar os icebergs do glaciar de Columbia e foi chocar coas rochas somerxidas do arrecife de Bligh, xa que a tripulación non se decatou de que o petroleiro se desviara moito das rutas de navegación[1]. Os compartimentos que contiñan petróleo romperon e vertéronse máis de 11 millóns de litros de cru, procedente da baía de Prudhoe, no estreito de Prince William. Esta foi a maior marea negra provocada por un petroleiro nos EUA e para a opinión pública foi unha das principais catástrofes ambientais da historia dos EUA.

1. As descricións do encallamento do *Exxon Valdez* poden atoparse no Comité Nacional de Seguridade no Transporte (1990) e en Moore (1994). Aplicáronse un número de medidas de contención e prevención da marea negra cando o cru comezou a ser transportando en barco desde Valdez. Estas medidas pretendían reducir varios tipos de riscos que se identificaran nunha avaliación inicial de riscos global. Nesta avaliación identificárase como un dos peores accidentes posibles aquel en que un petroleiro chocase co arrecife próximo a Bligh baixo unhas condicións máis ou menos semellantes ás do accidente do *Exxon Valdez*. Co paso do tempo estas medidas foron "suavizándose", debido en parte ós gastos que implicaban e en parte a que non se producira anteriormente ningún accidente realmente grave. Estas medidas poderían evitar ou conter en boa medida a marea negra provocada polo *Exxon Valdez* se se aplicasen no momento de se producir o vertido.

1 INTRODUCTION

On the night of March 24, 1989, the *Exxon Valdez* left the port of Valdez, Alaska and was steaming through the Valdez Narrows on its way to the open waters of Prince William Sound. The tanker left the normal shipping lanes to avoid icebergs from the nearby Columbia Glacier and ran into the submerged rocks of Bligh Reef; its crew failed to realize how far off the shipping lanes the tanker had strayed[1]. Oil compartments ruptured, releasing 11 million gallons of Prudhoe Bay crude oil into the Prince William Sound. It was the largest tanker spill in U.S. waters and to the public it was one of the major environmental disasters in U.S. history.

1. Descriptions of the grounding of the *Exxon Valdez* may be found in National Safety Transportation Board (1990) and Moore (1994). A number of spill prevention and containment measures were put into place when oil first began to be shipped from Valdez. These measures were intended to reduce various types of risks that had been identified in an initial comprehensive risk assessment. That assessment had identified one of its most likely bad accidents as a tank hitting the reef next to Bligh Reef under somewhat similar conditions as the *Exxon Valdez*. These measures had been progressively "relaxed" over time, in part due to their expense and in part because there had not previously been any really serious accident. These measures might have prevented or largely contained the *Exxon Valdez* spill had they been in place at the time of the spill.

Antes de producirse a marea negra do *Exxon Valdez*, o cálculo do valor do uso pasivo (Carson, Flores e Mitchell, 2001) ou, tal como se denominou anteriormente, o valor de existencia ou non-uso, era un campo dentro da investigación económica non moi coñecido para moitos economistas que traballaban fóra do ámbito da análise custo-beneficio dos proxectos que implicaban efectos ambientais ou riscos para a saúde. Nembargantes, baseándose na crenza de que o Estado de Alasca e o Goberno federal pretendían litigar unha demanda de danos ós recursos naturais pola perda do valor do uso pasivo, a atención prestada ás limitacións conceptuais e ás técnicas de cálculo do valor do uso pasivo cambiaron repentinamente.

Unha importante sentencia xudicial de 1989 no caso *Ohio contra o Ministerio de Interior dos EUA*[2] suscitou aínda máis o interese polos valores do uso pasivo. Esta sentencia ordenou revisar ó Ministerio de Interior (MI) algúns dos apartados da súa normativa de avaliación de danos producidos ós recursos naturais ó abeiro do estipulado na Lei sobre Augas Limpas e na Lei Global de Responsabilidade Civil, Compensación e Resposta por Danos Producidos no Medio Natural (CERCLA), coñecida como "Superfondo"[3]. Os resultados máis

Prior to the *Exxon Valdez* oil spill, the estimation of passive use value (Carson, Flores and Mitchell, 2001) or as it has often been previously termed, nonuse or existence value, was an area of economic research not well known to many economists working outside the area of benefit cost analysis of projects involving environmental amenities and health risks. However, based on a belief that the State of Alaska and the Federal Government intended to litigate a natural resource damage claim for lost passive use value, the attention paid to the conceptual underpinnings and estimation techniques for passive use value changed rather abruptly.

Further sparking the rapidly growing interest in passive use values was an important 1989 court opinion, *Ohio v. U.S. Department of the Interior*[2], which remanded back to the Department of the Interior (DOI) various components of its regulations for conducting natural resource damage assessments under the Clean Water Act and the Comprehensive, Environmental Response, Compensation and Liability Act (CERCLA), commonly known as Superfund[3]. Two particularly important as-

2. *Ohio v. Department of Interior*, 880 F.2d 432 (D.C. Cir. 1989).

3. Véxase sentencia do caso *Ohio v. Department of Interior* (1989). A normativa orixinal aprobada polo Ministerio

2. *Ohio v. Department of Interior*, 880 F.2d 432 (D.C. Cir. 1989).

3. See *Ohio v. Department of Interior*, 1989. The original Department of the Interior rules chal-

salientables desta sentencia resaltan dous aspectos especialmente importantes da decisión xudicial a favor do valor do uso pasivo, que son os seguintes:

(1) As perdas de uso pasivo eran compensables ó abeiro do establecido nestas leis, e

(2) A xerarquía de técnicas de avaliación de danos elaborada polo Ministerio de Interior, que situaba a valoración continxente en último lugar, era inxustificada[4].

O interese polos valores do uso pasivo estaba tamén a medrar no momento de realizar o estudio debido á aprobación da Lei de Contaminación por Hidrocarburos (OPA) de 1990 e das normas que promulgou a Administración Oceánica e Atmosférica Nacional (NOAA) ó abeiro desta Lei para as avaliacións de danos producidos nos recursos naturais. As normas establecían o seguinte: A NOAA

pects of the court's ruling for passive use value were its findings that:

(1) passive use losses were compensable under those Acts and

(2) the DOI hierarchy of damage assessment techniques, which placed contingent valuation at the bottom, was unjustified[4].

Interest in passive use values was also heightening at the time of the study by the passage of the Oil Pollution Act of 1990 (OPA) and the regulations that National Oceanic and Atmospheric Administration (NOAA) enacted under it for natural resource damage assessments. The regulations stated: "NOAA believes that the trustee(s) should have the discretion to include passive use values as a

de Interior, recusada no caso *Ohio contra o Ministerio de Interior,* foi publicada no *Federal Register*, vol. 51, do 1 de agosto de 1986. Véxase Kopp, Portney e Smith (1990) para un comentario exhaustivo sobre a sentencia pronunciada neste caso.

4. De acordo coa sentencia do caso *Ohio*, o Tribunal do Distrito de Utah dos Estados Unidos nun caso que atinxía a lei CERCLA rexeitou un auto de conformidade proposto, en parte debido a que non incluía os valores de uso pasivo na determinación de danos asociados coa contaminación das augas subterráneas. Véxase o caso *State of Utah v. Kennecott Corporation*, n.º CIV 86-0902G, Tribunal do Distrito dos Estados Unidos, Distrito de Utah, 3 de setembro de 1992, Memoria da Sentencia e Resolución Xudicial.

lenged in the *Ohio v. DOI* case were published in the *Federal Register*, vol. 51, August 1, 1986. See Kopp, Portney and Smith (1990) for a comprehensive discussion of the *Ohio* decision.

4. Following the *Ohio* decision, the U.S. District Court of Utah in a 1992 CERCLA case rejected a proposed consent decree, in part, for failing to include lost passive use values in the determination of damage associated with groundwater contamination. See *State of Utah v. Kennecott Corporation*, No. CIV 86-0902G, United States District Court, D. Utah, September 3, 1992, Memorandum Decision and Order.

cre que o(s) fiduciario(s) debería(n) ter a facultade discrecional para incluír os valores do uso pasivo na determinación de valores compensables incluídos na avaliación de danos ós recursos naturais[5].

Isto lévanos ó debate actual sobre a valoración continxente. En xeral recoñécese que os métodos de preferencia declarada (Mitchell e Carson, 1989; Louviere, Hensher e Swait, 2000; Carson, Flores e Meade, 2001) existen normalmente para calcular o valor do uso pasivo. A diferencia do uso directo destes recursos onde, por exemplo, se pode observar ás persoas navegando en embarcacións de recreo ou pescando e empregar estas observacións para establecer modelos económicos que permitan extraer conclusións sobre o valor que asignan as persoas a esas actividades[6], o uso pasivo non entraña contacto directo cos recursos naturais. Como resultado disto, os economistas acostuman dicir que o uso pasivo non ten implicacións directas no comportamento.

A valoración continxente é un método baseado en enquisas e deseñado para crear un mercado para bens públicos determinando a

5. Esta postura é coherente co historial lexislativo da OPA que se refire especificamente á diminución do valor como parte dos danos e cita a definición de valor establecida na sentencia do caso *Ohio*, que inclúe tanto o uso directo coma o uso pasivo.

6. Estes modelos e métodos denomínanse enfoques indirectos e inclúen o modelo do custo da viaxe e o modelo de valores hedónicos da propiedade. Unha introducción ó uso destes modelos para a avaliación de danos producidos nos recursos naturais pode atoparse en McConnell (1993).

component within the natural resource damage assessment determination of compensable values[5].

This brings us to the current debate over contingent valuation. It is generally recognized that only stated preference methods (Mitchell and Carson, 1989; Louviere, Hensher and Swait, 2000; Carson, Flores and Meade, 2001) usually exist for estimating passive use value. Unlike direct use of resources, where for example, one can potentially observe individuals boating and fishing and use these observations to build economic models permitting inference about the value individuals place on such activities[6], passive use entails no direct involvement with natural resources. As a result, economists are fond of saying passive use leaves no behavioral trace.

Contingent valuation is a survey approach designed to create the missing market for public goods by determining what people would be willing to pay (WTP) for specified changes in

5. This position is consistent with OPA legislative history that specifically refers to diminution in value as a part of damages and cites the *Ohio* decision definition of value, which includes both direct use and passive use.

6. These models and methods are termed indirect approaches and include the travel cost model and do the hedonic property value model. An introduction to the use of these models for the assessment of damages due to natural resource injuries can be found in McConnell (1993).

cantidade que as persoas están dispostas a pagar (*Willing to pay – WTP)* para cambios específicos na cantidade ou calidade de tales productos ou, con menos frecuencia, o que estarían dispostos a aceptar (*Willing to Accept – WTA*) en compensación por degradacións ben especificadas no abastecemento destes productos[7]. A valoración continxente soluciona a ausencia de mercados para os servicios derivados dos recursos naturais presentándolles ós consumidores un escenario de elección no que teñen a oportunidade de mercar ou vender os servicios en cuestión. O escenario de valoración continxente pode ser modelizado sobre un mercado privado ou un referendo político. Dado que os valores obtidos son continxentes respecto do escenario descrito ós entrevistados, este enfoque da valoración de non mercado chamouse método da valoración continxente.

É xusto dicir que o debate no seo da comunidade de economistas, provocado pola marea negra do *Exxon Valdez* e polas disposicións lexislativas referidas ós danos ós recursos naturais incluídas en diversas leis, inclúe discusións tanto sobre as limitacións conceptuais do uso pasivo como sobre a técnica para a súa medición. Sen embargo, foi a técnica de medición, é dicir, a valoración continxente, a que constituíu o branco das críticas máis duras. Gran parte da crítica recente ó método

7. Unha ampla discusión sobre a valoración continxente inclúese en Mitchell e Carson (1989).

the quantity or quality of such goods or, more rarely, what they would be willing to accept (WTA) in compensation for well-specified degradations in the provision of these goods[7]. Contingent valuation (CV) circumvents the absence of markets for natural resource services by presenting consumers with a choice situation in which they have the opportunity to buy or sell the services in question. A CV scenario may be modeled after either a private market or a political referendum. Because the elicited values are contingent upon the particular scenario described to respondents, this approach to non-market valuation came to be called the contingent valuation method.

It is fair to say that the debate within the economics community, instigated by the *Exxon Valdez* spill and the natural resource damage provisions of various laws, includes discussions of both the conceptual underpinnings of passive use and the technique for its measurement. However, it is the measurement technique, *i.e.*, contingent valuation, which has been the target of the sharpest criticism. Much of the recent

7. A comprehensive discussion of contingent valuation is contained in Mitchell and Carson (1989).

da valoración continxente está incluída no volume do congreso patrocinado por Exxon (Hausman, 1993) e nas propostas escritas dirixidas ós autores das normas sobre avaliación de danos ós recursos naturais do Ministerio do Interior e da NOAA[8]. Para axudar a avaliar estes comentarios, o conselleiro xeral da NOAA, Thomas Campbell, creou un grupo de traballo formado por científicos sociais para analizar explicitamente as críticas á valoración continxente e facer recomendacións á NOAA. Este grupo de traballo estaba presidido por Kenneth Arrow e Robert Solow e estaba formado por tres economistas máis: Edward Leamer, da Universidade de California, Los Ángeles, Paul Portney, do organismo *Resources for the Future*, e Roy Radner, dos Laboratorios *Bell*, así como Howard Schuman, director do Centro de Investigacións Estatísticas da Universidade de Michigan. O grupo de expertos chegou á conclusión de que os estudios de valoración continxente proporcionan "información útil" para a valoración de danos, incluídos os valores de uso pasivo, sempre que satisfagan unha serie de "recomendacións moi estrictas" (Arrow *et al.*, 1993). As recomendacións deste grupo de expertos tiveron influencia na elaboración da normativa aprobada pola NOAA e o

8. Para unha opinión xeral do debate inmediatamente posterior ó accidente do *Exxon Valdez*, véxanse os relatorios do simposio de Diamond e Hausman, Hanemann, e Portney no *Journal of Economic Perspectives* (1994). Para un estudio máis recente, véxase Carson, Flores e Meade (2001).

criticism of contingent valuation is contained in the Exxon-sponsored conference volume, Hausman (1993), and written submissions directed to writers of natural resource damage assessment regulations in DOI and NOAA[8]. To help assess these comments, the NOAA General Counsel, Thomas Campbell, formed a panel of social scientists to explicitly consider the criticisms of contingent valuation and make recommendations to NOAA. The panel was co-chaired by Kenneth Arrow and Robert Solow and was comprised of three additional economists: Edward Leamer of the University of California, Los Angeles, Paul Portney of Resources for the Future and Roy Radner of Bell Laboratories, as well as Howard Schuman, Director of the Survey Research Center at the University of Michigan. The panel concluded that CV studies convey "useful information" for damage assessment including lost passive use values, provided they follow a number of "stringent guidelines" (Arrow *et al.*, 1993). The recommendations of this panel have

8. For a sense of the debate immediately post *Exxon Valdez*, see the 1994 *Journal of Economic Perspectives* Symposium papers by Diamond and Hausman, Hanemann, and Portney. For a more recent review see Carson, Flores and Meade (2001).

Ministerio de Interior e no extenso debate académico.

Os resultados do estudio de valoración continxente levados a cabo para o Estado de Alasca na preparación da demanda presentada polo accidente do *Exxon Valdez* representaban o punto de referencia para avaliar as críticas á valoración continxente e quizais o debate máis xeral sobre o uso pasivo. A maioría das recomendacións feitas polo grupo de expertos da NOAA para garantir a fiabilidade das estimacións das perdas de uso pasivo feitas mediante a valoración continxente xa foran aplicados no estudio de Alasca, que incluía:

1) O uso de mostras estatisticamente rigorosas cun alto índice de resposta.
2) Enquisas persoais.
3) Un formato de pregunta de elección discreta tipo referendo.
4) Descricións axeitadas do programa.
5) Características de deseño conservadoras.
6) Comprobación sobre a comprensión e a aceptación.
7) Preguntas de seguimento despois das preguntas tipo referendo.
8) Probas exhaustivas do cuestionario.

Como gran parte do debate se centra nos antigos estudios de valoración continxente, ou en pequenos experimentos, un punto de referencia que considere a práctica da valoración continxente e no que estean dispoñi-

influenced the form of both the NOAA and DOI regulations and the wider academic debate.

The results of the CV study conducted for the State of Alaska in preparation for the *Exxon Valdez* litigation presented here represented the state-of-the-art, and therefore, stands as a reference point that may be used to assess the criticisms of contingent valuation and perhaps the more general debate surrounding passive use. Most of the recommendations made by the NOAA panel to help insure the reliability of CV estimates of lost passive use had already been implemented in the Alaska study including:

1) The use of rigorous probability sampling with a high response rate.
2) In-person interviews.
3) A discrete choice referendum elicitation format.
4) Accurate description of the program.
5) Conservative design features.
6) Checks on understanding and acceptance
7) Debriefing questions following the referendum questions.
8) Careful pretesting.

As much of the debate focuses on old CV studies, or small experiments,

bles gran cantidade de recursos para levar a cabo o estudio debe aumentar a calidade do debate[9].

O plan do relatorio é o seguinte: no apartado 2 fálase do deseño e desenvolvemento do cuestionario empregado na enquisa do estudio; no apartado 3 revísanse para o lector os elementos fundamentais da enquisa; no apartado 4 fálase da execución da enquisa incluído o proceso de mostraxe, a formación dos entrevistadores e a administración ou aplicación da enquisa; por último, no apartado 5 preséntanse resultados estatísticos e no apartado 6 inclúese un epílogo sobre o acordo extraxudicial alcanzado no caso do *Exxon Valdez*.

2 DESEÑO E DESENVOLVEMENTO DA ENQUISA

A enquisa de valoración continxente feita para o caso do *Exxon Valdez* foi desenvolvido durante un período de 18 meses, desde xullo de 1989 ata xaneiro de 1991. Foi deseñado para ser administrado en per-

9. Por limitacións de espacio, moitos detalles do estudio e a enquisa completa non se puideron incluír neste relatorio. O texto completo do informe pode atoparse na páxina web do Administrador Fiduciario da Marea Negra do *Exxon Valdez*: http://www.oilspill.state.ak.us/gem/facts/economic.html. O cuestionario completo, que inclúe copias en color do material visual empregado, pode atoparse en: http://www.econ.ucds.edu/~rcarson. Mitchell e Carson (1995) e Mitchell (2002) proporcionan máis comentarios sobre algunhas cuestións clave relacionadas co deseño de enquisas de valoración continxente.

a reference point portraying CV practice when substantial resources were available to undertake the study should enhance the quality of the debate[9].

The plan of the paper is as follows. Section 2 discusses the design and development of the survey questionnaire used in the study. Section 3 reviews for the reader the crucial elements of the survey. In section 4 we discuss the execution of the survey including survey sampling, interviewer training, and survey administration. Section 5 presents statistical results, and section 6 contains a postscript on the *Exxon Valdez* settlement.

2 SURVEY DESIGN AND DEVELOPMENT

The *Exxon Valdez* CV survey instrument was developed over an 18-month period from July 1989 to January 1991. It was designed to be adminis-

9. Due to space limitations, many details of the study and the complete survey instrument could not be incorporated into this paper. The complete text of the report can be found online at *Exxon Valdez* Oil Spill Trustee website: http://www.oilspill.state.ak.us/gem/facts/economic.html. The complete survey instrument including color copies of visual material used can be found at: http://www.econ.ucsd.edu/~rcarson. Mitchell and Carson (1995) and Mitchell (2002) provide additional discussion of various issues involved in the design of contingent valuation surveys.

soa, a unha mostra de todo o Estado. A parte principal do cuestionairo estaba constituída polo escenario da valoración que describía os danos provocados pola marea negra do *Exxon Valdez* e establecía un mercado tipo referendo para obter o valor que os entrevistados asignaban ó feito de previr un futuro accidente que provocase unha cantidade de danos equivalente na zona do estreito de Prince William. Outras preguntas que precedían ou ían despois das referentes ó escenario de valoración estaban relacionadas coas actitudes do entrevistado, coñecemento da marea negra anterior, a comprensión do escenario e as características persoais. Durante a entrevista persoal e en lugares axeitados mostrábanlle ó entrevistado unha representación visual de postais, fotografías e mapas para complementar a información proporcionada de palabra polo entrevistador.

Desenvolvemento inicial

Levouse a cabo un amplo programa de investigación para o desenvolvemento do cuestionario. O primeiro paso neste desenvolvemento requiría investigación preliminar, principalmente a través de grupos de enfoque. O segundo paso consistiu en elaborar un borrador de cuestionario e revisalo durante unha serie de enquisas persoais seguidas de probas de campo informais. O terceiro e último paso implicaba probas de campo formais e o traballo adicional de desenvolvemento, no

tered, face-to-face, to a national sample. The central part of the survey instrument was the valuation scenario that described the damages caused by the *Exxon Valdez* oil spill and established a referendum market for eliciting the value respondents place on preventing a future accident that would cause an equivalent amount of damage in the Prince William Sound area. Other questions preceding and following the scenario asked about the respondent's attitudes, previous awareness of the spill, understanding of the scenario, and personal characteristics. At appropriate places during the in-person interview, display cards, photographs, and maps were shown to the respondent to supplement the information conveyed verbally by the interviewer.

Initial Development

An extensive program of instrument development research was conducted. The first stage of instrument development involved exploratory research primarily through focus groups. In the second stage, an initial draft questionnaire was produced and revised during a series of one-on-one interviews followed by informal field testing. The third and final stage involved formal field testing and fur-

que se incluía unha serie de catro enquisas piloto.

O obxectivo da investigación consistía en desenvolver un instrumento válido para realizar unha enquisa coa que se medisen os valores do uso pasivo perdidos debido ós danos producidos nos recursos naturais pola marea negra do *Exxon Valdez*. Esta tarefa resultou moi laboriosa para o deseñador da enquisa xa que o instrumento tiña que cumprir múltiples obxectivos. O primeiro consistía en medir só un conxunto definido de danos. Isto esixía describir coidadosamente os danos específicos que debían ser valorados, os distintos períodos de recuperación para os recursos danados e os substitutos dispoñibles para garantir ó máximo que os entrevistados non valoraban danos máis ou menos extensos do que se pretendía[10]. Empregáronse preguntas abertas en varios puntos do escenario da valoración e preguntas de diagnóstico posteriores ó escenario da valoración para garantir o éxito á hora de alcanzar ese obxectivo.

ther development work, including a series of four pilot surveys.

The research goal was to develop a valid survey instrument to measure lost passive use values due to the natural resource injuries caused by the *Exxon Valdez* oil spill. This is a demanding task for the survey designer because the instrument had to meet multiple goals. The first was to measure only a defined set of injuries. This required carefully describing the specific injuries to be valued, the various recovery times for the injured, and the available substitutes, to ensure as much as possible that respondents did not value more extensive or less extensive injuries than intended[10]. Open-ended questions at various points in the valuation scenario and diagnostic questions that followed the valuation scenario were used to gauge success in meeting this goal.

10. A descrición dos danos baseábase en información científica proporcionada para o equipo de investigadores polo Estado de Alasca. Había bastante incerteza relacionada co alcance preciso dalgúns danos no momento en que se levou a cabo a enquisa final. Co fin de minimizar o risco para a demanda xudicial por mor desa incerteza, o equipo de investigadores valorou polo baixo unha representación dos danos. Polo tanto, só se empregaron os feitos referidos ós danos dos que os científicos estaban razoablemente seguros ata o outono de 1990. Cando o mellor cálculo do estado real das cousas amosaba unha escala de variación, empregábase o valor máis baixo desa escala.

10. The description of the injuries was based on scientific information provided to the study team by the State of Alaska. There was substantial uncertainty regarding the precise extent of some of the injuries at the time the final survey was conducted. In order to minimize the litigation risk associated with that uncertainty, the study team valued a conservative representation of the injuries. Therefore, only injury facts of which scientists were reasonably certain as of the fall of 1990 were used. When the best estimate of the actual state of affairs required a range, the conservative end of that range was used.

O segundo obxectivo consistía en garantir a coherencia coa teoría económica intentando obter unha aproximación á perda económica en utilidade sufrida polos enquisados como resultado dos danos provocados pola marea negra.

O terceiro obxectivo era basicamente de investigación: os enquisados de todos os niveis de estudios e con experiencias de vida diversas debían ser capaces de comprender a linguaxe, conceptos e preguntas empregados na enquisa para que puidesen tomar unha decisión con fundamento. O reto particular das enquisas realizadas no método de valoración continxente consistiu en transmitirlles ós enquisados o que poderían conseguir, como poderían obtelo e que tiñan que pagar por iso. Dada a cantidade de información que era necesario transmitir na enquisa, este traballo esixía un amplo período de investigación sobre a evolución do instrumento, que se vai describir máis adiante. Empregáronse diversas probas de diagnóstico na enquisa para determinar a aceptación das características do escenario.

A credibilidade, que constituía o cuarto obxectivo, require que a persoa enquisada atope o escenario e o vehículo de pagamento verosímil. A falta de credibilidade constitúe unha fonte moi importante de erro nas enquisas realizadas para o método de valoración continxente porque impide que os enquisados tomen en serio a situación de elección. Adoptamos diversas medidas para aumentar a credibilidade, incluído o uso de preguntas de

The second objective was to ensure consistency with economic theory by eliciting an approximation to the monetized loss in utility suffered by the respondents as a result of the injuries caused by the spill.

The third objective was a basic survey research goal: respondents from all educational levels and varied life experiences should be able to comprehend the language, concepts, and questions used in the survey so that they could make an informed decision. The particular challenge in CV surveys is to convey to respondents what they would get, how it would be provided, and that they would have to pay for it. Given the amount of information it was necessary to convey in the survey, this required an extended period of instrument development research, which is described below. Various diagnostic checks were used in the survey to determine acceptance of scenario features.

Plausibility, the fourth objective, requires that a respondent find the scenario and the payment vehicle believable. Lack of plausibility is a major source of error in CV surveys because it keeps respondents from taking the choice situation seriously. We took various steps to enhance plausibility, including the use of WTP

disposición a pagar, en vez de disposición a aceptar[11]. Unha pregunta con formato de referendo pediríalles ós enquisados que xulgasen se votarían a favor ou en contra dun programa que, de ser adoptado, lle custaría ó seu fogar unha cantidade determinada.

O quinto obxectivo era a neutralidade: a redacción e a información proporcionada na enquisa non debían ser percibidas polos enquisados como un instrumento para promover os intereses dunha parte interesada determinada, como por exemplo as compañías petrolíferas, o goberno ou os ecoloxistas[12]. A redacción da enquisa foi revisada exhaustivamente en varias etapas do seu desenvolvemento para axudar a avaliar o noso éxito á hora de acadar este obxectivo. Tamén se incluíu unha pregunta de diagnóstico sobre quen crían os enquisados que estaba a patrocinar o estudio para descubrir se identificaban algunha parte interesada determinada.

O obxectivo final consistía en ser prudente á hora de calcular a disposición a pagar. Cando nos enfrontamos á decisión de

rather than WTA elicitation questions[11]. A referendum format asked respondents to make a judgment as to whether they would vote for or against a program that, if adopted, would cost their household a specified amount.

The fifth objective was neutrality: the wording and information in the survey instrument should not be perceived by respondents as promoting the interests of any particular party such as the oil companies, government or environmentalists[12]. The instrument's wording was critically peer reviewed at various stages in its development to help assess our success in meeting this objective. A diagnostic question about who the respondents believed was sponsoring the study was also included to see if one party was identified more than another.

The final objective was to be conservative in estimating WTP. When faced

11. A disposición a aceptar é o dereito de propiedade axeitado para avaliar os danos ós recursos naturais. Os enquisados en valoración continxente adoitan atopar preguntas en que se lles cuestiona cánto estarían dispostos a aceptar en compensación pola aceptación voluntaria dunha perda dun ben ambiental público, pouco convincentes (Mitchell e Carson, 1989), xa que non cren que eles posúan un dereito de propiedade persoal para vender o ben.

12. A identidade do patrocinador da enquisa, o Estado de Alasca, non foi revelada nin ós entrevistadores nin ós enquisados.

11. Willingness to accept is the appropriate property right for natural resource damages. Respondents in CV surveys tend to find questions that ask them how much they would accept in compensation to voluntarily accept a loss to a public environmental good implausible for a variety of reasons (Mitchell and Carson, 1989), since they do not believe they possess a personal property right to sell the good.

12. The identity of the survey's sponsor, the State of Alaska, was not revealed to either the interviewers or the respondents.

elixir entre dúas formas de redactar, deseñar ou analizar opcións, onde ningunha das dúas opcións era claramente preferida baseándose na teoría ou en razóns metodolóxicas sólidas, nós eliximos a que, de ter algunha repercusión, diminuíse a disposición a pagar agregada total. Por esta razón, por exemplo, non se mostraban fotos de aves petroleadas ós enquisados, empregábase un pagamento dunha vez en vez de varios pagos en diferentes momentos e as respostas "Non sabe" eran consideradas respostas negativas en vez de retiralas da mostra.

Deseño da investigación

Durante a primeira etapa de desenvolvemento do instrumento, realizamos seis grupos de enfoque (Krueger, 1988)[13] en diferentes localizacións ó longo dos Estados Unidos. Nos primeiros grupos, os debates trataban de explorar os coñecementos dos enquisados sobre o *Exxon Valdez*, as opinións sobre a causa e a natureza dos danos e sobre as percepcións acerca da credibilidade de posibles formas de evitar unha marea negra no futuro. Unha vez que se estableceron e confirmaron os modelos particulares de comprensión e

13. Este tipo de investigación cualitativa é cada vez máis empregada polos investigadores nas primeiras etapas de deseño de cuestionarios de valoración continxente porque constitúe unha forma eficaz de explorar as crenzas, actitudes e coñecementos da xente sobre o ben que se vai valorar e de obter as súas reaccións ós posibles elementos do escenario da valoración continxente (Morgan, 1993).

with a decision between two wording, design, or analysis options, neither of which was clearly preferred on the basis of theory or solid methodological grounds, we chose the one that would, if it had any effect, lower the aggregate WTP amount. On this basis, for example, pictures of oiled birds were not shown to respondents, a one-time payment was used rather than installment payments, and "don't know" responses were treated as "no" votes instead of dropping them from the sample.

Design Research

During the first stage of the instrument development, we conducted six focus groups (Krueger, 1988)[13] in different locations around the United States. In the first groups, discussions explored participant knowledge of the *Exxon Valdez* spill, beliefs about the cause and nature of the harm, and perceptions of the plausibility of possible ways of preventing a future spill. Once particular patterns of understanding and knowledge were established and

13. This type of qualitative research is increasingly used by survey researchers in the early stages of designing contingent valuation questionnaires because they are an efficient way to explore people's beliefs, attitudes, and knowledge about the good to be valued, and to obtain their reactions to possible CV scenario elements (Morgan, 1993).

coñecemento, introducíronse novos temas en grupos posteriores[14].

Na seguinte etapa, que tivo lugar no outono de 1989, desenvolvemos un borrador do cuestionario e utilizámolo para efectuar entrevistas de proba. Durante estas enquisas persoais exhaustivas, o instrumento foi revisado unha e outra vez para pulir a información que presentaba e para mellorar a súa claridade e fluidez antes de que os entrevistadores o probasen na práctica.

Durante a terceira etapa de desenvolvemento do cuestionario, que tivo lugar entre febreiro e novembro de 1990, realizamos catro enquisas piloto en diversas partes do país[15]. As enquisas piloto permitíronnos examinar o instrumento nun escenario moi semellante ó da enquisa final, obter datos cuantitativos para avaliar se funcionaba o cuestionario e levar a cabo experimentos de múltiple mostraxe para indagar en cuestións

confirmed, new topics were introduced in subsequent groups[14].

In the next stage, which took place in the fall of 1989, we developed a draft of the questionnaire and used it to conduct trial interviews. During these in-depth one-on-one interviews, the instrument was repeatedly revised to refine the information it presented and to improve its clarity and flow before experienced interviewers tested it in the field.

During the third stage of instrument development research, which took place from February to November 1990, we conducted four pilot surveys in various parts of the country[15]. The pilots allowed us to test the instrument in a setting close to that of the final survey, obtain quantitative data to assess how the survey instrument was working, and conduct split-sample experi-

14. Nos seguintes grupos describíanse máis detalladamente elementos dun posible cuestionario para axudarnos a comprender como entendían os entrevistados estes elementos e como empregaban esta información. Entre estes elementos incluíanse o vehículo de pagamento, a duración dos pagamentos, a descrición dos danos, a descrición dun plan para evitar mareas negras no futuro e o emprego de determinadas fotografías e mapas para dar a coñecer aspectos obxectivos do escenario.

15. Westat, un dos organismos pioneiros do país en investigación mediante enquisas, levou a cabo as entrevistas para este estudio, contratou os entrevistadores profesionais (que fixeron as entrevistas persoalmente na casa do enquisado), elaborou os materiais da entrevista baseándose no instrumento que lle proporcionamos, dirixiu a formación do entrevistador, supervisou a elaboración de entrevistas *in situ* e corrixiu e validou os cuestionarios finais.

14. In later groups, elements of a possible questionnaire were described in more detail to help us understand how the participants understood these elements and how they used this information. These included the payment vehicle, duration of payments, description of the injuries, description of a plan to prevent future spills, and use of particular photographs and maps to communicate factual aspects of the scenario.

15. Westat, one of the country's premier survey research organizations conducted the interviews for this study, recruited the professional interviewers (who gave face-to-face interviews at the respondent's home), prepared the interview materials based on the instrument we delivered to them, conducted the interviewer training, supervised the production of interviews in the field, and edited and validated the completed questionnaires.

de deseño claves. A localización, a data e o tamaño da mostraxe das enquisas piloto aparecen na táboa 1[16].

Despois de cada enquisa piloto, analizamos os datos e revisamos o cuestionario baseándonos nas análises e nos amplos informes realizados polos entrevistadores. O instrumento foi reiteradamente revisado e mellorado desta maneira ata que confiamos en que cumpría cos obxectivos de investigación que pretendiamos.

ments to investigate key design issues. The location, date, and sample size of the pilot surveys are shown in Table 1[16].

After each pilot, we analyzed the data and revised the questionnaire on the basis of the analysis and extensive interviewer debriefings. The instrument was iteratively revised and improved in this manner until we were confident it met our research objectives.

Táboa / Table 1
Estudios piloto para o estudio do *Exxon Valdez*
Pilot Studies for *Exxon Valdez* Study

Enquisa piloto I Survey I	San José (California) San José, California	Febreiro de 1990 February, 1990	N=105
Enquisa piloto II Survey II	Dayton e Toledo (Ohio) Dayton & Toledo, Ohio	Maio de 1990 May, 1990	N=195
Enquisa piloto III Survey III	Cinco condados rurais de Xeorxia Five rural counties in Georgia	Setembro de 1990 September, 1990	N=224
Enquisa piloto IV Survey IV	Dayton e Toledo (Ohio) Dayton & Toledo, Ohio	Novembro de 1990 November, 1990	N=176

16. A enquisa piloto I reflicte a primeira proba de campo formal. A II, que é unha proba realizada nunha submostra, comparaba os efectos de dous posibles métodos de pagamento: os impostos sobre a renda e os prezos do petróleo. A III englobaba dúas probas adicionais con submostras, nas que se comparaba: a) versións revisadas sobre os métodos de pagamento do imposto sobre a renda e do prezo do petróleo e, b) o efecto que produce a exclusión dun elemento ambiental en cada unha das preguntas A-1 e A-3 sobre a disposición a pagar. A IV foi a última proba de campo formal e semellábase moito á enquisa final.

16. Pilot I reflects the first formal field test. Pilot II, a split-sample test, compared the effect of two possible payment vehicles, income taxes and oil prices. Pilot III encompassed two split-sample tests comparing: a) revised versions of the income tax and oil price payment vehicles and, b) effect of excluding an environmental item in each of questions A-1 and A-3 on the WTP estimate. Pilot IV was the last formal field test and closely resembled the final survey.

Cuestións claves relativas ó deseño

As cuestións clave relativas ó deseño neste estudio incluían a elección do método de obtención do valor, a natureza do método de pagamento, o período de tempo en anos no que se recadarían estes pagamentos e se o ben era valorado nunha secuencia que inclúe outros bens.

Con respecto ó formato de pregunta, decidimos nas primeiras etapas do proceso que os enquisados debían responder a unha pregunta binaria de elección discreta (Bishop e Heberlein, 1979). Este tipo de pregunta, normalmente denominada pregunta con formato "tomalo ou deixalo", require que o enquisado responda si ou non a un custo específico. Unha pregunta tipo referendo é incentivo-compatible baixo condicións bastante xenéricas cando o goberno ten a capacidade de facer efectivos os pagos se a política se aplica; é dicir, o enquisado non pode facer outra cousa mellor ca responder "si" se realmente prefire esa política ó custo especificado ou responder "non" se non se dá este caso. A pregunta binaria de elección discreta para a obtención de valor expandiuse cara a unha pregunta de elección discreta dobremente acoutada (Hanemann, Loomis e Kanninen, 1991). Neste tipo de preguntas o enquisado ten que responder "si" ou "non" a unha segunda pregunta que contén un prezo máis alto có primeiro se a resposta á primeira pregunta é "Si" e unha cantidade máis baixa se a resposta inicial é "Non". Se se empregan os

Key Design Issues

Key design issues for this study included the choice of the elicitation method, the nature of the payment vehicle, the years over which payments are collected, and whether the good is valued in a sequence which includes other goods.

With respect to the elicitation method, we determined early in the process that respondents should be asked a binary discrete choice question (Bishop and Heberlein, 1979). This type of question, often called a take-it-or-leave-it question, requests the respondent give a yes-or-no response to a specific cost. A single take-it-or-leave-it referendum-like question for a public good is incentive-compatible under fairly general conditions when the government has the ability to compel payment if the policy is implemented; that is, a respondent can do no better than saying "yes" if the policy is actually preferred at the specified cost or by saying "no" if otherwise. The simple binary discrete choice elicitation has been extended to the double-bounded dichotomous choice question (Hanemann, Loomis and Kanninen, 1991). Here the respondent is asked to give a yes-or-no response to a second pre-specified higher amount if the response to the initial take-it-or-leave-it

dous tipos de resposta aumenta considerablemente o poder estatístico do estimador da disposición a pagar, é dicir, tende a producir un menor intervalo de confianza para a disposición a pagar para un tamaño mostral fixo; non obstante, isto ocorre a expensas dun nesgo á baixa da estimación porque a segunda resposta non é, en xeral, incentivo-compatible[17].

Das tres opcións máis naturais de método de pagamento, é dicir, impostos máis altos, prezos do petróleo máis elevados e prezos máis elevados nunha gama de productos máis ampla, só se consideraron aceptables os dous primeiros na investigación preliminar. Despois de facer comparación entre submostras con imposto e con prezo do petróleo nas enquisas piloto II e III, decidimos empregar

question is "yes" and to a pre-specified lower amount if the initial response is "no". Using both responses substantially increases the statistical power of the WTP estimate, *i.e.*, it tends to produce a much tighter confidence interval for the WTP estimate for any fixed sample size; however, it does so at the expense of a downward bias in the estimate because the second response is not, in general, incentive-compatible[17].

Of the three natural choices for the payment vehicle –higher taxes, higher oil prices and higher prices over a wider range of goods– only the first two were found to be plausible in our preliminary research. After conducting split-sample comparisons of a

17. Este nesgo á baixa é suxerido pola evidencia empírica e probablemente procede das expectativas creadas pola estimación do custo inicial que se lle dá ó enquisado. Algunhas persoas enquisadas que votaron a favor de pagar a primeira cantidade poderían estar dispostas a pagar a segunda cantidade (máis elevada) pero votan en contra da cantidade máis elevada cando se lles pregunta, porque pensan que o goberno malgastaría o diñeiro extra solicitado. Ademais, algunhas persoas enquisadas que non están dispostas a pagar a primeira cantidade estarían dispostas a pagar a segunda cantidade (máis baixa) pero votan en contra da segunda cantidade porque cren que ou ben o goberno proporcionaría unha calidade inferior á prometida en primeiro lugar ou ben que a probabilidade de que o goberno proporcione o ben é menor a un prezo máis reducido. Estes dous modelos de voto dan como resultado un nesgo á baixa. O alcance do nesgo depende do grao co que o enquisado percibe a segunda cantidade como unha estimación de custo independente. Carson, Groves e Machina (1999) proporcionan un marco conceptual formal para ter en conta esta cuestión.

17. This downward bias is suggested by empirical evidence and probably results from expectations formed by the initial cost estimate given to the respondent. Some respondents who vote to pay the first amount might be willing to pay the second (higher) amount but vote against the higher amount when asked because they feel that the government would waste the extra money requested. In addition, some respondents who are not willing to pay the first amount would be willing to pay the second (lower) amount but may vote against the second amount because they believe that either the government will deliver a lower quality good than that first promised or that the probability of the government delivering the good is lower at the lower price. Both of these voting patterns result in a downward bias. The extent of the bias depends on the degree to which the second amount is perceived by the respondent as being an independent cost estimate. Carson, Groves and Machina (1999) provide a formal conceptual framework for considering this issue.

o pagamento cos impostos na enquisa final por dúas razóns: en primeiro lugar, o prezo da gasolina, que é o principal producto petrolífero mediante o cal os consumidores pagarían polo plan se se empregase o método de pagamento dos prezos do petróleo, era demasiado inestable debido á invasión de Kuwait por parte de Iraq. Semellaba probable que os prezos da gasolina ían aumentar rapidamente nun futuro próximo cando se estivese achegando a enquisa final ou, quizais, diminuirían se a crise se resolvese pacificamente. Esta inestabilidade incrementou a posibilidade de empregarse o prezo do petróleo como vehículo de pagamento, a disposición a pagar podería verse distorsionada debido a factores que non estaban relacionados con ningún valor económico de evitar o futuro dano ó estreito de Prince William. En segundo lugar, as dúas probas con submostras demostraron que o método de pagamento a través dos impostos tendía a obter as mesmas cantidades (enquisa piloto III) ou inferiores (enquisa piloto II) ás obtidas co método de pagamento mediante prezos do petróleo.

En relación co número de anos en que se recadarían eses pagamentos, tivéronse en conta tres aspectos moi importantes; en primeiro lugar, os períodos de pagamento máis prolongados significaban que as limitacións de orzamento, especialmente para aqueles fogares con ingresos máis baixos, eran menos vinculantes. En segundo lugar, os pagamentos periódicos tenden a garantir ós enquisados o compromiso

tax and an oil price vehicle in Pilots II and III, we decided to use the tax vehicle in the final survey for two reasons. First, the price of gasoline, the major type of oil product through which consumers would pay for the plan if we used the oil prices vehicle, had become quite unstable due to Iraq's invasion of Kuwait. It appeared likely that gasoline prices would increase rapidly in the near future when the final survey would be in the field or, perhaps, decrease if the crisis was resolved peacefully. This instability raised the prospect that if we used the oil prices vehicle, the respondents' WTP amounts might be distorted because of factors unrelated to any economic value they held for preventing future damage to Prince William Sound. Second, the two split-sample experiments showed that, if anything, the tax vehicle tended to elicit the same (Pilot III) or lower (Pilot II) amounts than those elicited by the oil prices vehicle.

With respect to the number of years over which payments are collected, three major issues were considered. First, longer payment periods mean that budget constraints, particularly for lower income households, are less binding. Second, periodic payments tend to assure respondents that the good will be provided in future

de que o ben será proporcionado en anos futuros. En terceiro lugar, con pagos durante varios anos algúns entrevistados poden chegar a crer que é posible que o goberno modifique o contrato se se producen mellores oportunidades. Non existía un fundamento obvio *a priori* no que se puidese asentar a elección entre un pagamento dunha soa vez ou o pagamento anual. Baseándonos no traballo adicional feito co grupo de enfoque e nunha enquisa telefónica, eliximos o pagamento dunha soa vez[18]. Os enquisados pertencentes ó grupo de enfoque decidiron facer polo menos o pagamento inicial e, en xeral, facer pagamentos dous ou tres anos máis, pero calquera sistema de pagamento de maior duración semellaba padecer o problema das expectativas sobre a futura modificación do contrato mencionado antes. O pagamento dunha soa vez evita este problema e ten a vantaxe de suprimir a necesidade de decidir que taxa debía aplicarse ó desconto de pagamentos posteriores. Tamén ten o inconveniente de que obriga ós enquisados a someterse a unha restricción de orzamento moito máis severa, como medida conservadora.

18. Na enquisa telefónica valorábase a instalación dun depurador de gases nunha central eléctrica en Columbus (estado de Ohio) empregando 500 observacións dun deseño con múltiples mostras cos sistemas do pagamento dunha soa vez e de pagamento anual. Aínda que os resultados desta enquisa rexeitaban claramente ($p < .01$) a opinión de Kahneman e de Knetsch (1992; p. 63) de que os enquisados non se fixan na natureza temporal da obrigación de pagamento, si resultaban coherentes coa presencia de altas taxas de desconto e/ou limitacións de empréstito observadas con moitos bens de consumo.

years. Third, with multiple year payments some respondents may believe that it is possible for the government to recontract if better opportunities come along. There was no obvious *a priori* basis on which to choose between the lump sum and the annual payment schemes. On the basis of additional focus group work and a telephone survey, we chose the lump-sum payment[18]. Focus group participants were committed to making at least the initial payment and generally to paying for two or three additional years, but any payment schedule longer than that appeared to suffer from the recontracting problem. The lump-sum payment avoids this problem and has the advantage of eliminating the need to determine what rate ought to be applied to discount future payments. It also has the disadvantage of forcing a much tighter budget constraint on respondents, a conservative feature.

18. The telephone survey valued the installation of a scrubber on a power plant in Columbus, Ohio using 500 observations in a split-sample design with a lump sum and annual payment schemes. While the results from this survey clearly rejected ($p < .01$) Kahneman and Knetsch's (1992; p. 63) contention that respondents do not focus on the temporal nature of the payment obligation, they were consistent with the presence of high discount rates and/or borrowing constraints observed with many consumer durables.

Por último, había dúas opcións relacionadas co chamado "embedding"[19] (= o feito de estar incluído, inserido, incrustado). A primeira referíase a se se debía valorar só o producto de interese primario ou nunha sucesión doutros bens públicos substitutivos. Para esta dúbida a teoría económica proporciona importantes pautas para a valoración dos danos ós recursos naturais[20]. Debido ós efectos substitución e renda, canto máis se tarde en valorar un producto normal nunha secuencia de disposición a pagar, máis baixo é o seu valor. Sen embargo, ocorre o contrario, cando se trata dunha secuencia de disposición a aceptar; canto máis se tarde en valorar un producto nunha secuencia de disposición a aceptar, maior é o seu valor. Estas dúas proposicións poden combinarse co feito de que a compensación que proporciona a disposición a aceptar un ben é maior ou igual á disposición a pagar para o mesmo producto (Hanemann, 1991), o cal demostra que a valoración dun ben en primeiro lugar (é dicir, por si mesmo) nunha secuencia de disposición a pagar constitúe a maior aproximación

Finally, there were two choices related to "embedding"[19]. The first was whether to value the good of primary interest by itself or in a sequence of other substitute public goods. Here economic theory provides some important guidance for the valuation of natural resource damages[20]. Due to substitution and income effects, the later in a WTP sequence a normal good is valued, the lower its value. The opposite, however, is true of a WTA sequence; the later in such a sequence a good is valued, the greater its value. These two propositions can be combined with the fact that WTA compensation for a good is greater than or equal to willingness to pay for the same good (Hanemann, 1991) to show that valuing a good first (*i.e.*, by itself) in a WTP sequence is the closest approximation to whatever sequence-specific WTA compensation measure is desired (short of being able to mea-

19. "Embedding" é un termo introducido por Kahneman no vocabulario específico relativo á valoración continxente para referirse a diversas cuestións que teñen que ver coa sucesión e inclusión de bens, así como un problema de deseño de enquisas coñecido como nesgo parte/todo. Véxase Carson e Mitchell (1995) para un comentario sobre este tema.

20. Para algúns comentarios sobre este tema, véxase Hoehn e Randall (1989), Bishop e Welsh (1992) e Carson, Flores e Hanemann (1998).

19. Embedding is a term introduced into the contingent valuation literature by Kahneman to refer to various issues related to the sequencing and nesting of goods as well as a survey design problem known as part-whole bias. See Carson and Mitchell (1995) for a discussion.

20. For discussions, see Hoehn and Randall (1989); Bishop and Welsh (1992); and Carson, Flores and Hanemann (1998).

a calquera medida de compensación baseada na disposición a aceptar e específica para esa secuencia (lonxe de poder medir a disposición a aceptar directamente, o cal resulta difícil de facer en termos xerais).

A segunda opción relativa a "embedding" era metodolóxica: o deseño debía garantir que os enquisados non respondesen a unha pregunta diferente da que se lles formulara, ben esquecendo as súas limitacións de orzamento, ben deixando que o estreito de Prince William fose sometido a todas as mareas negras ou mesmo a todos os danos posibles ocasionados ó medio natural. Para cumprir este requisito, o escenario debe presentar unha situación de elección crible que describa o producto e o seu método de provisión co nivel de detalle suficiente para que os entrevistados saiban o que poden ou non escoller. A elección de deseño consiste en decidir se se deben valorar os múltiples bens nunha soa enquisa ou se debe valorar un só ben e diferencialo coidadosamente no cuestionario dos outros bens cos que se podería confundir. Empregouse unha enquisa que valoraba un só ben por dúas razóns: en primeiro lugar, evitaba dificultades que se introducían cando se valoraban varios bens e, en segundo lugar, as enquisas de valoración continxente dun só ben que estaban ben deseñadas demostraron ser capaces de obter valores que eran sensibles ás características do ben que estaba a ser valorado (Carson e Mitchell, 1995; Carson, 1997; Carson, Flores e Meade, 2001).

sure willingness to accept directly, which is generally difficult to do).

The second "embedding" choice was methodological: the design should ensure that respondents do not answer a different question than the one they are asked, whether by forgetting about their budget constraints or by letting Prince William Sound stand for all oil spills or even all environmental damage. To meet this requirement, the scenario *must* present a plausible choice situation describing the good and its method of provision in adequate detail so that the respondents know what they will and what they will not get. The design choice is whether to value multiple goods in a single survey or to value a single good and carefully differentiate it in the instrument from those other goods with which it might be confused. A survey valuing a single good was used for two reasons. First, it avoids difficulties that are introduced by valuing multiple goods. Second, well-designed single-good CV surveys have been shown to be capable of eliciting values that are sensitive to the characteristics of the good being valued (Carson and Mitchell, 1995; Carson, 1997; Carson, Flores and Meade, 2001).

In constructing the scenario for this study, we took several steps to

Á hora de elaborar o escenario para este estudio, tomamos algunhas medidas para minimizar a posibilidade do erro de percepción por parte do enquisado á hora de entender o ben que se lle pide que valore. En primeiro lugar, prestamos especial atención ós grupos de enfoque e ás entrevistas a fondo para observar a forma de pensar da xente en relación co ben que lle ofrecemos. En segundo lugar, empregamos este coñecemento dunha maneira que se describirá máis adiante, para centrar a atención dos enquisados no que poderían obter se se levase a cabo o programa. En terceiro lugar, cada vez que empregamos o cuestionario, tanto durante o proceso de desenvolvemento como na propia entrevista final, formulamos preguntas abertas e pechadas para avaliar se os enquisados entenderan ben o que estabamos intentando transmitirlles na enquisa. Isto permitiunos identificar na análise a presencia de calquera problema de percepción que quedase e, na medida en que estaba presente, determinar se este problema afectaba ós resultados e de que xeito.

3 ESTRUCTURA DO CUESTIONARIO FINAL

Os instrumentos de valoración continxente, como o empregado neste estudio, difiren das sondaxes de opinión pública habituais en varios aspectos importantes. Unha diferencia consiste na cantidade de información que o entrevistador lle transmi-

minimize the possibility of respondent perceptual error in understanding the good they are being asked to value. First, we paid particular attention in the focus groups and in-depth interviews to how people think about the good we offer them. Second, we used this knowledge, in ways that will be described later, to focus the respondents' attention on what they would and would not get if the program were implemented. Third, each time we used the instrument, both during the development process and in the final interview itself, we asked open- and close-ended questions to assess how well respondents understood what we were attempting to convey in the survey. This enabled us in the analysis to identify the presence of any remaining perceptual problems and, to the extent that they were present, to determine if and how they affected the results.

3 STRUCTURE OF THE FINAL QUESTIONNAIRE

CV instruments such as the one used in this study differ from ordinary public opinion surveys in several important respects. One difference is the amount of information that the interviewer conveys to the respondent during the presentation of the sce-

te ó enquisado durante a presentación do escenario. Case a metade da entrevista, que durou 40 minutos, estivo dedicada a informar ó enquisado sobre os efectos da marea negra, sobre un programa que puidese evitar outra marea negra cos mesmos efectos e de que xeito podía contribuír economicamente o enquisado a pagar por este programa se considerase que valía o custo especificado. Unha segunda diferencia refírese a que a enquisa xira arredor dunha soa pregunta: se o enquisado vota a favor ou en contra do programa. O escenario baséase nesta pregunta e unha serie de preguntas de seguimento examinan as razóns do enquisado para votar da forma que o fixo e o que tiña na mente cando votou. Unha terceira diferencia refírese á oportunidade que se lles ofrece ós enquisados de cambiar o seu voto nunha etapa máis avanzada da enquisa se quixesen facelo despois de reflexionar un pouco máis.

Para manter o interese dos enquisados e aumentar a súa capacidade de asimilar a información recibida durante a entrevista, o material presentouse nunha secuencia moi coidada, intercalando material visual e preguntas. Este apartado ofrece unha visión xeral da entrevista. O texto que aparece en recadro ou entre comiñas procede do cuestionario a non ser que se indique outra cousa distinta. O texto da enquisa en maiúsculas indica as instruccións que se lle dan ó entrevistador e que este non le ós entrevistados.

nario. Almost half the length of the 40-minute interview was devoted to informing the respondent about the effects of the spill; a program that could prevent another spill with the same effects, and how the respondent could pay for this program if the respondent thought it was worth the specified cost. A second is the focus of the survey on a single question: whether the respondent would vote for or against the program. The scenario systematically builds up to this question and a series of follow-up questions explores the respondents' reasons for voting the way they did and what they had in mind when they voted. A third is the opportunity respondents were given to change their vote at a later point in the survey in case they wished to do so after further reflection.

To maintain the respondents' interest and enhance their ability to comprehend the information received during their interview, the material was presented in a carefully designed sequence interspersed with visual aids and questions. This section provides an overview of the interview. Boxed or quoted text is from the questionnaire unless otherwise indicated. Survey text in capital letters indicates interviewer instructions not read to the respondents.

Preguntas iniciais

Ó principio da entrevista, os enquisados non sabían que o tema principal da enquisa era a marea negra provocada polo *Exxon Valdez*[21], o cal nos permitiu medir as actitudes dos enquisados sobre varios tipos de bens públicos e o seu coñecemento anterior sobre a marea negra antes de desvelarlles o obxectivo da enquisa.

Despois de formular estas preguntas iniciais, o entrevistador comezaba a presentarlle os elementos do mercado construído sobre o que máis adiante se lle pediría ó enquisado que votase a favor ou en contra dun plan que lle custaría unha determinada cantidade de diñeiro. Este escenario transmitíalle información sobre o estreito de Prince William, o transporte de petróleo en barco desde Valdez, a marea negra do *Exxon Valdez* e os seus efectos, e un programa de barcos de acompañamento para evitar danos doutra marea negra que producise os mesmos efectos no medio natural. En varios lugares durante a presentación do escenario, os entrevistadores mostráronlles ós enquisados un dos dezanove materiais visuais: mapas, fotografías en color e imaxes gráficas. Estes materiais foron deseñados e avaliados previamente para axudarlles ós enquisados a visualizar aspectos importan-

21. Ós enquisados potenciais dixéronlles que a entrevista era para un estudio sobre as opinións da xente acerca de temas de actualidade.

Initial Questions

At the beginning of the interview, respondents did not know that the main subject matter of the survey was the *Exxon Valdez* oil spill[21]. This allowed us to measure respondent's attitudes about various types of public goods and their prior awareness of the spill before revealing the purpose of the survey.

After these preliminary questions, the interviewer began to present the elements of the constructed market in which the respondent would later be asked to vote in favor of or against a plan costing the respondent a specific amount of money. This scenario conveyed information about Prince William Sound, the transport of oil by ship from Valdez, the Exxon Valdez spill and its effects, and an escort ship program to prevent damage from another spill that would have the same effect on the environment. At various places during the presentation of the scenario, interviewers showed respondents one of nineteen visual aids: maps, color photographs, and show cards. These materials were designed and pretested to help respondents

21. Potential respondents were told that the interview was for a study of people's views about current issues.

tes do escenario e a entender o material que lles lían.

Descrición do estreito de Prince William

Despois de mostrarlles ós enquisados un mapa no que se localizaba o estreito de Prince William no contexto de Alasca, e Alasca no contexto dos Estados Unidos, describíase en detalle esta zona xeográfica coa axuda doutro mapa. O recadro A mostra unha parte do instrumento que ilustra como se integraban fotografías e texto para transmitir unha impresión do estreito e das súas características. As fotografías A, B e C amosaban diversas características do estreito, incluído o glaciar de Columbia.

Logo a descrición centrábase na fauna e na flora. Durante esta parte do texto ós enquisados ensinábanselles fotografías de exemplares vivos dalgunhas especies de fauna e flora que morreron a causa da marea negra. Para ser prudentes, non empregamos fotografías de animais feridos ou mortos pola marea negra.

O seguinte apartado do escenario describía a marea negra e o seu impacto no litoral. Despois de presentar unha fotografía dun petroleiro no estreito, o texto da pregunta centrábase na marea negra do *Exxon Valdez*. Neste punto formulábanse unha serie de preguntas para manter o enquisado activamente implicado na enquisa. O entrevistador presentáballe logo un mapa da zona afectada pola marea negra e sinalaba o lugar onde

visualize important aspects of the scenario and to understand the material being read to them.

Prince William Sound Description

After showing respondents a map that located Prince William Sound in the context of Alaska, and Alaska in the context of the United States, the Sound was described in detail with the help of another map. Box A provides a portion of the instrument that illustrates how text and photographs were integrated to covey a sense of the Sound and its features. Photographs A, B, and C were of various features of the Sound including the Columbia Glacier.

The description then turned to wildlife. During this part of the narrative respondents were shown photographs of living examples of some of the types of wildlife that were killed by the spill. To be conservative, we did not use photographs of actual animals harmed or killed by the spill.

The next section of the scenario described the spill and its impact on the shoreline. After a photograph of a tanker in the sound, the narrative focused on the *Exxon Valdez* spill. A series of questions were asked at this point to keep the respondent actively involved in the survey. The interviewer then presented a map of the spill area

RECADRO / BOX A

MOSTRE A FOTO A / SHOW PHOTO A

- Esta é unha fotografía aérea de Valdez. Esta é a cidade (SINÁLEA) e atravesándoa atópase a terminal onde o cru se introduce nos petroleiros (SINÁLEA). Estes son os petroleiros (SINÁLEOS).
- This photograph shows Valdez from the air. This is the town (POINT) and across from the town is the terminal where the oil is piped onto tankers (POINT). These are some tankers (POINT).
- Os petroleiros navegan a través dos pasos estreitos que hai aquí (SINÁLEOS) ata o estreito de Prince William. O petroleiro *Exxon Valdez* encallou nun arrecife baixo as augas arredor desta zona (SINÁLEA).
- The tankers go through the narrows here (POINT) into Prince William Sound. The *Exxon Valdez* tanker went aground on an underwater reef about here (POINT).
- Toda esta zona (SINÁLEA) é o estreito de Prince William.
- This whole area (POINT) is Prince William Sound.

MOSTRE A FOTO B / SHOW PHOTO B

- A seguinte foto mostra unha vista de parte do estreito.
- The next photo shows a view of part of the Sound.
- Como pode observar, está rodeada por altas montañas. En moitas zonas hai glaciares que rompen e producen pequenos icebergs. Esta foto mostra o glaciar de Columbia, que mide máis de 3 km de alto (SINALE UN FLANCO DO GLACIAR). Os icebergs deste glaciar ás veces flotan nas vías de navegación.
- As you can see, it is ringed with high mountains. In many areas there are glaciers that break up and produce small icebergs. This photo shows the Columbia Glacier which is more than 100 feet high (POINT TO GLACIER WALL). Icebergs from this glacier sometimes float into the shipping lanes.

MOSTRE A FOTO C / SHOW PHOTO C

- Como pode observar na seguinte foto, a zona non está moi desenvolvida.
- As you can see in the next photo, the area is largely undeveloped.
- Gran parte do terreo foi reservado para bosque nacional e parques estatais. A xente usa a zona para pescar, navegar en embarcacións de recreo, facer acampadas e outras actividades de lecer. En toda a zona só existen unhas poucas vilas. (PAUSA)
- Most of the land has been set aside as national forest and state parks. People use the area for fishing, boating, camping and other recreation. In the whole area there are only a few small towns. (PAUSE)

comezou o derramo, ata onde chegou e o tempo que lle levou ó petróleo chegar alí.

Outro mapa identificaba os lugares onde a costa estaba afectada, e onde non, no estreito de Prince William. Logo centraba a atención nos traballos de limpeza coa seguinte afirmación: "Como pode observar, Exxon fixo un gran esforzo para limpar o fuel das praias" e coa presentación da foto J, que mostraba a persoas traballando na limpeza do fuel nunha praia. Ós enquisados proporcionóuselles información específica sobre a duración dos danos coa seguinte afirmación: "Os científicos cren que os procesos naturais non eliminarán todo o hidrocarburo que queda nas praias ata pasados uns cantos anos despois da marea negra".

Descrición da fauna e da flora

O escenario describía logo o efecto da marea negra na fauna e na flora. A ficha 4 mostraba información sobre as doce especies de aves máis afectadas pola marea negra. Ademais do número de aves mortas que foron recuperadas, proporcionaba tamén a poboación total de cada unha das especies antes de acontecer a marea negra para proporcionar unha perspectiva sobre dispoñibilidade de substitutivos. Por exemplo, en relación cos araos, contabilizáronse 16.000 exemplares mortos e a poboación total de araos era 350.000. O recadro B presenta o texto que acompañaba á ficha 4. Este material comunicaba unha serie de datos importantes.

and pointed out where the spill began, how far it traveled, and the time it took for oil to travel that far.

Another map identified the places where the shore was and was not affected in Prince William Sound. Attention was then called to the cleanup effort in the statement, "As you may know, Exxon made a large effort to clean up the oil on the beaches," and in the presentation of Photo J which showed workers washing the oil off a beach. Respondents were given specific information about the duration of the injuries: "Scientists believe that natural processes will remove almost all the remaining oil from the beaches within a few years after the spill".

Description of Wildlife

The scenario then described the effect of the spill on wildlife. Card 4 displayed information about the twelve bird species most affected by the spill. In addition to the number of dead birds recovered, it gave the total pre-spill population for each of the species to provide a perspective on the available substitutes. For example, with respect to guillemot, 16,600 were reported dead, and the total population of guillemot was described as 350,000. Box B presents the narrative that accompanied Card 4. This materi-

MOSTRE A FOTO / SHOW PHOTO J

- A seguinte foto mostra algunhas das actividades de limpeza que se levaron a cabo no verán despois de se producir a marea negra. Unha das técnicas de limpeza consistía en eliminar con auga a maior cantidade posible de petróleo para introducilo no mar, onde era recollido cun equipo especial e logo retirado. Non foi posible eliminar deste xeito todo o cru dos coídos porque nalgúns lugares permanecía incrustado no solo e non se podía limpar. Os científicos cren que os procesos naturais non eliminarán todo o hidrocarburo que queda nas praias ata pasados uns cantos anos despois da marea negra. (PAUSA)
- The next photo shows some of the cleanup activity that took place in the summer after the spill. One of the cleanup techniques was to wash as much of the oil as possible off the shore into the water where it was scooped up by special equipment and taken away. It was not possible to remove all the oil from the rocky beaches in this way because some had already soaked into the ground and couldn't be washed out. Scientists believe that natural processes will remove almost all the remaining oil from the beaches within a few years after the spill. (PAUSE)

Por exemplo, asegurouse que ningunha destas especies se atopaba en perigo de extinción porque os nosos grupos de enfoque demostraron que este aspecto dos danos da marea negra era importante para os enquisados. Co fin de ofrecer o contexto real do que significa a morte masiva de aves, centrábase a atención no feito de que as mortes masivas de aves poden acontecer de forma natural. Tamén se lles dixo ós enquisados que as cifras de aves mortas mostradas nas fichas se limitaban ás que puideron ser recuperadas e que a cifra real calculábase que era entre tres e seis veces máis alta.

Noutra ficha mostráronse as cifras de mamíferos mortos nunha táboa. Igual que no caso das aves, proporcionáronse as estimacións do número total de exemplares que constituían a poboación, ademais das cifras de exemplares mortos. Cifráronse en 0 mortes de tres especies para as que non existían informes de animais

al communicated a number of important items.

For example, assurance was given that none of these species was threatened with extinction because our focus groups showed that this aspect of the spill injuries was important to respondents. In order to put the bird kill in perspective the text called attention to the fact that large bird kills can occur naturally. Respondents were also told that the numbers of dead birds shown on the cards are limited to those that were recovered and that the actual toll is estimated to be three to six times higher.

Mammal deaths were shown in a table on another card. As with birds, total pre-spill population estimates were provided in addition to kill estimates. Zero kill estimates were listed for three species for which no kills

mortos xa que algunhas persoas que fixeron a enquisa de proba deran por suposto que estas tres especies sufriran tamén danos.

were reported because some pretest respondents had assumed that there were also injuries to these species.

RECADRO / BOX B

- Durante o período en que se produciu a marea negra había cerca dun millón de aves e parrulos mariños de diversas especies na zona afectada pola marea negra dentro e fóra do estreito de Prince William (SINÁLEA).
- During the period of the spill there were about one and a half million seabirds and sea ducks of various species in the spill area inside and outside Prince William Sound. (POINT)
- Como pode observar nesta ficha, atopáronse 22.600 aves mortas (SINÁLEA).
- As you can see from this card, 22,600 dead birds were found. (POINT)
- A cifra real de aves mortas a causa do petróleo foi maior xa que non se puideron recuperar todos os cadáveres. Os científicos calculan que a cifra total de aves mortas a causa da marea negra foi de 75.000-150.000.
- The actual number of birds killed by the oil was larger because not all the bodies were recovered. Scientists estimate that the total number of birds killed by the spill was between 75,000 and 150,000.
- Uns tres cuartos das aves mortas atopadas eran araos, a ave branca e negra que lle ensinei antes. Isto móstrase na primeira liña da ficha. (SINÁLEA).
- About three-fourths of the dead birds found were guillemot, the black and white bird I showed you earlier. This is shown on the first line of the card. (POINT)
- Dado que se calcula que uns 350.000 araos viven na zona afectada pola marea negra, a cifra de mortes, aínda que é alta, non significa unha ameaza para a especie.
- Because an estimated 350,000 murres live in the spill area, this death toll, though high, does not threaten the species.
- Tamén se atoparon mortas a causa do cru unhas 100 das aproximadamente 5.000 aguias de cabeza branca que existían na zona.
- One hundred of the area's approximately 5,000 bald eagles were also found dead from the oil.
- A marea negra non supuxo a ameaza de extinción de ningunha das especies de aves de Alasca, nin sequera das aguias (PAUSA).
- The spill did not threaten any of the Alaskan bird species, including the eagles, with extinction. (PAUSE)
- As poboacións de aves ás veces sofren grandes perdas a causa de enfermidades ou outras causas naturais. Baseándose nesta experiencia, os científicos esperan que todas estas aves de Alasca se recuperen nun período entre 3 e 5 anos despois da marea negra (PAUSA).
- Bird populations occasionally suffer large losses from disease or other natural causes. Based on this experience, scientists expect the populations of all these Alaskan birds to recover within 3 to 5 years after the spill. (PAUSE)

Explicación do Plan de Barcos de Acompañamento

A seguinte parte do escenario de referencia introducía o concepto dunha posible segunda marea negra como a do *Exxon Valdez* e describía como un programa de barcos de acompañamento evitaría e/ou contería a devandita marea negra. Era importante que o programa fose percibido como factible, eficaz e que requiriría a cantidade de diñeiro que máis adiante se definiría como o custo que lle suporía a un fogar se a medida fose aceptada no referendo. Informouse ós entrevistados de que se se puxese en marcha o programa, dous grandes barcos de gardacostas acompañarían a cada petroleiro en toda a súa viaxe a través do estreito de Prince William. Os barcos de acompañamento axudarían a evitar un accidente e, en caso que ocorrese un accidente, poderían evitar incluso un gran derramo dende a zona onde estaba o petroleiro[22].

Para evitar sobrecargar de información ós enquisados, só se incluíu no texto información que se demostrou na enquisa de proba que resultaba esencial para comunicar unha situación de elección convincente. Por exemplo, incluíuse a mención do requisito de que todos os petroleiros debían ter dobre casco nos dez anos seguintes porque durante a rea-

Explanation of the Escort Ship Plan

The next portion of the scenario introduced the concept of a possible second spill like the *Exxon Valdez* spill and described how an escort ship program would prevent and/or contain such a spill. It was important that the program be perceived as feasible, effective, and requiring the amount of money later stated as the cost the household would pay if it was approved in the referendum. Respondents were told that if the program were put into effect, two large Coast Guard ships would escort each tanker throughout its journey in Prince William Sound. The escort ships would help prevent an accident and, if an accident occurred, they would keep even a very large spill from spreading beyond the tanker[22].

To avoid overburdening the respondents, only information shown in our pretesting to be essential to communicating a plausible choice situation was included in the narrative. For example, mention of the requirement that all tankers should be double-hulled within the next ten years

22. O trazado dunha ruta dun barco de acompañamento que recuperaba fuel nun vertido demostrou que resultaba moi útil á hora de explicar como funcionaría o programa de acompañamento.

22. A line drawing of an escort ship recovering oil at an oil spill proved to be very helpful in explaining how the escort program would work.

lización da enquisa de proba decatámonos de que este aspecto engadía credibilidade. Esta información tamén axudou a definir máis claramente o período de dez anos durante o cal se poría en funcionamento o programa dos barcos de acompañamento. O texto salientou que o plan non proporcionaría protección fóra da zona do estreito de Prince William.

Preguntas de valoración

Ós entrevistados comunicóuselles que o programa sería financiado a través dun imposto que se pagaría unha soa vez e que se lles aplicaría ás empresas petrolíferas que transportasen fuel fóra de Alasca, e que os fogares coma o deles tamén pagarían un imposto federal especial unha soa vez que iría parar á Fundación para a protección do estreito de Prince William[23]. Inmediatamente antes de formular as preguntas sobre a disposición a pagar, o entrevistador presentou o material incluído no recadro C, que pretendía informar ós

23. As enquisas de proba demostraron que algúns enquisados criticaron a idea de que os cidadáns compartirían o custo do plan. Como esta opinión podería leva-los enquisados a rexeitar a premisa do escenario, que supoñía que emitirían un xuízo sobre o que valoraban o plan, ós entrevistadores pedíuselles que dixesen o seguinte ós que expresaban a opinión de que Exxon ou as compañías petrolíferas eran as que debían pagar na espera de persuadilos de que as empresas petrolíferas si pagarían unha parte: "Se se acepta o plan, as empresas petrolíferas que transportan petróleo a través do oleoducto de Alasca (incluída Exxon) si terán que pagar parte do custo mediante un imposto especial sobre os beneficios da empresa".

was included because during our pretests we learned that it added credibility. This information also helped to sharply define the ten-year period during which the escort ship program would operate. The narrative further noted that the plan would not provide spill protection outside Prince William Sound.

Valuation Questions

Respondents were informed that the program would be funded by a one-time tax on the oil companies that take oil out of Alaska and that households like theirs would also pay a special one-time federal tax that would go into a Prince William Sound Protection Fund[23]. Immediately before asking the WTP questions, the interviewer presented the material shown in Box C, which was intended to reassure respondents who

23. Pretests had shown that some respondents criticized the notion that citizens should share in paying the cost of the plan. Because this could lead respondents to reject the premise of the scenario, that they should make a judgment about what the plan is worth to them, the interviewers were instructed to say the following to those who expressed the view that Exxon or the oil companies should pay in an attempt to persuade them that the oil companies would pay a share: "If the program is approved, the oil companies that bring oil through the Alaska pipeline (including Exxon) will have to pay part of the cost by a special tax on their corporate profits".

enquisados que puidesen non estar dispostos a pagar polo programa que un voto en contra era socialmente aceptable. As razóns presentadas aquí para votar en contra do programa proviñan das dadas polos enquisados durante a fase de deseño da investigación.

A pregunta sobre a disposición a pagar (A--15) empregaba un formato de elección discreta tipo referendo para preguntar se os

might not be willing to pay for the program that a no vote was socially acceptable. The reasons presented here for voting against the program came from those given by respondents during the design phase of the research.

The WTP question, A-15, used a discrete-choice referendum elicitation format to ask whether the respondent

RECADRO / BOX C

- A-14E. Como todo o mundo sufragaría parte do custo, estamos a empregar esta enquisa para preguntarlle á xente qué votaría se tivese a oportunidade de decidir sobre o programa.
- A-14E. Because everyone would bear part of the cost, we are using this survey to ask people how they would vote if they had the chance to vote on the program.
- Descubrimos que algunhas persoas votarían a favor do programa e que outras votarían en contra. Os dous grupos de persoas teñen boas razóns para emitir os seus votos.
- We have found some people would vote for the program and others would vote against it. Both have good reasons for why they would vote that way.
- Aqueles que votan a favor din que lles compensa pagar ese diñeiro e previr os danos doutro gran vertido na Baía de Principe William.
- Those who vote for say it is worth money to them to prevent the damage from another large spill in Prince William Sound.
- Os que votan en contra mencionan preocupacións como as seguintes:
- Those who vote against mention concerns like the following.

  – Algúns din que non protexerá ningunha outra parte do país agás a zona ó redor do estreito de Prince William.
  – Some mention that it won't protect any other part of the country except the area around Prince William Sound.
  – Algúns opinan que se pagan este programa disporían de menos diñeiro para outras cousas que son máis importantes para eles.
  – Some say that if they pay for this program they would have less money to use for other things that are more important to them.
  – E algúns cren que o diñeiro que terían que pagar para o programa é máis do que poden pagar.
  – And some say the money they would have to pay for the program is more than they can afford.

enquisados votarían a favor do programa se lles custase unha determinada cantidade de diñeiro que sería pagada mediante un imposto federal unha soa vez. Para obter respostas para un rango de cantidades, déronse catro versións diferentes (de A a D) do cuestionario a catro submostras equivalentes. A todos os enquisados preguntóuselles, a continuación, por unha cantidade de seguimento apropiada á versión que recibiran e á súa resposta á primeira pregunta da disposición a pagar. Ós que votaron a favor pedíuselles a cantidade máis alta para a pregunta A-16 e ós que votaron en contra a cantidade máis baixa das que se dan na pregunta A-17.

As cantidades de diñeiro empregadas neste estudio (véxase a táboa 2) estaban baseadas en información sobre a distribución da disposición a pagar que se desprendía dos estudios piloto[24]. Foron elixidas para proporcionarlle eficiencia razoable á hora de calcular estatísticos fundamentais, tales como a mediana, ó mesmo tempo que proporcionaban certa solidez (Alberini e Carson, 1993) con respecto á observación dunha distribución da disposición a pagar substancialmente diferente na enquisa final.

24. O primeiro estudio piloto estableceu que unha gran porción da poboación estaba disposta a pagar pequenas cantidades de diñeiro para o programa mentres que o cero por cento estaba disposto a pagar 1.000 dólares. Máis tarde dedicáronse esforzos a tratar de conseguir estimacións razoables da fracción a favor en cuantís medios da distribución da disposición a pagar.

would vote for the program if it cost a specified amount that would be paid by a one-time federal tax payment. To obtain responses to a range of amounts, four different versions (A through D) of the instrument were administered to equivalent subsamples. Every respondent was also asked a follow-up amount appropriate to the version they received and their answer to the first WTP question. Those who voted “for” were asked the higher amount for question A-16 and those who voted “against” the lower amount shown for A-17.

The dollar amounts used in this study (see Table 2) were based on information about the underlying WTP distribution obtained from the pilot studies[24]. They were chosen to provide reasonable efficiency in estimating key statistics, such as the median, while providing some robustness (Alberini and Carson, 1993) with respect to observing a substantially different WTP distribution in the final survey.

24. The first pilot study established a large fraction of the population was willing to pay small amounts for the program while zero percent was willing to pay $1000. After this effort was devoted to helping to get reasonable estimates of the fraction in favor at more central quantiles of the WTP distribution.

O resto do apartado A estaba dedicado a preguntas abertas de seguimento deseñadas para proporcionar información sobre as razóns das respostas dadas polos enquisados ás preguntas de valoración. Ós enquisados que responderon afirmativamente formulóuselles a seguinte pregunta: "¿Que aspecto do programa o fixo estar disposto a pagar por el?". Ós enquisados que responderon negativamente ou "Non estou seguro" formuláronselles preguntas similares.

O apartado B incluía unha serie de preguntas deseñadas para avaliar as crenzas que tiñan os enquisados sobre elementos clave do escenario cando responderon ás preguntas de disposición a pagar. Malia que este tipo de avaliación é difícil de facer, pode resultar moi útil á hora de comprobar se os enquisados comprenderon o escenario e aceptaron as súas características básicas. Outras preguntas deste apartado medían características que poderían afectar ás preferencias á hora de

The remainder of Section A was devoted to open-ended debriefing questions designed to provide some information about the reasons for respondent answers to the valuation questions. Respondents who said "yes" were asked: "What was it about the program that made you willing to pay for it?" Respondents answering "no" or "not sure" were asked similar questions.

Section B contained a number of questions designed to assess the beliefs respondents held about key elements of the scenario when they answered the WTP questions. Although this type of assessment is difficult to make, it can be very helpful in checking whether respondents understood the scenario and accepted its basic features. Other questions in this section measured attributes that might affect preferences for protecting the Prince

Táboa / Table 2
Custo do programa por versión e pregunta
Program Cost by Version and Question

Versión / Version	A-15	A-16	A-17
A	$10	$30	$5
B	$30	$60	$10
C	$60	$120	$30
D	$120	$250	$60

protexer o contorno do estreito de Prince William dos efectos doutra marea negra.

Ademais das preguntas demográficas, no apartado C a todos os entrevistados que votaran a favor de pagar unha ou máis cantidades das presentadas nas preguntas de disposición a pagar preguntóuselles con cánta intensidade estarían dispostos a apoiar este programa se custase esta cantidade tan elevada de cartos. A todos os que responderon "non demasiada" ou "con ningunha intensidade" preguntóuselles logo: "¿Tendo en conta todos os aspectos, gustaríalle cambiar o seu voto por un voto en contra se lle custase ó seu fogar X dólares? A enquisa concluía coa pregunta sobre quen crían que era o patrocinador do estudio[25].

4 EXECUCIÓN DA ENQUISA

A enquisa levouse a cabo empregando unha mostra probabilística multi-etápica por áreas en vivendas residenciais escollidas nos 50 estados dos Estados Unidos e no distrito de Columbia. Na primeira fase de selección, escolléronse 61 condados ou grupos de condados considerados como unidades de mos-

25. Pouco despois de rematar cada entrevista, o enquisador cubría unha serie de preguntas no apartado D sobre as circunstancias baixo as que se levou a cabo a entrevista e as impresións do entrevistador sobre se o enquisado tivera algunha dificultade á hora de entender as preguntas en que se lle pedía o seu voto e a seriedade da consideración do enquisado sobre estas preguntas.

William Sound environment from the effects of another oil spill.

In addition to demographic questions, in Section C all respondents who had voted for one or more of the amounts asked about in the WTP questions were asked how strongly they favored the program if it cost this much money. Everyone who answered "not too strongly" or "not at all strongly" was then asked: "All things considered, would you like to change your vote on the program if it cost your household $__ from a vote for the program to a vote against?" The interview concluded with the question that asked for their best guess as to who "employed my company to do this study"[25].

4 SURVEY EXECUTION

The survey was conducted using a multi-stage area probability sample of residential dwelling units drawn from the 50 United States and the District of Columbia. In the first stage selection, 61 counties or county groups

25. Shortly after completing each interview, the interviewer completed a series of questions in Section D about the circumstances under which the interview was conducted and the interviewer's impressions about whether the respondent had any difficulty understanding the vote questions and the seriousness of the consideration the respondent gave to these questions.

traxe primarias con probabilidades proporcionais ós datos da poboación[26]. Dentro destas unidades de mostraxe primarias, seleccionáronse 334 grupos compactos do censo con probabilidades proporcionais ós datos na poboación total. Os grupos compactos do censo foron estratificados por dúas características comúns: a porcentaxe da poboación negra e a media ponderada do valor de vivenda en propiedade e o aluguer da vivenda ocupada polo arrendador. Na terceira fase aproximadamente elixíronse 1.600 fogares a partir dos bloques seleccionados. Todas as unidades de vivenda elixidas para a mostraxe foron logo asignadas aleatoriamente a unha das catro diferentes versións dos prezos incluídos na enquisa.

Foi elixido aleatoriamente un enquisado dentro de cada fogar para a entrevista. Despois de eliminar fogares baleiros e os fogares en que os seus inquilinos non eran falantes de inglés, xa que non eran elixibles

known as primary sampling units (PSU's) were drawn with probabilities proportionate to their population counts[26]. Within these selected PSU's, 334 Census block groups were drawn with probabilities proportionate to their total population counts. The census block groups were stratified by two block characteristics: percent of the population that was black and a weighted average of the value of owner-occupied housing and the rent of renter-occupied housing. In the third stage, approximately 1,600 dwelling units were drawn from the selected blocks. All dwelling units chosen for the sample were then randomly assigned to one of the four different dollar versions of the survey instrument.

A respondent within each dwelling unit was randomly chosen for the inter-

26. Antes de facer a selección, estratificáronse as 1.179 unidades de mostraxe primarias polas seguintes características do censo decenal feito en 1980: (1) rexión do país; (2) SMSA versus non-SMSA; (3) índice de cambio de poboación entre 1970 e 1980; (4) porcentaxe de habitantes no rural (para os non–SMSA PSU's); (5) porcentaxe empregada en fábricas; (6) porcentaxe de brancos; (7) porcentaxe de habitantes de cidades e (8) porcentaxe de maiores de 65 anos. A selección a partir de estratos aumenta normalmente a precisión dos resultados da enquisa se se comparan coa selección non estratificada. Para un debate sobre as vantaxes comparativas da selección estratificada, véxase Sudman (1976). Para a mostraxe foi empregado o censo de 1980, xa que os resultados dos censos de 1990 aínda non estaban dispoñibles.

26. Before the selection was made, the 1,179 PSU's were stratified by the following 1980 Decennial Census characteristics: (1) region of the country; (2) SMSA versus non-SMSA; (3) rate of population change between 1970 and 1980; (4) percent living on a farm (for non-SMSA PSU's); (5) percent employed in manufacturing; (6) percent white; (7) percent urban; and (8) percent over age 65. Selection from strata typically increases the precision of the survey results compared to unstratified selection. For a discussion of the comparative advantages of stratified selection, see Sudman (1976). The 1980 census was used for the sample, as results from the 1990 census were not yet available.

para a enquisa[27], esta tivo un índice de resposta do 75,2%, o cal se compara favorablemente coas mellores enquisas académicas, como as da Investigación das Eleccións Nacionais Americanas da Universidade de Michigan e a Investigación Social Xeral da Universidade de Chicago.

Como non se lles proporcionaba información sobre o tema da enquisa ás persoas ata que estaba en marcha esta, a disposición a pagar polo programa para o estreito de Prince Willian *per se* non podía influír no feito de que un fogar respondese ou non á enquisa. Sen embargo, é posible que outras características (tamaño do fogar ou, como se sinalou antes, a residencia en grandes zonas urbanas) estivesen relacionadas coa diferencia entre responder ou non. Así pois, a composición da mostra entrevistada podería diferir da mostra aleatoriamente elixida ó principio. Para tratar de corrixir este posible problema, fixéronse ponderacións de mostras que incorporaban tanto axustes relativos ós que non respondían como á postestratificación dos totais dos fogares a partir do censo decenal de 1990. As

27. Debido fundamentalmente a consideracións loxísticas e de custo, non se fixeron versións do cuestionario en linguas estranxeiras. Como resultado disto, os fogares non falantes de inglés non se elixían para a entrevista. Así, reducimos o cálculo do número de fogares dos EE.UU. (93.347.000) do censo de 1990 nun 2,7%, o noso cálculo da proporción de fogares dos EE.UU. que non eran falantes de inglés para a nosa enquisa. Esta equivale a unha poboación de 90.838.000 fogares en que se fala inglés, ós que se extrapolaron os nosos resultados.

view. After dropping vacant dwelling units and non-English speaking households who were ineligible for the survey[27], the survey had an overall response rate of 75.2%. This response rate compares favorably with the best academic surveys such as the University of Michigan's American National Election Surveys and the University of Chicago's General Social Survey.

As information about the survey topic was not provided to individuals until the interview was underway, willingness to pay for the Prince William Sound Program *per se* could not have directly affected whether a household responded. It is possible, however, that other characteristics (*e.g.*, household size or, as noted above, residence in large urban areas) were related to responding/non-responding status. Thus, the composition of the interviewed sample could differ from that of the random sample initially chosen. To help correct this potential problem,

27. Due primarily to logistical and cost considerations, no foreign language versions of the questionnaire were developed. As a result, non-English speaking households were not eligible to be interviewed. Thus, we correspondingly reduced the 1990 Census estimate of the number of U.S. households (93,347,000) by 2.7%, our survey's estimate of the proportion of U.S. households that were non-English speaking. This yields a population of 90,838,000 English-speaking households to which our results may be extrapolated.

variables empregadas foron rexión, idade, raza, tamaño do fogar e tipo (casados ou outros). Os entrevistados de estados do oeste, as persoas maiores, os de raza negra e as vivendas unifamiliares tendían a presentar maiores ponderacións.

5 RESULTADOS

Disposición a pagar

Na táboa 3 móstranse as frecuencias de cada resposta á pregunta A-15. Tal como se agardaba, a porcentaxe que responde que está a favor de pagar descende a medida que aumenta a cantidade que se lle suxire que pague, descendendo dun 67% a favor da cantidade de 10 dólares ata un 34% cando se trata da cantidade de 120 dólares.

A resposta á pregunta A-15 pode ser analizada cun modelo de elección discreta binaria, como un *probit*, ou tamén se pode combinar a resposta á pregunta A-15 coas das preguntas A-16 e A-17. O feito de considerar as respostas "Non estou seguro/-a" como respostas negativas dá como resultado catro tipos de respostas[28]. Estas respostas preséntanse segundo a versión do cuestionario na táboa 4.

28. Para á maioría dos entrevistados que deron a resposta "Non estou seguro/-a", esta interpretación semella axeitada. Algúns enquisados responderon afirmativamente á pregunta A-15 e dixeron que non estaban seguros sobre unha cantidade superior na pregunta A-16. Unha interpretación semellante implica que estas respostas "Non

sample weights were constructed that incorporated both nonresponse adjustment and poststratification to household totals from the 1990 Decennial Census. The variables used were region, age, race, household size and type (married versus other). Respondents from a western state, the elderly, blacks, and single households tended to be assigned higher weights.

5 RESULTS

Willingness to Pay Questions

Table 3* shows the frequencies of each response to question A-15. As expected, the percentage responding with a "for" vote declines as the amount the respondent is asked to pay increases, dropping from 67 percent in favor at $10 to 34 percent at $120.

The A-15 response can be analyzed with a binary discrete choice model, such as a probit, or the A-15 it can be combined with the A-16 and A-17 responses. Treating the "not sure" responses as "no" responses results in four response types[28]. These are pre-

* Numbers in tables are written in latin style, that is, 29,92 in english and 287.000 would be 287,000 in english. The editors have maintained this criteria to simplify the tables)

28. For most of the respondents giving "not sure" answers, this interpretation seems to be appropri-

Táboa / Table 3
Resposta á pregunta A-15 por versión
A-15 Response by Version

Versión / Version	Non / No	Non estou seguro/a Not Sure	Si / Yes
A (10$) / A($10)	29,92%	2,65%	67,42%
B (30$) / B($30)	39,33%	8,99%	51,69%
C (60$) / C($60)	43,53%	5,88%	50,59%
D (120$) / D($120)	59,14%	6,61%	34,24%

As dobres respostas afirmativas e negativas son as máis fáciles de interpretar xa que cabería agardar que as dobres respostas afirmativas entrasen dentro da categoría en que ós entrevistados se lles pide que paguen entre 30 dólares na versión A (é dicir, o 45% responde afirmativamente á cantidade de 30 dólares) e 250 dólares na versión D (é dicir, o 14% responde afirmativamente á cantidade de 250 dólares). Tamén cabería esperar que as dobres respostas negativas aumentasen a medida que se pasa da

estou seguro/-a" representan a enquisados que estaban razoablemente próximos ós seus límites de indiferencia. Dos 141 enquisados que responderon unha ou máis veces "Non estou seguro/-a", 111 seguiron este modelo. Os outros 30 enquisados (menos do 3% da mostra) responderon "Non estou seguro/-a" ás preguntas A-15 e A-17; estas persoas pode que non fosen capaces de responder ás preguntas sobre a súa disposición a pagar. Tamén consideramos estas respostas de xeito prudente coma se fosen respostas negativas a ambas as dúas preguntas.

sented by questionnaire version in Table 4.

The yes-yes and no-no responses are the easiest to interpret because one would expect the yes-yes responses to fall as the dollar amount the respondent is asked to pay goes from $30 in version A (*i.e.*, 45 percent say yes to $30) to $250 in version D (*i.e.*, 14 percent say yes to $250). We would also expect the no-no respons-

ate. Some respondents gave a "not sure" answer to A-15 and subsequently gave a "yes" answer to the substantially lower amount in A-17. Similarly, some respondents gave "yes" responses to A-15 and "not sure" responses to the higher amount in A-16. A likely interpretation is that these "not sure" responses represent respondents who were reasonably close to their indifference thresholds. Of the 141 respondents who gave one or more "not sure" responses, 111 followed this pattern. The other 30 respondents (less than 3% of the sample) gave "not sure" responses to both A-15 and A-17; these respondents may not have been capable of answering the WTP questions. We have also conservatively treated these as no-no responses.

Táboa / Table 4
Versión do cuestionario segundo o tipo de resposta
Questionnaire Version by Type of Response

Versión / Version	Si – Si / Yes-Yes	Si – Non / Yes-No	Non – Si / No-Yes	Non – Non / No-No
A (10, 30, 5$) A ($10, $30, $5)	45,08%	22,35%	3,03%	29,55%
B (30, 10, 60) B (30, 10, 60)	26,04%	26,04%	11,32%	36,60%
C (60, 120, 30) C (60, 120, 30)	21,26%	29,13%	9,84%	39,76%
D (120, 250, 60) D (120, 250, 60)	13,62%	20,62%	11,67%	54,09%

versión A (é dicir, o 30% responde negativamente á cantidade de 5 dólares) á versión D (é dicir, o 54% responde negativamente á cantidade de 60 dólares). A dobre resposta negativa á versión A define o límite máximo sobre a porcentaxe de entrevistados ós que pode que non lles importe en absoluto o feito de evitar unha marea negra semellante á do *Exxon Valdez*. Sen embargo, cómpre salientar que tamén é probable que este grupo de enquisados poida incluír a aqueles que non cren que o plan dos barcos de acompañamento funcione ou que crean que as compañías petrolíferas deben pagar todos os gastos deste plan.

Modelo estatístico

Este tipo de datos recollidos que empregan o formato de pregunta dicotómica dobre refíes to increase as one moves from version A (*i.e.*, 30 percent say no to $5) to version D (*i.e.*, 54 percent to $60). The no-no responses to version A define the upper bound on the percentage of respondents who may not care about preventing an *Exxon Valdez* type oil spill. It should be noted, though, that this group of respondents is also likely to include those who do not think that the escort ship plan will work or who believe that the oil companies should pay the entire cost of the plan.

Statistical Model

The type of data gathered using the double-bounded dichotomous choice

rense ás veces a datos de supervivencia en intervalos censurados (Nelson, 1982). O seu uso no traballo de valoración continxente foi explicado en profundidade por Carson e Steinberg (1990), Hanemann, Loomis e Kanninen (1991), Carson, Wilks e Imber (1994) e Haab e McCommell (1997) baixo a suposición da revelación dunha preferencia real en ambas as dúas preguntas[29]. En vez de "tempo", a supervivencia defínese con respecto á variable do custo. Unha persoa enquisada que está disposta a pagar unha cantidade específica "sobrevive" a esa cantidade e unha persoa que non está disposta a pagar unha cantidade específica "falla" esa cantidade. Unha dobre resposta afirmativa indica que o límite máximo da disposición a pagar do enquisado sitúase entre a cantidade reflectida na pregunta A-16 e o infinito. Unha resposta "Si – Non" (é dicir, "Si" para a pregunta A-15 e "Non" para a pregunta A-16) indica que o límite máximo da disposición a pagar expresada

elicitation method is sometimes referred to as interval-censored survival data (Nelson, 1982). Its use in CV work has been explicated at length by Carson and Steinberg (1990), Hanemann, Loomis and Kanninen (1991), Carson, Wilks and Imber (1994), and Haab and McConnell (1997) under the assumption of truthful preference revelation to both questions[29]. Instead of "time", survival is defined with respect to the cost variable. A respondent willing to pay a specific amount "survives" that amount and a respondent who is not willing to pay a specified amount "fails" that amount. A yes-yes response indicates that the respondent's maximum willingness to pay lies between the A-16 amount and infinity. A yes-no response (*i.e.*, yes to A-15 and no to A-16), indi-

29. Na análise que segue demos por suposto que os enquisados non adoptan unha revelación de preferencia que non sexa real con respecto á segunda pregunta de elección. A forte predicción teórica (Carson, Groves e Machina, 1999) radica en que a resposta á segunda pregunta debería ser inconsistente coa primeira. Baixo condicións máis estrictas pero fiables, a resposta á segunda pregunta corresponderase a unha disposición a pagar menor ca na primeira pregunta. Os resultados empíricos obtidos aquí son coherentes con esta predicción en que unha análise baseada en só a primeira pregunta produce un cálculo sobre a disposición a pagar máis alto que se se usan as dúas preguntas. Pódese obter información útil dunha segunda pregunta sen dar por suposta unha coherencia entre preguntas, pero o modelo estatístico é moito máis complexo e depende máis dos supostos (Alberini, Kanninen e Carson, 1997).

29. In the analysis that follows we have also assumed that respondents do not engage in non-truthful preference revelation with respect to the second choice question. The strong theoretical prediction (Carson, Groves, and Machina, 1999) is that the response to the second question should be inconsistent with the first. Under stronger but plausible conditions, the response to the second question will be consistent with lower willingness to pay than the first question. The empirical results obtained here are consistent with this prediction in that an analysis based upon only the first question results in a larger WTP estimate than using both questions. Useful information from the can be obtained from a second question without assuming consistency between questions, but the statistical modeling is much more complex and more dependent upon assumptions made (Alberini, Kanninen and Carson, 1997).

polo entrevistado sitúase entre a cantidade expresada na pregunta A-15 e a cantidade expresada na pregunta A-16. Nas condicións da análise de supervivencia, o fallo deuse entre as cantidades expresadas entre as preguntas A-15 e A-16. Unha resposta "Non – Si" indica que o límite máximo de disposición a pagar por parte do enquisado sitúase entre a cantidade expresada na pregunta A-15 e a cantidade expresada na pregunta A-17. Unha dobre resposta negativa indica que o límite máximo de disposición a pagar por parte do enquisado sitúase entre cero e a cantidade expresada na pregunta A-17[30]. Así pois, pódese demostrar que a resposta de disposición a pagar por parte do enquisado se atopa nun dos seguintes intervalos, dependendo do modelo concreto de resposta e da versión do cuestionario:

A: (0-5 $ [Non – Non]; 5-10 $ [Non – Si];
10-30 $ [Si – Non]; 30-∞ [Si – Si]
B: (0-10; 10-30; 30-60; 60-∞)
C: (0-30; 30-6-; 60-120; 120-∞)
D: (0-60; 60-120; 120-250; 250-∞)[31].

cates that the respondent's maximum WTP amount lies between the amount asked in A-15 and the amount asked in A-16. In survival analysis terms, the failure occurred between the A-15 and A-16 cost amounts. A no-yes response indicates that the respondent's maximum WTP response lies between the amount asked in A-15 and the amount asked in A-17. A no-no response indicates that the respondent's maximum willingness to pay lies between zero and the amount asked in A-17[30]. Thus, a respondent's WTP response can be shown to lie in one of the following intervals depending on the particular response pattern and questionnaire version:

A: ($0-$5 [No-No]; $5-$10 [No-Yes];
$10-$30 [Yes-No]; $30-∞ [Yes-Yes])
B: (0-10; 10-30; 30-60; 60-∞)
C: (0-30; 30-6-; 60-120; 120-∞)
D: (0-60; 60-120; 120-250; 250-∞)[31].

30. Se o servicio que se está a avaliar é considerado un "mal" polo entrevistado, entón o límite inferior do intervalo é potencialmente negativo en vez de cero. Aínda que existe esta posibilidade con algúns bens públicos, non é probable que alguén considere algo desexable unha marea negra como a do *Exxon Valdez*.

31. Os intervalos referidos da disposición a pagar das dez persoas enquisadas que indicaron que querían cambiar a súa resposta foron establecidos desde cero ata a cantidade máis elevada á que anteriormente dixeron que votarían. Ademais, catro dos entrevistados que non responderon a ningunha pregunta sobre a disposición a pagar (A-16 ou A-17) basearon os seus intervalos só na resposta á pregunta A-15.

30. If the amenity being valued is a "bad" to the respondent, then the lower bound on the interval is potentially negative infinity rather than zero. While a possibility with some public goods, it is unlikely that anyone views an *Exxon Valdez* type oil spill as something desirable.

31. The WTP intervals of the 10 respondents who indicated that they wanted to change their votes were set from zero to the highest amount to which they had previously said they would vote "for". In addition, four respondents who did not answer the second WTP question (A-16 or A-17) had their WTP intervals based only on their response to A-15.

O marco da análise de supervivencia impón o suposto clave da teoría económica de que a fracción do público que está a favor do programa é lixeiramente monótona decrecente no seu custo. Efectivamente, o logaritmo da función de verosemellanza vén definido pola diferencia na densidade da disposición a pagar avaliada en dous puntos definidos por dúas cantidades correspondentes ós custos sobre os que se lle preguntou ó enquisado, sendo o límite superior o infinito no caso dunha dobre resposta afirmativa e o límite inferior cero no caso dunha dobre resposta negativa. Pódese maximizar esta función de verosemellanza supoñendo unha distribución paramétrica determinada, como a de Weibull, ou empregando a modificación feita por Turnbull (1976) do estimador de Kaplan-Meier[32].

O enfoque non paramétrico de Turnbull non fai ningunha suposición sobre a forma da distribución da disposición a pagar. Como resultado, con esta técnica só se calcula a fracción da densidade que entre dentro dos intervalos definidos polos diferentes límites de diñeiro empregados nas preguntas A-15, A-16 e A-17. Na táboa 5 móstrase que arredor do 29% dos entrevistados entran no

The survival analysis framework imposes the key assumption from economic theory that the fraction of the public in favor of the program is weakly monotonically decreasing in its cost. Effectively, the log likelihood function is defined by the difference in WTP density evaluated at two points defined by the two cost amounts the respondent was asked about with the upper end being infinity in the case of a yes-yes response and the lower end being zero in the case of a no-no response. One can maximize this likelihood function assuming a particular parametric distribution, such as the Weibull, or by using Turnbull's (1976) modification of the Kaplan-Meier estimator[32].

The Turnbull nonparametric approach makes no assumptions about the shape of the underlying WTP distribution. As a result, this technique only estimates the fraction of the density falling into the intervals defined by the different dollar thresholds used in A-15, A-16, and A-17. Table 5 shows that about 29 percent of the respondents fall into the interval $0 to $5,

32. A distribución Weibull é a máis sinxela que permite unha función aleatoria crecente, decrecente ou constante. Tamén é o suficientemente flexible para aproximar outras distribucións residuais empregadas habitualmente, como a exponencial, a de Raleigh, a normal e a do valor extremo máis pequeno.

32. The Weibull is the simplest distribution that allows an increasing, decreasing, or constant hazard function. It is also flexible enough to approximate several other commonly used survival distributions, such as the exponential, the Raleigh, the normal, and the smallest extreme value.

intervalo de 0 a 50 dólares, que menos do 9% están dispostos a pagar máis de 250 dólares e que a mediana entra no intervalo 30-60 dólares[33].

Tamén empregamos as estimacións do cambio de densidade que se dá en cada intervalo para determinar unha estimación do límite inferior para a media da distribución da disposición a pagar. Este cálculo faise multiplicando a densidade que se calcula que existe en cada intervalo polo valor límite inferior do intervalo, e despois sumándollo ó intervalo que dá un cálculo do límite inferior da media da distribución a pagar de 53,60 dólares[34]. Así pois, calquera distribución empírica que produciu as estimacións do intervalo de Turnbull daría como resultado un estimador empírico da media igual ou maior de 53,60 dólares.

and that less than 9 percent are willing to pay over $250, and that the median falls into the interval $30-$60[33].

We can also use the estimates of the change in density occurring in each interval to determine a lower-bound estimate for the mean of the WTP distribution. This is done by multiplying the density estimated to be in each interval by the lower end-point of the interval and then summing over the interval that yields a lower-bound estimate of mean WTP of $53.60[34]. Thus, any empirical distribution that produced the Turnbull interval estimates would result in an empirical estimate of the mean equal to or greater than $53.60.

33. Desde este punto en diante, empregamos as ponderacións dos fogares proporcionadas por Westat á hora de realizar as estimacións. As diferencias entre os cálculos ponderados e non ponderados son case sempre bastante pequenas, sendo as estimacións ponderadas lixeiramente inferiores ás estimacións non ponderadas. A realización das ponderacións coméntase no apartado 4.10 e no apéndice B.3 do estudio orixinal e están baseadas nas variables demográficas do censo. As frecuencias ponderadas e non ponderadas aparecen no Apéndice C.1.

34. Como este cálculo é unha función lineal de puntos de mostraxe predeterminados e unha variable polinómica, un un erro estándar para este cálculo de 2,71 $ e un intervalo de confianza dun 95% [48,28 – 58,91 $] son fáciles de calcular. O límite inferior de Turnbull sobre a media aumenta cara á media desde abaixo a medida que se engaden máis puntos de deseño. Sen embargo, para un tamaño fixo da mostra o feito de engadir máis puntos provoca o aumento da varianza deste estimador e, polo tanto, pódese considerar que este estimador representa o habitual “trade-off” ou conflicto entre nesgo e varianza.

33. From this point on we use the household weights provided by Westat in performing any estimations. The differences between the weighted and unweighted estimates are almost always quite small, with the weighted estimates being slightly lower than the unweighted estimates. The construction of the weights is discuss at length in section 4.10 and Appendix B.3 of the original study and are based solely on Census demographic variables. Unweighted and weighted frequencies are provided in Appendix C.1.

34. Since this estimate is a linear function of predetermined design points and a multinomial variable, a standard error for this estimate $2.71, and a 95% confidence interval [$48.28-$58.91] are straightforward to calculate. The Turnbull lower bound on the mean increases toward the mean from below as more design points are added. However, for a fixed sample size adding more design points causes the variance of this estimator to grow and hence this estimator can be seen to represent the commonly found bias-variance tradeoff.

Táboa / Table 5
Resultados da estimación de Turnbull
Turnbull Estimation Results

Límite inferior do intervalo Lower Bound of Interval	Límite superior do intervalo Upper Bound of Interval	Probabilidade de ser maior có límite superior Probability of Being Greater Than Upper Bound	Cambio na densidade Change in Density	t-Valor asintótico* Asymptotic t-Value*
0	5	.714	.286	15.46
5	10	.685	.029	2.93
10	30	.535	.150	10.57
30	60	.377	.157	11.04
60	120	.220	.157	11.46
120	250	.088	.132	9.02
250	∞	.000	.088	Normalizado Normalized
Logaritmo da función de verosemellanza – 1325,186 Log-Likelihood - 1325.186 *Contra nulo ou ningún cambio na densidade *Against null of no change in density				

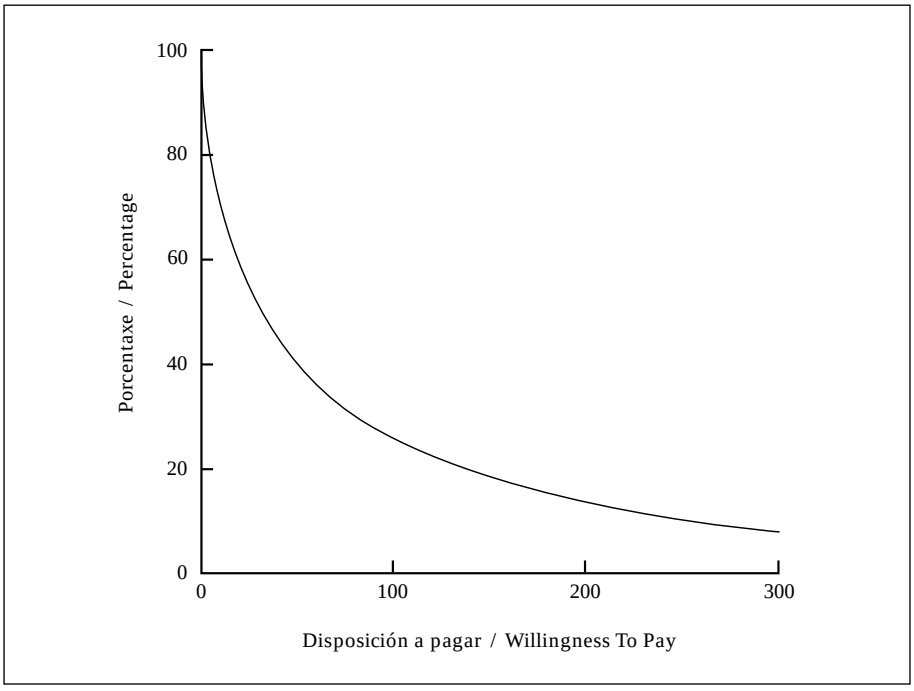
A maximización da función de verosemellanza baixo o suposto dunha distribución Weibull dá como resultado os cálculos reflectidos na táboa 6 e unha estimación de 30 $ para a mediana e de 97 $ para a media. Os erros estándar indican que os parámetros son calculados con razoable precisión e reflíctense nos intervalos de confianza ó 95% para a media e a mediana. A figura 1 mostra a curva de supervivencia de Weibull. Un axuste paramétrico ideal ocorre cando a

Maximizing the likelihood function under the assumption of a Weibull distribution yields the estimates in Table 6 and result in estimates of $30 for the median and $97 for the mean. The standard errors indicate that the parameters are estimated with reasonable precision and are reflected in the 95 percent confidence intervals for the mean and median. Figure 1 displays the Weibull survival curve. An ideal

curva residual paramétrica alcanza o máximo de cada paso da función non paramétrica. A de Weibull é unha boa aproximación sobre a maioría dos intervalos de diñeiro con algunha indicación de diverxencia nas dúas colas. Este problema pode resolverse axustando un modelo de Weibull que permita un

parametric fit occurs when the parametric survival curve just touches the top of each step of the nonparametric function. The Weibull is a good approximation over most of the dollar range with some indication of divergence in the two tails. This problem

Figura / Figure 1
Porcentaxe da disposición a pagar como función do custo do programa
Percent Willing to Pay As A Function of Program Cost



pico en cero[35]. Ese modelo mellora significativamente o axuste situando o 20,6% dos enquisados en cero e reduce a media estimada a 79,20 $ cun intervalo de fiabilidade dun 95% igual a [67,93 – 90,47 $][36].

Unha función de valoración

Unha función de valoración é un modo estatístico de relacionar a disposición a pagar dos enquisados coas súas características. Calcúlase normalmente para demostrar a validez de construcción da estimación dun estudio de valoración continxente. De forma máis sinxela, significa que a disposición a pagar do entrevistado ou un indicador desta disposi-

35. É posible axustar outras distribucións residuais de dous parámetros, que tenden a dar como resultado cálculos semellantes da mediana da disposición a pagar pero bastante diferentes na media. O axuste da distribución Weibull é ou estatisticamente superior ou indiferenciable con respecto a estas outras distribucións. Outras distribucións de tres parámetros máis flexibles tenden a suxerir unha diminución máis acusada na porcentaxe da disposición a pagar próxima a cero e un descenso máis acusado na cola dereita. Como resultado disto, a estimación media da disposición a pagar a partir destas distribucións tende a entrar entre o cálculo do límite inferior a partir do estimador de Turnbull e o dos dous parámetros Weibull.

36. A probabilidade logarítmica para o modelo spike ou de pico de Weibull (Kristrom, 1990) é de –1331,293, de tal xeito que unha proba da ratio de verosemellanza rexeita o modelo de Weilbull de dous parámetros a favor do modelo de pico de Weibull en $p < .01$. Efectivamente, o que está a acontecer é que o mellor axuste cerca de cero reduce a varianza implícita da distribución da disposición a pagar. Esta reducción na varianza (reflectida nun parámetro de escala inferior) despraza a cola dereita de distribución e, polo tanto, reduce a estimación da media da disposición a pagar.

can be rectified by fitting a Weibull model that allows for a spike at zero[35]. That model significantly improves the fit by placing 20.6% of the respondents at zero and reduces the estimated mean to $79.20 with a 95% confidence interval of [$67.93-$90.47][36].

A Valuation Function

A valuation function is a statistical way to relate respondents' WTP to their characteristics. They are often estimated to demonstrate the construct validity of the estimate from a CV study. In the simplest sense, the respondent's

35. It is possible to fit a number of other common two-parameter survival distributions to our data. These tend to result in similar estimates of the median WTP but quite different estimates of the mean. The fit of the Weibull distribution is either statistically superior or indistinguishable with respect to these other distributions. More flexible three parameter distributions tend to suggest a sharper drop-off in the percent willing to pay near zero and a sharper drop-off in the right tail. As a result, estimates of mean WTP from these distributions tend to fall between the lower-bound estimate from the Turnbull estimator and that of the two parameter Weibull.

36. The log-likelihood for the Weibull spike model (Kristrom, 1997) is -1331.293 so a likelihood ratio test rejects the two parameter Weibull model in favor of the Weibull spike model at $p < .01$. Effectively what is happening is that the better fit near zero reduces the implied variance of the WTP distribution. This reduction in variance (reflected in a decreased scale parameter) pulls in the right tail of the distribution, and hence, reduces the estimate of mean WTP.

Táboa / Table 6
Resultados da estimación Weibull
Weibull Estimation Results

Parámetro Parameter	Estimación Estimate	Erro medio Standard Error	Valor t asintótico Asymptotic t-Value
Localización Location	58,417	3,914	14,93
Escala Scale	0,558	0,024	23,68
Mediana 30,30 $ [26,18 – 35,08 $] / Median $30.30 [$26.18-$35.08]* Media 97,18 $ [85,82-108,54 $] / Mean $97.18 [$85.82-$108.54]*			
Logaritmo da función de verosemellanza –1343,014 / Log-Likelihood -1343.014 *95% do intervalo de confianza / *95% Confidence Interval			

ción a pagar están relacionados con características do enquisado como os ingresos así como coas preferencias relativas polo ben que se está a valorar.

Unha función de valoración calcúlase seguindo varios pasos. En primeiro lugar, para as observacións con valores perdidos en variables de predicción, eses valores deben ser atribuídos ou ben eliminar as observacións de calquera cálculo que utilice esa variable, opción que non semella moi desexable[37].

WTP or an indicator of that WTP is regressed on respondent characteristics such as income and on preferences relevant to the good being valued.

A valuation function is estimated in several steps. First, for observations with missing values in predictor variables, those values must either be imputed or the observations dropped from any estimation using that variable, a generally undesirable option[37].

37. Como a maioría dos valores que faltan están relacionados cos ingresos, calculamos unha ecuación para predicir o logaritmo de ingresos. Os coeficientes calculados para esta ecuación, que está baseada principalmente en características demográficas, inclúense no informe do estudio. Todas as variables teñen o signo esperado e a ecuación ten un R^2 de .46.

37. Because most of the missing values are on income, we have estimated an equation to predict the log of income. The estimated coefficients for this equation, which is based largely on demographic characteristics, are provided in the study report. All of the variables have the expected sign, and the equation has an R^2 of .46.

O seguinte paso consiste en determinar as variables que cómpre incluír na función de valoración. Algunhas deben incluírse sen dúbida, mentres que para outras a elección non é tan clara. Por último, a función de valoración pode ser usada para facer axustes nos cálculos da disposición a pagar para elementos como as respostas protesta.

Unha gran cantidade de predictores posibles poden empregarse na función de valoración que queremos calcular. Algunhas, como os ingresos ou a preocupación polo medio natural, son opcións obvias. Outra elección obvia é a preocupación polo ambiente. Poden empregarse diferentes preguntas para obter información sobre esta dimensión co fin de facer operativa esta variable de diversas maneiras. Outras posibles variables de predicción inclúen a posibilidade de visitar Alasca e as respostas a preguntas que informen sobre as percepcións das características do plan de prevención da marea negra por parte do enquisado. Ademais, un candidato firme tamén é algún indicador das respostas protesta.

Na táboa 7 presentamos a función de valoración escollida. Os dous primeiros parámetros son parámetros de escala e localización baseados na suposición dunha distribución de supervivencia Weibull. Cómpre salientar que o parámetro de escala é un pouco maior có calculado na táboa 6 e o parámetro de localización é bastante diferente porque parametrizamos o parámetro de localización orixinal como función das covariables incluídas na ecuación. Trala introducción

Next, the variables to include in the valuation function must be determined. Some variables should clearly be included, while for others, the choice is less clear. Finally, the valuation function may be used to make adjustments to WTP estimates for such things as protest responses.

A large number of possible predictors are available for use in the valuation function we wish to estimate. A few, such as income, are obvious choices. Another obvious choice is concern about the environment. Different survey questions that tap this dimension can be used to operationalize this variable in a variety ways. Other good candidates for predictor variables include the likelihood of visiting Alaska and answers to questions that elicit the respondent's perceptions of the characteristics of the oil spill prevention plan. Also, a strong candidate is some indicator of protest responses.

We present our preferred valuation function in Table 7. The first two parameters are the scale and location parameters based on the assumption of a Weibull survival distribution. Note that the scale parameter is a little larger than that estimated in Table 6 and the location parameter is quite different because we are parameterizing the original location parameter as a func-

das covariables, un pico en cero xa non é significativo, dado que agora se prevé que moitos entrevistados teñen valores de disposición a pagar moi baixos.

As primeiras catro variables (GMORE, MORE, LESS e NODAM) son variables *dummy* que indican que enquisados crían que o dano que podería ocorrer na ausencia do plan dos barcos de acompañamento sería diferente do da marea negra do *Exxon Valdez*. Os coeficientes destas catro variables son significativos e seguen a orde esperada. Estes enquisados que pensan que se produciría un dano moito maior (GMORE) están dispostos a pagar algo máis de diñeiro có entrevistado medio. Os que pensan que se produciría unha marea algo menor, pero aínda así máis danos (MORE), están dispostos a pagar menos cós GMORE, pero aínda un pouco máis có enquisado medio. Os que pensan que se producirían menos danos (LESS) están dispostos a pagar menos có enquisado medio e os que pensan que sería probable que non se producise ningún dano (NODAM) están dispostos a pagar moito menos. Estas catro variables tomadas no seu conxunto proporcionan probas suficientes sobre a sensibilidade do entrevistado co tamaño ou escala do ben que se vaia valorar.

As dúas seguintes variables (MWORK e NWORK) indican os entrevistados que cren que o plan evitará menos da maior parte do dano, sendo MWORK a que indica os que pensan que o plan evitará certos danos e

tion of the various covariates included in the equation. After the introduction of the covariates, a spike at zero is no longer significant, as many respondents are now predicted to have very small willingness to pay values.

The first four variables, GMORE, MORE, LESS, and NODAM, are dummy variables indicating which respondents believed that the damage likely to occur in the absence of the escort ship plan would be different from that of the *Exxon Valdez* spill. The coefficients on all four of these variables are significant and follow the expected rank ordering. Those respondents who think that there would be a great deal more damage, GMORE, are willing to pay quite a bit more money than the average respondent. Those who think that there will be somewhat less, but still more damage, MORE, are willing to pay less than the GMORE respondents, but still quite a bit more than the average respondent. Those who think that there would be less damage, LESS, are willing to pay less than the average respondent, and those who think that there would likely be no damage, NODAM, are willing to pay much less. These four variables taken together provide suggestive evidence of respondent sensitivity to the scope of the good valued.

Táboa / Table 7
Función de valoración Weibull
Weibull Valuation Function

Parámetro Parameter	Estimación Estimate	Erro estándar Standard Error	t-Valor asintótico Asymptotic t-Value	Media da covariable Covariate Mean
Localización Location	1,637	1,641	1,00	—
Escala Scale	0,662	0,029	22,91	—
GMORE	0,867	0,284	3,06	0,0721
MORE	0,669	0,164	4,07	0,162
LESS	-0,273	0,146	-1,88	0,228
NODAM	-0794	0,432	-1,84	0,028
MWORK	-0,862	0,131	-6,57	0,265
NWORK	-1,754	0,200	-8,79	0,073
NAME	0,203	0,134	1,51	0,520
COASTAL	0,414	0,143	2,89	0,803
WILD	0,261	0,119	2,19	0,556
STENV	0,473	0,229	2,06	0,098
LIKVIS	0,240	0,138	1,74	0,335
LINC	0,284	0,100	2,85	10,228
WHITE	0,423	0,151	2,80	0,784
PROTEST	-1,226	0,145	-8,45	0,179

NWORK a que indica os que cren que non reducirá os danos en absoluto. Unha vez máis, ambas as dúas variables son significativas e levan un signo negativo. O coeficiente NWORK mide case o dobre do coeficiente MWORK en valor absoluto. As variables MWORK e NWORK proporcionan máis probas que debilitan a insensibilidade ó tamaño ou escala, xa que suxiren que as valoracións dos enquisados e a disposición a pagar si responden ás características do ben que se lles

The next two variables, MWORK and NWORK, indicate respondents who think that the plan will prevent less than a great deal of the damage, with MWORK indicating those who think that the plan will prevent some of the damage and NWORK indicating those who think that the plan will not reduce the damage at all. Again, both variables are significant and of the expected negative sign. The NWORK

está a ofertar; neste caso, a capacidade do programa para efectivamente evitar os danos descritos.

NAME é unha variable ficticia que corresponde ós entrevistados que mencionaron espontaneamente a marea negra do *Exxon Valdez* na pregunta A-2 como unha das principais catástrofes ambientais provocadas polos seres humanos. Tal como se esperaba, esta variable, que mide a prominencia, exerce unha influencia positiva na disposición a pagar do enquisado. COASTAL, que é outra variable ficticia que indica qué entrevistados dixeron que a protección das zonas costeiras das mareas negras era "extremadamente importante" ou "moi importante" na pregunta A-3f, exerce unha influencia positiva significativa na disposición a pagar do enquisado. Así mesmo, WILD, que é unha variable ficticia para os que consideraban que o goberno debería reservar unha "cantidade moi grande" ou unha "gran cantidade" de novas terras como terreo sen explotar na pregunta A-4, repercute positivamente na disposición a pagar do enquisado. STENV, que significa a identificación dun mesmo como ecoloxista comprometido, e LIKVIS, que é unha variable ficticia para indicar que era "moi probable" ou "algo probable" que os membros da familia visiten Alasca no futuro, tamén suxiren unha maior disposición a pagar.

Os entrevistados con ingresos máis elevados (LINC) están fortemente asociados cunha maior disposición a pagar para evitar

coefficient is about twice the size of the MWORK coefficient in absolute value. The MWORK and NWORK variables provide further evidence undercutting the insensitivity to scope criticism, as they suggest that respondents' valuations and expressed WTP are responsive to the characteristics of the good being offered; in this case, the ability of the program to actually prevent the described injuries.

NAME is a dummy variable for those respondents who spontaneously named the *Exxon Valdez* spill in question A-2 as one of the major environmental accidents caused by humans. As expected, this variable, which measures salience, has a positive influence on a respondent's willingness to pay. COASTAL, which is a dummy variable indicating which respondents said that protecting coastal areas from oil spills was "extremely important" or "very important" in A-3f, has a large and highly significant positive influence on a respondent's willingness to pay. Likewise, WILD, which is a dummy variable for those who felt that the government should set aside a "very large amount" or "large amount" of new land as wilderness in A-4, has a positive effect on a respondent's willingness to pay. STENV, identification of oneself as a strong environmental-

outra marea negra semellante á do *Exxon Valdez*, así como os clasificados como brancos, WHITE. Os LINC están aínda máis vinculados á idea da disposición a pagar se se inclúe o subgrupo de enquisados para os que non se atribuíron ingresos. Só 3 de 1.043 entrevistados responderon afirmativamente a unha cantidade superior ó 2% dos seus ingresos e só 17 responderon afirmativamente a unha cantidade superior ó 1% dos seus ingresos. Os enquisados que protestaron espontaneamente (PROTEST) nas preguntas A-14D ou A-15A que Exxon debía pagar o total dos custos que implicaba o plan dos barcos de acompañamento (antes de que lles preguntasen por qué non estaban dispostos a pagar na pregunta A-18), por termo medio, estaban dispostos a pagar moito menos cós enquisados coas mesmas características que non protestaron (que Exxon debía pagar) neste punto do cuestionario.

Dependendo das características do enquisado, a disposición a pagar mediana condicional predita pola función de valoración varía moito; o valor predito máis baixo para un entrevistado nesta mostraxe é menor a 1 dólar e a máis elevada é 421 dólares.

Axustes e análise da sensibilidade

A función de valoración calculada anteriormente permítenos examinar o efecto que producirían diversos axustes no cálculo que fixemos da mediana da disposición a pagar. O

ist, and LIKVIS, a dummy variable for indicating that the household was "very likely" or "somewhat likely" to visit Alaska in the future, also suggest higher willingness to pay.

Respondents with higher incomes, LINC, are strongly associated with having a higher willingness to pay to prevent another *Exxon Valdez* type oil spill as is being WHITE. LINC is even more strongly associated with willingness to pay using the subset of respondents for whom income is not imputed. Only 3 of 1043 respondents said "yes" to an amount more than 2% of their income and only 17 said "yes" to an amount more than 1% of their income. Respondents who spontaneously protested (PROTEST) in A-14D or A-15A that Exxon should pay all of the escort ship plan costs (before being asked why they were not willing to pay in A-18), were on average willing to pay much less than those respondents with the same characteristics who did not protest (that Exxon should pay) by this point in the questionnaire.

Depending on a respondent's characteristics, the conditional median willingness to pay predicted by the valuation function varies widely; the lowest predicted value for a respondent in our sample is less than $1 and the highest is $421.

primeiro tipo de axuste corrixe os supostos inconsistentes con tres características importantes do escenario. A información da que dispoñemos sobre estas inconsistencias procede de respostas dos entrevistados a preguntas do apartado B da enquisa relativas ó que tiñan na mente no momento de responderen ás preguntas sobre a súa disposición a pagar. O ideal sería que os enquisados baseasen as cantidades que indicaron para a súa disposición a pagar no feito de evitar danos da mesma magnitude cós provocados pola marea negra do *Exxon Valdez*. No caso dos entrevistados que non o fixeron así, hai catro variables ficticias na nosa función de valoración. Unha destas toma valor un para representar a desviación particular desta percepción desexada de mesmo dano (GMORE, MORE, LESS e NODAM). O establecemento do valor destas variables ficticias en cero forza as percepcións cara ós mesmos danos. Este axuste reduce o cálculo da mediana da disposición a pagar por cada fogar duns 30 a uns 27 dólares.

Outro posible axuste refírese á percepción da eficacia do plan dos barcos de acompañamento. O ideal sería que todos os enquisados percibisen o plan como completamente eficaz. Unha de dúas variables ficticias na función de valoración ten un valor de un se un enquisado indicou que o plan non resultaba completamente eficaz: MWORK e NWORK. O establecemento destas dúas variables ficticias en cero forza a percepción de que o plan era completamen-

Adjustments and Sensitivity Analysis

The valuation function estimated above allows us to examine the effect that various adjustments would have on our median WTP estimate. The first type of adjustment corrects for respondent assumptions inconsistent with three important features of the scenario. Our information about these inconsistencies comes from respondent answers to questions in Section B of the survey concerning what they had in mind when they answered the WTP questions. Ideally, respondents would have based their WTP amounts on preventing damages of the same magnitude as those caused by the *Exxon Valdez* spill. For those respondents who did not, there are four dummy variables in our valuation function. One of these has a value of one to represent the particular deviation from this desired perception of the same damage: GMORE, MORE, LESS, and NODAM. Setting the value of these dummy variables to zero effectively forces the perceptions to the same damages. This adjustment reduces the estimate of the median household willingness to pay from $30 to $27.

Another possible adjustment is for the perceived effectiveness of the escort ship plan. Ideally, all respondents would have perceived the plan as being completely effective. One of two dummy

te eficaz. Este axuste cambia o cálculo da mediana da disposición a pagar de 30 a 42 dólares.

Un terceiro axuste é para as respostas protesta. O problema consiste en definir con exactitude qué é unha reposta protesta. A definición máis conservadora é a empregada na variable PROTEST na función de valoración. Esta variable adopta o valor un se o enquisado manifesta de *motu propio* que Exxon e as compañías petrolíferas debían pagar antes de que se lle preguntase por qué estaba en contra do plan (pregunta A-18) e adopta o valor cero se a resposta é diferente. O establecemento da variable PROTEST en cero fai baixar esta consideración e cambia o cálculo da mediana de 70 a 37 dólares. O feito de realizar os tres axustes ó mesmo tempo resulta no cálculo de 48 dólares para a mediana da disposición a pagar de cada familia para evitar outra marea negra semellante á do *Exxon Valdez*.

Tamén examinamos a sensibilidade dos cálculos a outros catro factores. O primeiro consiste en empregar só a resposta á pregunta A-15 (máis que á A-16 e á A-17), xa que a segunda resposta pode introducir certo nesgo. Aquí o estimador de Turnbull aínda sitúa a mediana no intervalo 30-60 dólares e dá como resultado un cálculo do límite inferior da media que difire en menos de 2 dólares. Os enfoques paramétricos adoitan dar como resultado cálculos máis elevados. O segundo factor consiste en eliminar da mostra os enquisados que non

variables in the valuation function has a value of one if a respondent indicated that the plan was not completely effective: MWORK and NWORK. Setting both of these dummy variables to zero forces the perception that the plan was completely effective. This adjustment changes the estimate of the median willingness to pay from $30 to $42.

A third adjustment is that for protest responses. The problem here is how to exactly define a protest response. The most conservative definition is the one used in the variable PROTEST in the valuation function. This indicator variable takes the value of one if the respondent volunteered that Exxon or the oil companies should pay before the respondent was asked why he was against the plan (A-18) and takes the value zero otherwise. Setting PROTEST to zero forces out that consideration and changes the estimate of the median from $30 to $37. Making all three adjustments simultaneously yields a point estimate of $48 for the median household willingness to pay to prevent an *Exxon Valdez* type oil spill.

We have also examined the sensitivity of the estimates to four other factors. The first of these is using only the A-15 response (rather than A-15, A-16 and A-17) since the second response may introduce some bias. Here the Turnbull estimator still places the median in the $30-

entenderon claramente o escenario da valoración continxente que se lles presentou. Aquí poden empregarse algúns criterios máis ou menos globais baseados nas avaliacións do entrevistador e nas respostas a determinadas preguntas de finalidade informativa. En todos os exemplos, o feito de eliminar estes enquisados eleva os cálculos da disposición a pagar para a restante mostra. O terceiro factor consiste en fixarse na pregunta sobre o patrocinador. Unha maioría relativa (o 42%) dos enquisados crían que Exxon ou as compañías petrolíferas foran as que patrocinaran a enquisa, sendo o goberno o segundo votado (o 23%). O feito de crer que Exxon ou as compañías petrolíferas patrocinaran a enquisa non era un predictor estatisticamente significativo da disposición a pagar dos entrevistados. O cuarto factor de análise de sensibilidade é a consideración de se son estables ou non os cálculos da distribución da disposición a pagar co paso do tempo. Isto pode calcularse observando as enquisas realizadas en Dayton-Toledo, Ohio, dous estudios piloto e unha enquisa de seguimento levados a cabo simultaneamente coa enquisa final. Esta comparación demostra que o cálculo da distribución da disposición a pagar resultaba estatisticamente imposible de diferenciar en tres mostras diferentes no tempo ó longo do ano. O Centro de Investigacións Sociolóxicas da Universidade de Chicago realizou o cuestionario final en todo o Estado dous anos máis tarde e, a partir deses datos, obtivemos cál-

$60 interval and results in a lower-bound estimate of the mean which differs by less than $2. Parametric approaches tend to result in somewhat higher estimates. The second is to drop respondents from the sample who may not have clearly understood the CV scenario posed to them. Here a number of more or less inclusive criteria can be employed based upon the interviewer evaluations and responses to particular debriefing questions. In all instances, dropping these respondents raises WTP estimates for the remaining sample. The third is to look at the sponsor question. A plurality (42%) of the respondents believed that Exxon or the oil companies sponsored the survey with the government (23%) being next. Believing that Exxon or the oil companies had sponsored the survey was not a statistically significant predictor of respondent willingness to pay.

The fourth type of sensitivity analysis is a consideration of how stable the estimates of the WTP distribution are over time. This can be done by looking at the surveys completed in Dayton-Toledo, Ohio, two pilot studies and a tracking survey conducted simultaneously with the final survey. This comparison shows that the estimates of the WTP distribution were statistically indistinguishable at three different points in time over the course of a year. The University of Chicago's

culos case idénticos ós mostrados aquí (Carson *et al.*, 1997).

Valor agregado da perda do uso pasivo

O estudio orixinal daba como resultado un cálculo de 2.800 millóns de dólares (en 1990) como cota inferior de perda de valores de uso pasivo agregados. Este cálculo obtívose multiplicando o número de fogares de fala inglesa, que constitúen a poboación obxecto da mostra, polo cálculo da mediana da disposición a pagar. Esta cifra deu un resultado moi prudente por dous motivos. O primeiro, desde una perspectiva teórica, a media da disposición a aceptar compensación (que é moito maior cá media da disposición pagar) é a medida máis axeitada dos servicios perdidos ou afectados pola marea negra do *Exxon Valdez*[38]. O segundo, a mediana da disposición a pagar é menor cá media da disposición a pagar baixo o suposto débil de que a distribución da disposición a pagar está positivamente nesgada. A vantaxe da mediana consiste en que tende a calcularse de forma bastante robusta en mode-

National Opinion Research Center administered the final questionnaire nationally two years later and, from that data, we obtained almost identical estimates to those reported here (Carson, *et al.,* 1997).

Aggregate Lost Passive Use Value

The original study reported an estimate of $2.8 billion (1990) dollars as the lower bound on the estimated aggregate lost passive use values. This estimate was obtained by multiplying the number of English-speaking households, the population sampled, by the estimate of median WTP. This estimate was very conservative in two main ways. First, from a theoretical perspective, mean WTA (which is greater than mean WTP) is the most appropriate measure of the services lost or disrupted by the *Exxon Valdez* oil spill[38]. Second, median WTP is less than the mean WTP under the weak assumption that the WTP distribution

38. A normativa sobre a avaliación de danos segundo a OPA tamén salienta que a disposición a aceptar compensación é unha medida axeitada dos danos: "Dado que o goberno mantén os recursos naturais en fideicomiso para o público, o criterio da disposición a aceptar unha compensación é conceptualmente o máis axeitado para medir os danos á hora de facer reclamacións por danos producidos ós recursos naturais", *Federal Register*, vol. 59, 7 de xaneiro de 1994, p. 1.150.

38. The damage assessment regulations under OPA also note that WTA is the appropriate measure of damages: "Because the government is holding natural resources in trust for the public, the WTA criterion is conceptually the more appropriate measure of damages for natural resource damage claims". *Federal Register*, vol. 59, January 7, 1994, p. 1150.

los de supervivencia e é bastante insensible ós supostos distributivos. Desde que se fixo o informe, conseguiuse avanzar moito no cálculo de modelos paramétricos e non paramétricos máis flexibles da distribución da disposición a pagar. Se se empregase o cálculo máis baixo da media da disposición a pagar coherente cos parámetros de densidade de Turnbull non paramétricos, o cálculo total da perda de uso pasivo dá o resultado de 4.870 millóns de dólares[39].

Se se emprega o cálculo da media da disposición a pagar a partir da distribución paramétrica de tres parámetros de Weibull dá como resultado unha cifra de 7.190 millóns de dólares.

Estas cantidades reflicten a disposición a pagar da xente para evitar outra marea negra semellante á do *Exxon Valdez* dado o escenario presentado. Os resultados son cifras máis elevadas se se axustan simultaneamente os cálculos da disposición a pagar para as respostas protesta, as percepcións de danos maiores ou menores provocados pola marea negra do *Exxon Valdez* e para percepcións de que o plan proposto non sería completamente eficaz.

is positively skewed. The advantage of the median is that it tends to be quite robustly estimated in survival models and is relatively insensitive to distributional assumptions. Since the report, substantial progress has been made on estimating non-parametric and more flexible parametric models of the WTP distribution. If one were to employ the most conservative estimate of mean WTP consistent with the non-parametric Turnbull density parameters, the estimate of aggregate lost passive use is 4.87 billion dollars[39].

Using the mean WTP estimate from the parametric three-parameter Weibull distribution yields an estimate of 7.19 billion dollars.

These amounts reflect the public's willingness to pay to prevent another *Exxon Valdez* type oil spill given the scenario posed. Simultaneously adjusting the WTP estimates for protest responses, perceptions of damages larger or smaller than the *Exxon Valdez* spill, and for perceptions that the proposed plan would not be completely effective, results in higher estimates.

39. Esta cifra obtense multiplicando a media do límite inferior de Turnbull polo número de fogares estadounidenses que falan inglés (90.838.000).

39. This number is obtained by multiplying the Turnbull lower bound mean by the number of English-speaking U.S. households (90,838,000).

6 EPÍLOGO

O Estado de Alasca e o Goberno dos Estados Unidos resolveron as súas demandas xudiciais contra Exxon por 1.000 millóns de dólares en concepto de danos provocados ós recursos naturais e para a restitución polos prexuízos causados[40]. Ademais, Exxon gastou máis de 2.000 millóns de dólares en concepto de recuperación e medidas contra a marea negra. Pódese comparar esta cantidade cos 2.800 millóns de dólares que se necesitarían para evitar que se volva producir unha marea negra semellante á provocada polo *Exxon Valdez* presentada no informe do estudio orixinal. Se pensamos sobre esta resolución, pode resultar útil reflexionar que as orientacións sobre a avaliación de danos producidos ós recursos naturais esixen que os cartos recadados polo goberno deben gastarse na recuperación e/ou na adquisición de recursos semellantes cando non é factible a recuperación. Desde logo cabe discutir sobre que gastos cubertos por Exxon representaban a resposta ó problema provocado (sen contar os danos indemnizables) e cales representaban a recuperación (contados como danos indemnizables). Tamén é posible ser crítico cos labores de recuperación. Sen embargo, aprendéronse moitas cousas

40. Houbo tamén algunhas demandas privadas por danos punitivos e producidos ó mercado presentadas por particulares. Aínda que moitos destes casos foron resoltos, aínda segue a haber algúns litixios no ano 2003.

6 A POSTSCRIPT

The State of Alaska and the U.S. Government settled their lawsuits against Exxon for 1 billion dollars in natural resource damages and restitution for injuries[40]. In addition, Exxon spent over 2 billion dollars on oil spill response and restoration. This compares to the 2.8 billion dollars to prevent an *Exxon Valdez* type oil spill put forth in the original study report. In thinking about the settlement, it may be useful to keep in mind that guidelines on natural resource damage assessment require that any money collected by the government be spent on restoration and/or the acquisition of like resources where restoration is not feasible. It is clearly possible to argue about which Exxon expenditures represented response (not to be counted toward compensable damages) and which represented restoration (counted toward compensable damages). It is also possible to be critical of the restoration effort. Much, however, has been learned since the *Exxon Valdez* oil spill about the effects of oil

40. There were also a number of private claims for commercial and punitive damages brought by private parties. While many of those cases have been settled, some litigation continues as of 2003.

desde que ocorreu o accidente do *Exxon Valdez* sobre os efectos das mareas negras, a forma de evitalas e de que forma hai que facer fronte a elas[41].

Sen embargo, non se presta moita atención a exemplos que demostran a forma de evitar as mareas negras. Despois da marea negra producida polo *Exxon Valdez*, a garda costeira dos Estados Unidos puxo en marcha un programa de prevención e resposta que se parecía moito ó programa descrito ós enquisados utilizado neste estudio. A avaliación do impacto normativo deste plan baseouse no feito de evitar danos da magnitude indicada pola resolución xudicial do litixio do goberno contra Exxon. Os custos deste programa foron transferidos posteriormente ós consumidores nos Estados Unidos en forma de prezos da gasolina máis elevados. Despois de poñer en marcha este plan, un petroleiro tivo problemas co seu sistema de dirección despois de levantar a áncora en Valdez e atopábase a pouco máis de 3 km das rochas cando o seu barco de acompañamento conseguiu afastalo da zona de perigo (Fararo, 1992). Este uso dos resultados do estudio para unha avaliación custo-beneficio dun programa que sirva para protexer *ex ante* os recursos natu-

41. Tamén se aprendeu moito sobre como estructurar os plans de recuperación e indemnización por danos producidos ós recursos. Para máis detalles, véxase http://www.oilspill.state.ak.us/.

spills, how to prevent them, how to respond to them[41].

Indeed, instances where a spill is averted receive little attention. After the *Exxon Valdez* oil spill, the U.S. Coast Guard put into effect an oil spill prevention and response program that strongly resembled the program described to respondents in this study. Their regulatory impact assessment for this plan was based on preventing damages of the magnitude indicated by Exxon's settlement with the government. The costs of this program have subsequently been passed on to consumers throughout the United States in the form of higher oil prices. After the plan was put into effect, a tanker had problems with its steering system after leaving Valdez and was about 100 feet from hitting the rocks when its escort ship succeeded in pushing it away (Fararo, 1992). This use of the study results for a benefit-cost assessment of a program to protect *ex ante* the natural resources of Prince William Sound complete the circle between the usual policy analy-

41. Much has also been learned about how structuring restoration and resource compensation plans. For details in this case, see http://www.oilspill.state.ak.us/.

rais do estreito de Prince William pecha o círculo entre a análise da política habitual e a avaliación de danos producidos ós recursos naturais[42].

O debate sobre as medicións do uso pasivo proporcionadas pola valoración continxente e o seu papel na avaliación dos danos producidos ós recursos naturais e a toma de decisións por parte da Administración converteuse nun tema principal de debate para os economistas (Carson, Flores e Meade, 2001). O *Exxon Valdez* representaba o caso por antonomasia no que o feito de esquecer os valores do uso pasivo era o mesmo que dicir que os recursos que elixira a opinión pública para ser conservados podían ser danados sen que repercutise ningún ou case ningún custo na parte responsable deses danos.

É posible crer que os valores do uso pasivo deban ser indemnizados pero non crer en utilizar a valoración económica directa a través da valoración continxente. Esixir que o remedio debería ser a recuperación dun recurso danado, tal como argumentaban moitos críticos da utilización da valoración económica, demostrouse que era un concepto baleiro de significado cando morren grandes cantidades de animais e os ecosistemas resultan danados durante anos. Aínda que está claro que é posible compensar os particulares sis and natural resource damage assessment[42].

The debate over CV measures of passive use and their role in the assessment of natural resource damages and public decision-making has become a major topic of debate for the economics community (Carson, Flores and Meade, 2001). The *Exxon Valdez* represented the quintessential case in which, to ignore passive use values, was to effectively say that resources that the public had chosen to set aside and not develop could be harmed at little or no cost to the responsible party.

It is possible to belief that lost passive use values should be compensated but not believe in using direct monetary valuation via contingent valuation. Requiring restoration of an injured resource as many critics of using monetary valuation had argued should be the remedy has been shown to be a vacuous concept when large numbers of animals are killed and ecosystems disrupted for years. While it is clearly possible to compensate the public by providing additional natural resources to compensate for the lost service flows until the resource recovers, determin-

42. O Estado de California encargou un estudio *ex ante* (Carson *et al.*, 1996) sobre os beneficios que implica o feito de evitar mareas negras ó longo do litoral californiano que foi empregado para varias tarefas.

42. The State of California commissioned an *ex ante* study (Carson, *et al.*, 1996) of the benefits of preventing oil spills along California's central coast which it has used for a number of different purposes.

proporcionándolles máis recursos naturais para reparar a perda de servicios ata que se recuperen os recursos, determinar o nivel de recursos compensatorios para o público require coñecementos de que valor económico lle atribúe o público ós recursos (Flores, 2002).

No momento en que se produciu a marea negra do *Exxon Valdez* non estaba claro se a Lei do Almirantado, que limita os danos ó valor do barco e do seu cargamento, tiña prioridade á hora de determinar a responsabilidade civil sobre os estatutos da contaminación estatal/federal. A aprobación da Lei de control da contaminación por hidrocarburos dos Estados Unidos en 1990 eliminou esa ambigüidade e apostou claramente por incluír o uso pasivo á hora de avaliar os danos. A decisión política non se adoptou claramente noutras partes do mundo. Así, a responsabilidade civil asumida por unha gran marea negra nos Estados Unidos é moi elevada e, quizais como consecuencia disto, non se produciron grandes mareas negras nos Estados Unidos desde o accidente do *Exxon Valdez*. Houbo mareas negras que puideron ser moi graves e provocar grandes danos se non se fixeran esforzos por aplicar os plans de resposta planificados de antemán[43]. Esta ausencia de grandes mareas negras nos Estados Unidos durante máis de

ing the level of compensatory resources that would make the public whole effectively requires knowledge of how much monetary value the public placed on the resource (Flores, 2002).

At the time of the *Exxon Valdez* oil spill it was not clear whether Admiralty law which limits damages to the value of the ship and its cargo would take precedent in determining liability over federal/state pollution statues. The passage of the U.S. Oil Pollution Control Act of 1990 removed that ambiguity and came down clearly on the side of including passive use in assessing damages. That policy decision has not been decisively made elsewhere in the world. As such, perceived liability for a major oil spill in the United States is very high and, perhaps as a consequence, there have been no extremely large spills in the United States since the *Exxon Valdez* oil spill. There have been spills that might have become very large and caused widespread injuries if it had not been for the preplanned aggressive response effort undertaken[43]. This lack of extremely large oil spills in the United States for over a decade has had an interesting effect; it implies that while

43. A maioría dos danos provocados polas mareas negras nos Estados Unidos desde o accidente do *Exxon Valdez* foron a curto prazo para as actividades de lecer ó aire libre

43. Most oil spill injuries in the U.S. since the *Exxon Valdez* have been short term to outdoor recreation or to small parts of larger ecosystems

dez anos produciu un efecto moi interesante; implica que aínda que non se empregou moito a valoración continxente para avaliar os danos producidos ós recursos naturais por grandes mareas negras, o seu uso potencial pode desempeñar un papel importante á hora de evitar as mareas negras[44]. Sen embargo, noutros lugares do mundo o número de grandes mareas negras non cambiou moito co paso do tempo.

CV has not been used much for assessing natural resource damage of large oil spills, its potential use may be playing an important role in preventing such spills[44]. Elsewhere in the world, the number of big oil spills has been largely unchanged over time.

ou a pequenos anacos de grandes ecosistemas dos que o goberno é o fiduciario. Empregáronse técnicas que se consideraron preferenciais, técnicas indirectas como a análise dos custos da viaxe, e a análise da equivalencia do hábitat para axudar a resolver estes casos. Estas mareas negras tamén provocaron certos danos a intereses comerciais que presentaron denuncias de carácter privado nas que están en xogo a perda de beneficios, actuais e futuros.

44. A inmensa maioría dos estudios de valoración continxente sempre se fixeron por motivos políticos. O número de estudios deste tipo segue a medrar rapidamente. Carson (en prensa) proporciona citas de máis de 5.000 traballos e estudios de valoración continxente en máis de 100 países.

for which the government is the trustee. Stated preference techniques, indirect techniques like travel cost analysis, and habitat equivalence analysis have been used to help settle these cases. These spills have also caused some harm to commercial interests who can bring private lawsuits where lost profits, current at prospective, are at issues.

44. The vast majority of CV studies have always been done for policy purpose. The number of such studies continues to grow rapidly. Carson (forthcoming) provides citations to over 5000 CV papers and studies from over 100 countries.

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XESTIÓN DA RECUPERACIÓN ECONÓMICA E AMBIENTAL: O CONSELLO DE ADMINISTRADORES FIDUCIARIOS DA MAREA NEGRA DO *EXXON VALDEZ*

MANAGEMENT OF ECONOMIC AND ENVIRONMENTAL RECOVERY: THE *EXXON VALDEZ* OIL SPILL TRUSTEE COUNCIL

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Executive Director *Exxon Valdez* Oil Spill Trustee Council

INTRODUCCIÓN

É para min un pracer participar neste seminario en calidade de directora executiva do Consello de Administradores Fiduciarios da Marea Negra do *Exxon Valdez*, cargo que ocupo desde 1994. É certo que houbo mareas negras peores cá do *Exxon Valdez*, pero non houbo ningunha na que se vertese unha cantidade tan grande de petróleo nun medio tan rico e limpo. Desde o primeiro día, esta marea negra atraeu a imaxinación e a preocupación dos cidadáns e creou un interese que aínda persiste nestes días, case catorce anos despois. Nesta conferencia falareilles das circunstancias que rodearon o accidente, do alcance inicial dos danos provocados, da valoración destes, do estado da recuperación hoxe en día e finalmente describirei o proceso seguido polo Consello de Administradores Fiduciarios.

INTRODUCTION

I am pleased to be here with you today at the conference. I have had the honor of serving as the Executive Director of the *Exxon Valdez* Oil Spill Trustee Council since 1994. There have been larger oil spills than the *Exxon Valdez* oil spill, but none that involved the release of such a large quantity of oil into such a rich and pristine environment. From the first day, this oil spill engaged the imagination and concern of the public, and created an interest that still exists to this day, nearly fourteen years later. I will first give you some background on the spill, the original extent of the injury, the valuation of damages, the status of recovery today, and a description of the Trustee Council process.

O CRU

O petróleo cru de toda a vertente norte de Alasca producese ó longo da costa norte do país en distintas zonas como a baía de Prudhoe e en Kuparuk. O hidrocarburo é cru pesado cun alto grao de toxicidade e cando se verte ó mar resulta difícil de disolver. Recóllese na baía de Prudhoe e é enviado a unhas 800 millas a través dun oleoducto ata unha terminal sen xeo en Valdez (Alasca). Desde alí o hidrocarburo cárgase en petroleiros e é transportado cara ó sur polo estreito de Prince William ata Washington ou California, onde é refinado e distribuído para o seu uso.

A MAREA NEGRA

No serán do xoves 23 de marzo de 1989, o *Exxon Valdez*, un buque de transporte de hidrocarburos enorme e un dos petroleiros máis grandes de Exxon, saíu do porto de Valdez rumbo a Long Beach (California). Debido a varios erros humanos, o buque perdeu o rumbo e pouco despois da medianoite do venres 24 de marzo de 1989 tocou no arrecife de Bligh e encallou. O encallamento perforou o buque dun só casco e, a consecuencia disto, once dos depósitos de cru do buque romperon e verteron uns 50.000 m^3 de hidrocarburo ás augas limpas do estreito de Prince William. Esta foi a maior marea negra na historia dos Estados Unidos.

THE OIL

Alaska North Slope crude oil is produced along the northern coast of Alaska in various fields such as Prudhoe Bay and Kuparuk. The oil is heavy crude, highly toxic and slow to disperse when released into the environment. It is gathered in Prudhoe Bay and sent 800 miles through a pipeline to an ice-free terminal in Valdez, Alaska. From there the oil is loaded on tankers and shipped south, through Prince William Sound, down to Washington or California, where it is refined and distributed for use.

THE SPILL

On Thursday evening March 23, 1989, the *Exxon Valdez*, a very large crude carrier and one of Exxon's two largest oil tankers, left the Port of Valdez bound for Long Beach, California. Due to a variety of human errors, the ship was directed off course and shortly after midnight on Friday March 24, 1989, struck Bligh Reef and fetched up hard aground. The grounding punctured the single-hulled vessel, resulting in the rupture of eleven of the vessel's crude oil tanks and releasing over 11 million gallons of crude oil into the pristine environment of Prince William Sound. It was the largest oil spill in United States history.

RESPOSTA

Durante case tres días, o tempo no estreito de Prince William foi anormalmente bo. Sen embargo, a compañía do oleoducto de Alyeska, que foi a que primeiro reaccionou, non estaba preparada xa que non tiña equipamento suficiente na zona para actuar de xeito oportuno. Non había case ningunha barreira de contención despregada e as que había non servían de moita axuda. Levouse a cabo unha queima controlada de proba, que non serviu de moito, xa que o contido acuoso da escuma oleaxinosa fixo que a queima resultase axiña impracticable ou mesmo imposible. Aínda que os dispersantes foron a primeira ferramenta de resposta na que se pensou, foron probados con resultados pouco fructíferos; Exxon e Alyeska nin tiñan dispersantes nin equipamento suficiente para despregar axeitadamente.

En todo caso, un cambio natural do tempo rematou axiña con toda esperanza de contención do petróleo. Un forte temporal de inverno no estreito de Prince William provocou que se convertese rapidamente dunha masa relativamente compacta a un conxunto bastante disperso de galletas e fíos de fuel. O hidrocarburo comezou a chegar ás praias da zona occidental do estreito de Prince William, superando todos os esforzos posibles para poder paralo. Unha excepción salientable é a dos esforzos feitos polos mariñeiros do lugar por salvar un criadeiro de salmón do estreito de Prince William da contaminación da marea negra. Os mariñeiros, empregando utensilios de limpeza rudimenta-

RESPONSE

For almost three days, the weather in Prince William Sound was unusually quiet. However, Alyeska Pipeline Company, the initial responder, was not ready and few pieces of equipment were in the area in a timely manner. There was little or no containment boom deployed and what was in the water was of little help. A test burn was conducted, which worked to some extent, but the water content of the oily mousse soon made burning impractical or impossible. Although dispersants were a primary response tool, and were tested with somewhat inconclusive results, Exxon and Alyeska had neither sufficient dispersant or equipment to adequately deploy it.

In any event, a natural gyre and the weather soon put an end to any hope of containment. A severe winter storm blew into Prince William Sound, and the oil slick quickly went from a relatively compact mass to a widely dispersed uncontrollable collection of patches and streaks. Oil began to hit the beaches of western Prince William Sound, overwhelming almost all efforts to stop it. A major exception was the effort put forth by local commercial fishermen to save a salmon hatchery in western Prince William Sound from getting oiled. Fishermen,

rios, principalmente esponxas e caldeiros, limparon máis neses poucos días da "Batalla da Baía de Sawmill" do que fixeron as empresas Alyeska e mais Exxon nas semanas seguintes ó vertido.

Durante cinco meses e medio, os traballos de limpeza incrementáronse progresivamente, para converterse ó final no maior proxecto privado realizado en Alasca desde a construcción do oleoducto de Trans-Alasca, no que traballaron máis de 11.000 persoas na limpeza no momento culminante. Gastáronse un total de 2000 millóns de dólares nos catro anos que levaron as tarefas de limpeza de máis de 1500 millas de costa contaminada polo fuel, cun ancho de case 500 millas[1]. O método fundamental empregado para a limpeza do petróleo foi o lavado con chorro de auga quente a alta presión, co que se conseguiu botar o petróleo da costa mar a fóra, onde se bombeaba e recollía sobre tecido absorbente. Tamén se aplicaron métodos de biorremediación con diferentes resultados.

Pero mesmo cando se estaban a desenvolver os labores de limpeza, os altos cargos do goberno xa estaban a planear sobre o que se ía facer cando rematase a limpeza. Comezaron a formular preguntas acerca dos danos ó medio natural, sobre cómo se recuperaría, cánto custaría e cómo se pagarían estes gastos. Estas preguntas levaron á conclusión de que os gobernos estatal e federal debían tra-

1. Exxon Mobil (2002): "Exxon statement Valdez ten-year anniversary", www.exxonmobil.com/corporate/newsroom/publications/valdez_bulletin.

using primitive cleanup tools – mainly sponges and buckets – did more cleanup in those few days of the "Battle of Sawmill Bay" than was done by Alyeska and Exxon in the first weeks following the spill.

Over the next five and a half months, the cleanup operations grew exponentially, ultimately becoming the largest private project in Alaska since construction of the Trans-Alaska Pipeline, with over 11,000 people working on cleanup at its high point. At times it looked like an invasion force had entered Prince William Sound. About $2 billion total was spent over the four year period to clean up more than 1,500 miles of oiled shoreline that stretched nearly 500 miles[1]. The primary method used for cleanup was a high pressure, hot water wash that caused the oil to flow right offshore, where it was boomed and absorbed with pads. Some bioremediation was done, all with mixed results.

But even as cleanup continued, government officials began to plan for the day when it ended. They began to ask questions, such as: What is the injury to the environment? What can be done to restore it? What will it cost

1. Exxon Mobil (2002): "Exxon statement Valdez ten-year anniversary", www.exxonmobil.com/corporate/newsroom/publications/valdez_bulletin.

ballar xuntos para avaliar o alcance dos danos producidos ó medio natural, contabilizar eses danos, esixir á compañía Exxon que pagase por eles e empregar o diñeiro recibido para reparalos.

AVALIACIÓN

O único problema importante que implicaba a avaliación do alcance dos danos ambientais provocados pola marea negra consistía en que, con poucas excepcións, non existía moita información previa sobre os recursos naturais da zona castigada pola marea negra para poder comparar as poboacións existentes despois de se producir a marea negra con respecto ás que había antes, e tamén as poboacións que había en zonas contaminadas con respecto ás que había en zonas non contaminadas. A medida que se estendía a marea negra, algúns científicos trataban de apurar para reunir datos antes de que a marea negra chegase ás praias. Sen embargo, a marea era demasiado extensa e avanzaba demasiado rápido como para poder acadar esta información. Aínda nos casos en que existían datos, como por exemplo sobre as migracións de salmón, a variación natural destes recursos presentaba dúbidas sobre a comparación entre os datos recollidos antes e despois da marea negra. Así pois, para poder documentar o alcance dos danos, unha das medidas máis rudimentarias empregadas era a contabilización de corpos, que ó final se converteu nun criterio fundamental á hora de

and how can we pay for it? Those questions led to the conclusions that the state and federal governments, working together, must assess the extent of the damages to the environment, value those damages, require Exxon to pay for them, and use the money received to restore the damages.

ASSESSMENT

The single biggest problem with assessing the extent of environmental damage caused by the oil spill was that, with a few exceptions, there was little baseline information on the natural resources in the oil spill area in order to compare post-spill populations with pre-spill populations, or populations in oiled areas versus populations in unoiled areas. As the spill expanded some scientists raced to gather data ahead of oil hitting the beaches. However, the spill was too big and too fast for much of this. Even where data existed, such as data on local salmon runs, the natural variation in those resources made pre-spill and post-spill comparisons suspect. Thus, to document the extent of damages, one of the crudest measures, a body count, became a primary yardstick for describing the damage to the public. Much of the early science program was oriented toward documenting injuries

describir os danos á opinión pública. Gran parte do programa científico empregado ó principio tiña como obxectivo documentar os danos e os cambios producidos nas poboacións de especies únicas, non en ecosistemas completos, mediante a rastrexadura do destino e da persistencia do fuel.

Trala marea negra, atopáronse grandes cantidades de cadáveres de animais, entre os que se incluían aproximadamente 21.000 araos dos cons, 1100 araos *(Brachyramphus marmoratus)*, 838 corvos mariños, 151 aguias americanas *(Haliaeetus leucocephalus)* e 1100 lontras de mar. Sen embargo, esta medida claramente infravaloraba as perdas reais, xa que os cadáveres dos animais se afundiron ou nunca foron atopados nunha zona tan grande como a que resultou afectada pola marea negra. Como exemplo disto, pódese constatar que aínda que só se atoparon 21.000 cadáveres de araos, a perda total estimada, baseada en estudios realizados daquela, ascendía a 250.000. Esta cifra constituía arredor do 40% da poboación da zona afectada que existía antes de se producir a marea negra. As mortes inmediatas foron calculadas en 2800 lontras de mar, 300 focas e 22 candorcas.

Non se atoparon cadáveres de candorcas despois da marea negra, pero 14 das 36 candorcas que residían na manda no estreito de Prince William desapareceron durante os anos 1989 e 1990. Durante este mesmo período non naceron máis candorcas nesa manda e a estructura social tan complexa semellaba verse deteriorada. O vínculo entre estas perdas é circuns-

and changes in populations of single species, rather than entire ecosystems, and by tracking the fate and persistence of the oil.

Following the oil spill, animal carcasses were found in large numbers, including approximately 21,000 murres, 1,100 marbled murrelets, 838 cormorants, 151 bald eagles, and 1,000 sea otters. However, this measure clearly understated the actual losses since animal carcasses sank or were never discovered in the huge area covered by the oil spill. As an example, even though "only" about 21,000 murre carcasses were found, the estimated total loss, based on studies done at the time, was 250,000. This was about 40% of the pre-spill population of the oil spill area. Immediate mortalities were estimated to include 2,800 sea otters, 300 harbor seals and 22 killer whales.

No oiled killer whale carcasses were found following the oil spill, but 14 out of the 36 killer whales in the resident Prince William Sound pod disappeared in 1989 and 1990. During that same period, no whales were born in that pod, and the pod's complex social structure appeared to be deteriorating. The link between these losses is circumstantial – but the public and the Trustee Council have continued to monitor killer whales and report regularly on their status.

tancial, pero os cidadáns e o Consello de Administradores Fiduciarios continuaron controlando as candorcas e presentaban informes sobre a súa situación cada certo tempo.

Outro caso de proba circunstancial de danos apareceu co arenque do Pacífico no estreito de Prince William. A poboación desta especie descendeu en 1993, que foi o primeiro ano en que se recolleu un gran número de arenques das ovas producidas nas costas contaminadas en 1989 da poboación que estaba a desovar. Estudios posteriores a este achado demostraron que o descenso da poboación se debeu a unha enfermidade vírica normalmente latente e que a exposición a hidrocarburos, que é un "estresante" moi coñecido, pode inducir á súa aparición. Non está "probado" que neste caso a marea negra fose o factor "estresante". Sen embargo, esta especie ecoloxicamente vital (e moi importante desde o punto de vista comercial) aínda tivo que recrutar os exemplares de maior idade, que son esenciais para a súa recuperación total.

Os danos subletais producidos ós recursos naturais foron aínda máis misteriosos. Por exemplo, despois de se producir a marea negra, a troita asasina *(Oncorhynchus clarki)* que habitaba en regatos afectados pola marea negra foi medrando máis lentamente ca nos regatos non afectados, e isto foi posiblemente consecuencia da diminución dos recursos alimenticios ou da exposición ó petróleo. Por este motivo, o descenso no índice de crecemento pode dar lugar a un grao de supervivencia menor.

Another case of circumstantial evidence of injury was with Pacific herring in Prince William Sound. That population collapsed in 1993, the first year when large numbers of herring from eggs spawned on oiled shorelines in 1989 were recruited to the spawning population. Subsequent studies have shown that the collapse was due to a usually latent viral disease and that exposure to hydrocarbons – a known stressor – can induce its expression. It can't be "proven" that in this case, the oil spill was the "stressor". However, this ecologically vital and commercially important species has yet to recruit the kind of large year-class that is essential for full recovery.

Sublethal injuries to natural resources were even more subtle. For example, following the oil spill cutthroat trout in oiled streams grew more slowly than those in unoiled streams, possibly as a result of reduced food supplies or exposure to oil. Reduced growth rates may lead to reduced survival.

An even more complex problem arose with pink salmon. Pink salmon in the Sound are both wild and hatchery raised. Wild pink salmon spawn in intertidal areas as well as in streams. These fish spawned in an oiled intertidal zone, swam through oiled waters and ingested oil particles and oiled

Un problema aínda máis complexo xurdiu co salmón rosado, especie que nesta zona se cría tanto no seu hábitat natural coma en piscifactorías. O salmón rosado silvestre desova en zonas intermareais e en regatos. Estes peixes desovaron nunha zona intermareal petroleada, avanzaron por augas contaminadas por medio do fuel, inxeriron partículas de hidrocarburo e presas petroleadas das que se alimentaban no estreito mentres migraron cara ó mar. Como consecuencia disto, os estudios realizados trala marea negra coincidían en que se produciran tres tipos de danos: en primeiro lugar, reducíronse os índices de crecemento nos xuvenís procedentes das zonas contaminadas do estreito de Prince William; en segundo lugar, aumentou a mortaldade de ovas en regatos contaminados polo hidrocarburo con respecto ós non contaminados; e, por último, semella que se produciron danos xenéticos. Os investigadores do Consello de Administradores Fiduciarios demostraron que concentracións moi baixas de cru emulsionado poden ter efectos tóxicos nas primeiras etapas de vida do salmón rosado.

Deste xeito, sabemos que os stocks de salmón rosado resultaron afectados pola marea negra, pero segue a ser unha dúbida o alcance dos danos producidos nesta especie, xa que a variabilidade natural do salmón rosado silvestre no estreito é enorme, desde un límite máximo de 21 millóns de peixes en 1984 ata un mínimo de 1,8 millóns de 1988, no período anterior a se producir a marea negra. Desde que se produciu esta, a volta variou entre un máximo de

prey as they foraged in the Sound and emigrated to the sea. As a result, post-spill studies indicated three types of injury. First, growth rates in juvenile salmon from oiled areas of Prince William Sound were reduced; second, there was increased egg mortality in oiled versus unoiled streams; and third, genetic damage appears to have occurred. Trustee Council researchers have shown that even very low concentrations of weathered oil can have toxic effects on early life stages of pink salmon.

Thus, we know there was injury to wild pink salmon stocks from the oil spill, but the question remains, to what extent. Natural variability in wild pink salmon in the Sound is huge, ranging in the years before the oil spill from a high of 21 million fish in 1984 to a low of 1.8 million in 1988. Since the oil spill, the return has varied from a high of 14.4 million in 1990 to a low of 2.2 million in 1992. While we can monitor growth and egg mortality rates to assess recovery, it is very difficult, in light of the natural variability, to determine the effect on Prince William Sound pink salmon stocks that can be attributed to the spill.

The oil-related loss of about 300 harbor seals was added to a pre-spill decline in its Prince William Sound

14,4 millóns en 1990 ata un mínimo de 2,2 millóns en 1992. Aínda que podemos controlar os índices de crecemento e de mortaldade de ovas para avaliar a recuperación desta especie, resulta moi difícil, á vista da variabilidade natural, determinar os efectos nos stocks de salmón rosado do estreito de Prince William, que se poden atribuír á marea negra.

Á perda dunhas 300 focas atribuída á marea engadiuse un descenso da súa poboación no estreito de Prince William que se produciu antes. Este descenso continúa na actualidade, por motivos probablemente non relacionados con esta.

En resumo, aínda que sabemos que se produciron danos inmediatos enormes a determinadas especies, houbo e aínda segue a haber moita incerteza acerca do alcance exacto deses danos. Como o proceso da marea negra aínda está en litixio, todos os estudios de avaliación de danos mantivéronse en secreto e non foron sometidos ás habituais inspeccións e publicacións a que están afeitos a maioría dos estudios científicos.

VALORACIÓN

Se resultou difícil avaliar o alcance dos danos producidos ós recursos naturais, aínda resulta máis desalentador darlles un valor económico ós danos. ¿Canto vale unha lontra, unha foca ou un arao común? ¿Cal é o custo económico dunha troita asasina que medra máis lentamente? Para responder a estas preguntas, os avogados estatais e federais fixá-

population. This decline continues today, for reasons probably not related to the oil spill.

In summary, while we know there was tremendous immediate injury to individual species, there was, and is, much uncertainty as to the exact amount of that injury. Since the oil spill was still under “litigation”, all the damage assessment studies were kept secret, and were not subject to the usual peer review and publication that most scientific studies are subject to.

VALUATION

As difficult as it seemed to be to assess the extent of injury to natural resources, placing a dollar value on that injury was even more daunting. What is the value of an otter, a seal or a common murre? What is the financial cost of a cutthroat trout that grows slower? To answer these questions, state and federal lawyers looked, for the most part, to the value of the services that these resources provide to people, such as sport fishing and tourism.

One of the first studies initiated was a “replacement cost” analysis. This study estimates the value of injuries to natural resources based on the costs of relocation of adult animals from areas

ronse sobre todo no valor dos servicios que eses recursos proporcionan ás persoas, como por exemplo na pesca deportiva e no turismo.

Un dos primeiros estudios iniciados foi a análise do "custo de reposición". Este estudio calcula o valor dos danos producidos ós recursos naturais baseándose nos custos de recolocación dos animais adultos procedentes de zonas onde abundan, na reposición de animais e na recuperación dos animais feridos.

Os *custos de cambio de lugar* son os custos que implica a captura dun animal para aclimatalo a un novo lugar e soltalo despois nel. Deste xeito, tomando como exemplo as aguias, os custos que implican a captura e o cambio de lugar dunha delas ascenden a entre 1000 e 1500 dólares. Sen embargo, as aguias tenden "ó seu fogar", así que este custo non é realmente indicativo dos custos de reposición dunha parella reproductora. Como este factor non resulta facilmente comprensible, esta cifra non foi moi útil á hora de establecer un valor económico.

Os *custos de substitución* constitúen esencialmente o custo que supón criar os animais ata a súa etapa de madurez. Con respecto ás aguias, fixéronse algúns esforzos por criar aguias novas e introducilas no seu hábitat natural. Unha destas iniciativas supuxo un custo de aproximadamente 22.500 dólares para conseguir que unha aguia volvese vivir no seu hábitat natural. A outra iniciativa tivo uns custos de entre 12.500 e 15.000 dólares por animal, e unha terceira tivo uns custos duns 21.500 dólares.

where they are abundant, the replacement of animals, and the rehabilitation of injured animals.

Relocation costs are the costs of capturing an animal, acclimating it to a new location and releasing it in that location. Thus, for example with eagles, the costs of capture and relocation were $1,000 - $1,500 per eagle. However, eagles tend to "home" so this cost was not truly indicative of the costs of replacing a breeding pair. Because this factor is not well understood, this number was not particularly useful for setting value.

Replacement costs are essentially the cost of raising young animals to maturity. Again looking at eagles, there have been several efforts to raise young eagles and introduce them into the wild. One of these efforts reported a cost of approximately $22,500 to successfully produce one adult eagle living in the wild. Another had costs of $12,500 - $15,000 per eagle, while a third reported costs of about $21,500.

Rehabilitation costs for injured animals was a third option. In 1989 Exxon spent about $100,000 per eagle in its rehabilitation program for animals injured by the oil spill. Looking at all of these figures, eagles were valued at about $22,000 per bird.

Os *custos de readaptación* dos animais feridos constitúen unha terceira opción. En 1989 a empresa Exxon gastou uns 100.000 dólares por aguia no programa de readaptación dos animais afectados pola marea negra. Se se observan estas cifras, cada ave foi valorada nuns 22.000 dólares.

PESCA DEPORTIVA

A pesca deportiva é unha actividade que resultou claramente prexudicada pola marea negra. Para esta actividade existen datos históricos: en 1989 o número de pescadores diminuíu nun 13%, os días de pesca reducíronse nun 6% e os peixes capturados diminuíron nun 10%. Á hora de proporcionarlle un valor económico a este descenso, os economistas determinaron, a través de entrevistas cos pescadores, que unha persoa gastaba unha media de 250 dólares ó día cando ía pescar nesa zona. Polo tanto, esta cifra foi considerada o valor medio por persoa na actividade da pesca. Se se multiplica este valor polo número de días de pesca perdidos (124.185), os economistas estableceron que na actividade da pesca deportiva existiron unhas perdas aproximadas de 31 millóns de dólares en 1989.

TURISMO

A repercusión da marea negra no turismo foi valorada mediante enquisas realizadas a turistas reais e potenciais e tamén ó conxunto da poboación. Estas enquisas indicaban que o

SPORTFISHING

Sportfishing was an activity clearly impacted by the oil spill. It is also an activity for which there is historic data. In 1989 the number of anglers decreased by 13%, the days fished decreased by 6%, and the fish caught decreased by 10%. To place a value on this decrease, economists, through interviews with anglers, determined that the average person spent $250 a day to fish in this area. This was assumed then to be the value to an average person of the fishing experience. By multiplying this value by the number of lost angler days (124,185), economists determined that the lost value of sportfishing in 1989 was approximately $31 million.

TOURISM

The impact of the oil spill on tourism was measured by surveys of planned and actual visitors to the state and the general population. These surveys indicated that visitor spending in 1989 decreased 8% in Southcentral Alaska and 35% in Southwest Alaska. In the spill area 59% of businesses reported cancellations. Of visitors who actually traveled to Alaska, 16% reported that the oil spill affected their travel plans and half of these said they

gasto por cada turista en 1989 descendeu un 8% no sur de Alasca e un 35% no sudoeste. Na zona afectada pola marea negra, o 59% dos negocios hostaleiros indicaron que tiveran cancelacións. Dos turistas que si viaxaron a Alasca, o 16% informou de que a marea negra trastornara os seus plans de viaxe e a metade destes dixo que evitara ir ó estreito de Prince William. O resultado global contabilizouse nunha perda de 19 millóns de dólares en 1989. En 1990 o impacto non foi tan importante e desde entón non houbo repercusións a longo prazo, malia que os axentes de viaxes aínda evitan ofrecer certas praias contaminadas e informan de que hai menos lugares de interese paisaxístico natural que visitar.

USO PASIVO

Ironicamente, o dano máis importarte en termos económicos non se orixinou pola utilización directa dos recursos, como por exemplo no caso dos que practican a pesca deportiva ou dos mariñeiros, senón sobre todo polas persoas que só teñen un contacto indirecto co estreito de Prince William. Estes usos denomínanse "usos pasivos". O método empregado para a súa determinación foi denominado "valoración continxente", que xa describiu Richard Carson[2].

2. econ.ucsd.edu/~rcarson.

avoided Prince William Sound altogether. The result was an estimated loss of $19 million in 1989. The impact in 1990 was much less severe, and since then, there has been little long term impact, although some recreation providers still avoid certain oiled beaches and report fewer wildlife sightings.

PASSIVE USE

Ironically, the largest damage, in monetary terms, came not from the direct use of injured resources by individuals such as sport or commercial fishermen but rather, from people who have only an indirect connection to Prince William Sound. These uses are called "passive uses". The method used was called "contingent valuation", which Richard Carson just described[2].

2. econ.ucsd.edu/~rcarson.

SOLUCIÓN

Aínda que este enfoque foi utilizado dun xeito conservador, seguiu habendo problemas á hora de defender esta cantidade perante os tribunais. A metodoloxía era polémica e nunca foi considerada nos tribunais. Xurdiron algúns problemas metodolóxicos, o que levou a que outros economistas reducisen a cantidade nun 50%. Tendo en conta estas incertezas, o Estado pensou que a reclamación valía algo menos cá metade do seu valor aparente. Ó final resolveuse que a cantidade de 1000 millóns de dólares era aceptable á hora de chegar a unha resolución xudicial.

Coa ameaza dun xuízo penal nos tribunais federais, a empresa Exxon mostrou interese por chegar a un acordo cos gobernos. Así, o 28 de agosto de 1991, o tribunal do distrito federal aprobou un memorando de acordo que establecía as normas polas que se debían rexer os gobernos, para traballar xuntos na recuperación das zonas contaminadas empregando todos os cartos recibidos por Exxon. A finais de setembro, os gobernos e Exxon asinaron un convenio sobre a responsabilidade civil e Exxon e os Estados Unidos chegaron a un acordo sobre responsabilidade penal. Estes acordos[3] foron aceptados polo tribunal o 8 de outubro de 1991.

3. Tribunal do Distrito dos Estados Unidos (1991): "Agreement and Consent Decree, Civil Action No. A91-083 CIV". Distrito de Alasca (xerocopiado).

SETTLEMENT

Even though this approach had been used conservatively, problems remained in obtaining this amount through the courts. The methodology was controversial and never tried in court. There were some methodological problems that other economists said should reduce the amount by 50%. Taking these uncertainties into account, the state felt the claim was worth somewhat less than half of its face value. $1 billion was decided upon as an acceptable amount for purposes of settlement.

With a federal criminal trial looming on the horizon, Exxon was interested in settling its disputes with the governments. On August 28, 1991, a Memorandum of Agreement setting out the rules by which the governments would work together to recover and spend any settlement money received from Exxon was approved by the federal district court. In late September the governments and Exxon signed a civil settlement agreement and Exxon and the United States reached a criminal plea agreement. These agreements[3] were approved by the court on October 8, 1991.

3. U.S. District Court (1991): "Agreement and Consent Decree, Civil Action No. A91-083 CIV". District of Alaska (xerocopiado).

Segundo o acordo civil, os gobernos ían recibir 900 millóns de dólares da empresa Exxon durante un período de dez anos, cunha reserva para o pagamento dunha cantidade adicional de 100 millóns de dólares para compensar os danos descoñecidos no momento da conciliación. Este diñeiro ía ser empregado para devolverlles ós gobernos os gastos producidos pola marea negra, para pagar os labores de limpeza adicionais e para pagar a recuperación das zonas afectadas. Mediante a sentencia penal, a Exxon viuse obrigada a pagarlles a cada goberno 50 millóns de dólares en concepto de devolución penal e 25 millóns de dólares ós Estados Unidos en concepto de multa penal.

Moitos cidadáns de Alasca non quedaron convencidos desta conciliación, en parte debido ó feito de que os estudios de valoración de danos orixinais aínda se mantiñan en secreto. Os cidadáns non sabían realmente o alcance dos danos e, polo tanto, resultoulles difícil avaliar se o acordo extraxudicial fora bo ou non. Unha das principais leccións que se sacaron da marea negra foi a importancia de garantir a transparencia de todos os estudios científicos.

O CONSELLO DE ADMINISTRADORES FIDUCIARIOS

O memorando de acordo entre os gobernos do estado de Alasca e os Estados Unidos solicitou que o gasto dos cartos obtidos polo acordo extraxudicial fose revisado por seis

Under the civil settlement agreement, the governments were to receive $900 million from Exxon over a 10 year period, with a provision for payment of an additional $100 million for damages not known at the time of the settlement. The money was to be used to reimburse the governments for their expenses in the oil spill, to pay for any additional cleanup, and to pay for restoration. Through the criminal judgment, Exxon was to pay each government $50 million in criminal restitution and $25 million to the United States for a criminal fine.

Many Alaskans were suspicious of the settlement. This was partly because the original damage assessment studies were still secret. The public really didn't know the extent of the damage, therefore, they found it difficult to assess whether the settlement was a good one or not. One of the main lessons of the spill has been the importance of ensuring openness of all scientific studies.

TRUSTEE COUNCIL

The Memorandum of Agreement between the State of Alaska and the United States governments called for the expenditure of settlement money to be overseen by six Trustees – three federal and three state government officials: the

administradores fiduciarios: tres funcionarios do goberno federal e tres do goberno estatal; o secretario do Ministerio do Interior dos EUA, o secretario do Ministerio de Agricultura dos EUA e o administrador da Administración Atmosférica e Oceánica Nacional por parte do goberno federal; e o avogado do Estado de Alasca, o ministro de Conservación da Natureza de Alasca e o ministro de Caza e Pesca de Alasca por parte do goberno deste. Estes administradores fiduciarios crearon un Consello de Administradores en Alasca que tiña como finalidade adoptar as decisións cotiás sobre os gastos. Os administradores do Estado aínda seguen sendo os representantes do Consello de Administradores Fiduciarios, pero os administradores federais delegaron as súas competencias do Consello nos seus principais representantes en Alasca. Segundo as cláusulas do acordo, todas as decisións adoptadas polo Consello de Administradores Fiduciarios deben ser unánimes. Este requisito esixía que os seus administradores fiduciarios traballasen xuntos. Tamén garantía que todas as decisións tomadas fosen realmente apoiadas e reducía as posibilidades de que houbese liortas con respecto ás subvencións.

Nun principio o Consello de Administradores Fiduciarios intentou traballar empregando persoal designado polos distintos organismos estatais e federais. Pero non existía moita confianza entre todos estes organismos. Empezouse a traballar moito mellor cando o Consello contratou a profesionais independentes que os informaban a eles

Secretary of the U.S. Department of Interior, the Secretary of the U.S. Department of Agriculture, and the Administrator of the National Oceanic and Atmospheric Administration on the federal side, and the Alaska Attorney General, the Commissioner of the Alaska Department of Environmental Conservation, and the Commissioner of the Alaska Department of Fish and Game on the state side. The trustees created a Trustee Council in Alaska to handle the day to day decisions on expenditures. The state trustees are still the representatives on the Trustee Council, but the federal trustees have delegated their Council responsibilities to their chief representatives in Alaska. Under the terms of the settlement – all decisions made by the Trustee Council must be unanimous. This has required all six trustees to work very closely together. It also has ensured that all decisions made are truly supported and has reduced much of the potential for fighting over funds.

Originally, the Trustee Council tried to operate using assigned staff from various state and federal agencies, but there wasn't a lot of trust among all the agencies. It worked much better when the Council hired independent professional staff that reported directly to them. I have run that office for nine years, using a small staff that works

directamente. Eu levo nove anos dirixindo este órgano, cun cadro de persoal reducido que traballa directamente para min. O meu traballo consiste en ter contacto directo cos científicos e co público para garantir que están a facer todo o que poden para restablecer os danos producidos ó medio natural.

RESTABLECEMENTO

O Consello tamén tivo que tomar unha decisión sobre o esquema xeral de gastos do diñeiro recibido tralo acordo extraxudicial. Como esta foi a maior marea negra da historia dos Estados Unidos (e polo tanto tamén recibiu a maior compensación económica), non existía ningún modelo de programa de recuperación a esta escala[4]. Ó principio houbo moito debate da opinión pública sobre se o diñeiro debía ser empregado para a investigación científica, para actividades de recuperación directa, para a adquisición de hábitat ou para a prevención doutras mareas negras. Algúns eran partidarios de investir o diñeiro nos recursos naturais danados e outros pensaban que as persoas que se viron afectadas pola marea negra deberían beneficiarse directamente destes cartos.

4. Exxon Valdez Oil Spill Trustee Council (1994): "Exxon Valdez Oil Spill Restoration Plan", Anchorage, Alasca. www.oilspill.state.ak.us/facts/restorationplan.html.

directly for me. My job is to work closely with the scientists and with the public to ensure that we are doing as much as we can to restore the injury to the environment.

RESTORATION

The Council also had to decide on a general outline of how to spend the settlement monies. Since this was the largest spill – and the largest settlement – in U.S. history, there was no model for a restoration program of this scale[4]. Early on there was much discussion by the public as to whether the money should be used for scientific research, direct restoration activities, habitat acquisition, or oil spill prevention. Some advocated spending most of the money on injured natural resources; others felt that people who suffered from the spill should benefit directly.

4. Exxon Valdez Oil Spill Trustee Council (1994): "Exxon Valdez Oil Spill Restoration Plan", Anchorage, Alaska. www.oilspill.state.ak.us/facts/restorationplan.htm.

Os avogados do Estado e os federais decidiron que algunhas destas propostas non eran xuridicamente admisibles, como por exemplo os investimentos na prevención de futuras mareas negras. Tras un proceso de información masiva sobre as axudas que podían obter os afectados, o Consello de Administradores Fiduciarios tomou unha decisión sobre o que se denominou plan de recuperación "global e equilibrado", que consistía en asignar o diñeiro á protección do hábitat, á investigación científica e ós labores de recuperación directa e inmediata. O Consello tamén aceptou a solicitude dos cidadáns de non asignar todos os cartos a medida que chegaban, senón deixar reservada unha cantidade para actividades de recuperación a longo prazo.

Os asesores científicos do comité sostiñan que un primeiro paso esencial consistía en evitar danos maiores ós hábitats dos que dependían poboacións de fauna e peixes sometidos a presión. A opinión pública estivo de acordo con esta proposta e, ata a data de hoxe, os administradores fiduciarios protexeron unhas 263.000 hectáreas de terreos privados na zona afectada pola marea negra a un custo de 400 millóns de dólares, que son moi importantes para os araos *(Brachyramphus marmoratus)* e outras aves, para o salmón e outros peixes e para os mamíferos mariños.

O programa de investigación e control tiña tres obxectivos fundamentais: atopar as zonas danadas e recuperalas, comprender os factores ecolóxicos que inflúen na productividade (e, polo tanto, na recuperación) e mellorar a xestión e a administración dos recursos.

State and federal lawyers determined that some of these were not legally permissible – such as prevention of future oil spills. Following a massive public outreach process, the Trustee Council decided on what became known as a "balanced and comprehensive" plan for restoration: money for habitat protection, scientific research, and direct –hands on – restoration. The Council also adopted the request of the public to not spend all of the money as it came in, but to set some aside in a reserve account for long term restoration activities.

The Trustee's scientific advisors argued that an essential first step was to prevent further harm to the habitats on which stressed fish and wildlife populations depend. The public agreed, and to date, the Trustees have protected about 650,000 acres of privately-owned lands in the spill area at a cost of close to $400 million, lands important for marbled murrelets and other birds, salmon and other fish, and marine mammals.

The research and monitoring program had three main purposes: to track injury and recovery; to understand the ecological factors that influence productivity and, therefore, recovery; and to improve resource management and stewardship.

ESTADO DE RECUPERACIÓN 14 ANOS DESPOIS DA MAREA NEGRA

O Consello de Administradores Fiduciarios[5] estableceu unha lista de recursos que sufriron danos a nivel da poboación a causa da marea negra. O noso obxectivo é recuperar esas poboacións ó nivel en que estarían de non producirse a catástrofe. Sen embargo, moitos destes recursos están tamén a experimentar os efectos doutros factores humanos e naturais, que dan lugar a descensos de poboación importantes. Existe unha gran preocupación en relación cos efectos persistentes do hidrocarburo, sobre todo no que respecta a como se poden combinar os cambios na poboación global ou na abundancia dos danos asociados ó petróleo con outros tipos de cambios e perturbacións no ecosistema mariño. Co paso do tempo, conseguimos elaborar obxectivos de recuperación que eran os máis específicos e medibles posibles, pero a clasificación dun recurso nunha categoría distinta esixe un grao de comprensión considerable por parte do Consello de Administradores Fiduciarios e, de feito, pode que non reflicta necesariamente o estado ou a condición saudable dun recurso.

5. www.oispill.sate.ak.us.
Exxon Valdez Oil Spill Trustee Council (1999): "Status Report", Anchorage, Alasca.
Exxon Valdez Oil Spill Trustee Council (2002): "Restoration Plan. Update on Injured Resources and Services", Anchorage, Alasca.

RECOVERY 14 YEARS AFTER THE SPILL

The Trustee Council[5] established a list of resources which suffered population-level injuries due to the spill. Our goal is to get these populations back to the level they would have been if the spill had not occurred. However, many of these resources are also experiencing the effects of other natural and human factors, resulting in significant population declines. A major concern with lingering oil effects is how the changes in overall population or abundance from the initial oil-related damage may combine with other kinds of changes and disturbances in the marine ecosystem. Over time, we developed recovery objectives that were as specific and measurable as possible, but placement of a resource in a discrete category requires considerable judgment on the part of the Trustee Council, and in fact, may not necessarily reflect a resource's overall status or health.

5. www.oilspill.sate.ak.us.
Exxon Valdez Oil Spill Trustee Council (1999): "1999 Status Report", Anchorage, Alaska.
Exxon Valdez Oil Spill Trustee Council (2002): "Restoration Plan. Update on Injured Resources and Services", Anchorage, Alaska.

Das vinteoito especies que se inclúen na lista de recursos afectados, sete foron xa declaradas como "recuperadas" dos efectos da marea negra: recursos arqueolóxicos, aguias americanas, gaivotas, arao común, salmón rosado, lontras de río e salmón do Pacífico.

Considérase que outros oito recursos conseguiron un avance importante cara á recuperación e están rexistrados como "en estado de recuperación".

O que máis nos preocupa é a lista das oito especies que están incluídas dentro da categoría de "non recuperadas" e que se refiren ás que sufriron continuos descensos de poboación a longo prazo, importantes perdas durante a marea negra ou manifestación de efectos continuos producidos por esta. Nesta categoría inclúense as seguintes especies: a mobella, tres especies de corvos mariños, a foca, o pato arlequín *(Histrionicus histrionicus),* o arenque do Pacífico e o arao pichón *(Cepphus columba).*

Existen algunhas especies das que temos moi pouca información sobre o alcance real dos danos que sufriron desde o principio, sobre a poboación global e sobre a historia ou o estado de recuperación. Son as que están clasificadas como "recuperación descoñecida" e inclúen as seguintes: troita asasina, troita do Pacífico, o arao Kittlitz *(Brachyramphus brevirostris),* cherna e comunidades submareais. Nunca se chegou a acadar información suficiente para poder eliminalos desta lista.

Of the 28 species on the list of injured resources, seven have now been declared "Recovered" from the effects of the oil spill: archaeological resources, bald eagles, black oystercatcher, common murre, pink salmon, river otter, and sockeye salmon.

Eight other resources are considered to have made substantive progress toward recovery and are listed as "Recovering".

The list of eight species "Not Recovering" is our greatest concern. These are the species which are having continued long-term declines in population, suffered severe losses during the spill, or show continuing effects from the spill. They include: common loon, three species of cormorants, harbor seal, harlequin duck, Pacific herring, and pigeon guillemot.

For some species, we know very little about the actual extent of the original injury, the overall population and life history, or the status of recovery. These are called "Recovery Unknown": cutthroat trout, Dolly Varden, Kittlitz's murrelets, rockfish, and subtidal communities. We may never get enough information to take them off this list.

EFECTOS PERSISTENTES DO VERTIDO

Os resultados de estudios feitos no litoral nos anos 2001 e 2002 indicaban que as praias que aínda seguían contaminadas con hidrocarburo no estreito de Prince William equivalían a un total de 11,34 hectáreas. Estes resultados foron sorprendentes xa que se atopou máis cru do esperado, especialmente nas capas subsuperficiais; ademais, o petróleo atopado aí estaba menos alterado e polo tanto era máis tóxico. Por último, atopouse hidrocarburo nunha capa máis profunda na zona intermareal máis próxima á zona de producción biolóxica.

Outros estudios realizados polo Consello de Administradores Fiduciarios indican que non se conseguiu a recuperación das lontras de mar e dos arlequíns na rexión occidental do estreito de Prince William, que resultou fortemente afectada pola marea negra, e suponse que é un factor desencadeador desta situación a continua exposición ó hidrocarburo. Tamén se levaron a cabo outras investigacións sobre a biodispoñibilidade deste e sobre os posibles impactos desta continua exposición ó petróleo.

O modelo conceptual deste dano continuo consiste en que o cru permanece nas capas profundas dos coídos, debaixo das cunchas de mexillón e na zona submareal. Deste xeito introdúcese na cadea alimenticia, contaminando a presa que é consumida polos parrulos mariños (como por exemplo os arlequíns) ou polas lontras de mar. Ese hidrocarburo inxerido metabolízase e os productos metabólicos producen danos nos tecidos.

LINGERING OIL EFFECTS

Shoreline surveys in 2001 and 2002 found beaches in Prince William Sound still contaminated with oil equivalent to about 28 acres total. The results were surprising: more oil was found than expected, especially in the subsurface; subsurface oil was less weathered and more toxic; and oil was found lower in the intertidal, closest to the zone of biological production.

Other Trustee Council studies indicate that recovery of sea otters and harlequin ducks in the heavily oiled region of western Prince William Sound has not occurred, with continuing oil exposure suspected as a factor. Additional research on the bioavailability of this oil is being conducted, as well as on the potential impacts of this continued exposure.

The conceptual model of this continuing injury is that oil still remains deep in the cobble beaches, under mussel beds, and in the subtidal zone. Oil is now making its way into the food web, contaminating prey that is consumed by sea ducks, such as harlequin ducks, and by sea otters. That ingested oil is being metabolized, and the metabolic products are causing tissue damage.

Assessing recovering has not been easy. First of all, since under U.S. rules

O traballo de avaliación da recuperación trala marea negra non resultou fácil. En primeiro lugar, dado que ó abeiro da lexislación dos EUA a avaliación de danos foi levada a través dun proceso xudicial, a énfase dos primeiros estudios recaía fundamentalmente nas especies particulares ás que había que asignar un valor económico. Sen embargo, non se tiña en conta a importancia destas especies como alimento, por exemplo no caso dos bolos *(Ammodytes hexapterus)* e de xuvenís de arenque. No aspecto da recuperación, a natureza do programa era cada vez máis ecolóxica. A enorme variabilidade natural das aves e dos animais mariños tamén enleaba o asunto. E, por último, advertiuse que se produciu un amplo "cambio de réxime" no momento en que ocorreu a marea negra, o cal causou cambios importantes nas condicións oceánicas.

IMPLICACIÓN CIDADÁ

A cidadanía tamén desempeñou un papel moi importante nos labores de recuperación. O Consello de Administradores Fiduciarios ten un comité asesor público composto por vinte membros, que organiza xuntanzas abertas ó público en todas as zonas afectadas pola marea negra e fomenta o intercambio de opinións sobre todas as actividades. Non resulta sempre fácil xa que o programa do Consello é algo restrinxido e o público ó que se dirixen é moi numeroso e diverso, entre os que se inclúen vilas indíxenas de Alasca moi illadas, intereses pesqueiros, habitantes de cidades e científicos.

damage assessment was litigation-driven, much of the emphasis of the early studies was on individual species that would get a large dollar figure in court. The importance of such species as forage fish – sand lance and juvenile herring – was overlooked. Under restoration, the program became increasingly ecological in nature. The huge natural variability of marine birds and animals also complicated the story. And finally, it became apparent that a huge "regime shift" occurred at the time of the spill, resulting in major changes in ocean conditions.

PUBLIC INVOLVEMENT

The public has always been a major partner in the restoration effort. The Trustee Council has a 20-member Public Advisory Committee, holds public meetings throughout the spill-impacted area, and seeks public comment on all activities. This is not always easy since the Council's program is somewhat restricted and there are numerous, diverse audiences, including isolated Alaska Native villages, commercial fishing interests, urban dwellers, and scientists.

The restoration program is largely science-driven. It must have scientific credibility. But it is also absolutely critical to have community residents and

O programa de recuperación ten un enfoque principalmente científico, xa que debe ter credibilidade científica. Pero tamén é esencial que residentes, grupos de interesados afectados como pescadores, axentes de viaxes ou beneficiarios indíxenas que utilizaban os recursos para a súa subsistencia sexan considerados como verdadeiros participantes nos traballos de recuperación.

REPERCUSIÓNS HUMANAS

O acordo extraxudicial dos gobernos coa compañía Exxon referiuse ós danos ós "recursos naturais públicos". En canto ás persoas que habitaban na zona afectada pola marea negra, o suceso que aconteceu o Venres Santo de 1989 aínda segue a ter importantes impactos económicos e psicolóxicos neles. Resultaría difícil esaxerar o trauma psicolóxico que produciu a marea negra na xente que vive na zona afectada e que resultou máis influída por esta. O pobo indíxena dos Alutiiq denomínao "o día en que morreu a auga", aínda que sabemos que iso non ocorreu en realidade e que se produciu unha recuperación xeral notable.

A marea negra provocada polo *Exxon Valdez* ten todas as características dunha catástrofe tecnolóxica:

- Foi provocada por un erro humano.
- Causou contaminación na biosfera.
- O incidente afectou a familias e comunidades.

affected stakeholder groups such as commercial fishermen, tour operators, Alaska Native subsistence users be true partners in restoration efforts.

HUMAN EFFECTS

The governments' settlement with Exxon was for damages to the "public's natural resources". As for the people of the spill-impacted area, the event that took place on Good Friday 1989 still has significant psychological and economic impacts. It would be hard to overstate the psychological trauma that the spill imposed upon the people who live in the spill area and were most affected by it. The Native Alutiiq people still call it "The Day the Water Died," although we now know that that did not in fact happen and that there has been remarkable overall recovery.

The *Exxon Valdez* oil spill has all the characteristics of a technological disaster:

- It was caused by human error.
- It resulted in contamination of the biosphere.
- The incident eroded families and communities.
- There were physiological impacts – stress-related illnesses, higher incidents of alcoholism.

- Producíronse impactos psicolóxicos, enfermidades asociadas á tensión e un aumento dos episodios de alcoholismo.
- O suceso foi levado a xuízo, do que aínda non se pronunciou sentencia 14 anos despois.
- Por último, ten un final ambiguo. Existe aínda incerteza sobre o alcance dos danos e o estado da recuperación.

A xente non esquece que os gobernos foron capaces de conseguir un acordo extraxudicial con Exxon pero que os cidadáns particulares non puideron. No xuízo dos demandantes privados en 1994, o xurado determinou unha indemnización compensatoria por danos directos, xerais ou efectivamente causados fixada en aproximadamente uns 287 millóns de dólares, ademais doutros 3,5 millóns a outros demandantes, como por exemplo os usuarios de subsistencia, municipios e empresas da zona. O xurado tamén asignou 5000 millóns de dólares por danos punitivos. O xuízo privado foi recorrido por Exxon e aínda está sen resolver polo sistema xudicial federal.

PROGRAMA GEM

Como co paso do tempo resultaba cada vez máis difícil separar un efecto da marea negra doutros factores que afectan a unha especie, o Consello de Administradores Fiduciarios decidiu empregar os fondos que lle quedaban (arredor duns 100 millóns de dólares) para crear

- The incident resulted in litigation that is still not resolved – 14 years later.
- And, it has an ambiguous ending. There is still uncertainty about the extent of injury and the status of recovery.

It has not been lost on the people that the governments were able to settle their claims with Exxon, but private citizens haven't. At the trial for the private plaintiff claims in 1994, the jury found compensatory damages for commercial fishermen in the amount of approximately $287 million, with another $3.5 million to other claimants such as subsistence users, municipalities and area businesses. The jury also assigned $5 billion in punitive damages. The private litigation is under appeal by Exxon and is still working its way through the federal court system.

GEM PROGRAM

Because it will be increasingly difficult over time to separate out an oil spill effect from some other factor affecting a species, the Trustee Council decided to use its remaining funds – about $100 million – to establish an endowment for long term monitoring and research in the oil spill area –

unha dotación para o control e a investigación a longo prazo na zona afectada pola marea negra, principalmente no norte do golfo de Alasca. Este programa, denominado GEM (Programa de Investigación de Control do Ecosistema do Golfo de Alasca)[6], representa o legado do Consello para o fomento da recuperación da rexión afectada pola marea negra, comprendendo os cambios naturais e os humanos nos ecosistemas e nas especies mariñas.

Cada vez vese máis claro que o clima e a oceanografía desempeñan un papel importante no control dos procesos biolóxicos e nas poboacións de peixes e fauna que son importantes para a especie humana. De feito, o control a longo prazo demostra agora un cambio de réxime importante no norte do golfo de Alasca, cun ecosistema dominado por gambas a principios dos anos 70 que cambiou a un dominado por bacallao e solla nos 90.

Ademais dos cambios de ecosistemas naturais, sabemos que as actividades humanas desempeñan un papel fundamental neste sistema mariño e poden ter consecuencias imprevisibles na dinámica global do ecosistema.

REAPERTURA

No momento do acordo extraxudicial, o Goberno Federal insistiu nunha disposición denominada a cláusula da "reapertura", que

6. Exxon Valdez Oil Spill Trustee Council (1999): "Gulf of Alaska Ecosystem Monitoring and Research Program", Anchorage, Alasca. www.oilspill.sate.ak.us.

essentially the northern Gulf of Alaska. This program – called GEM[6] – represents the Council's ongoing legacy for promoting recovery of the spill-affected region by understanding the natural and human-caused changes to marine ecosystems and marine species.

It is becoming increasingly clear that climate and oceanography play major roles in controlling biological processes and populations of fish and wildlife important to people. In fact, long-term monitoring now shows a major regime shift in the northern Gulf of Alaska, with an ecosystem dominated by shrimp in the early 1970s, changing to one dominated by cod and flatfish in the 1990s.

Added to natural ecosystem changes, we know that human activities play a prominent role in this marine system and may have unintended consequences on the overall ecosystem dynamics.

REOPENER

At the time of the settlement, the federal government insisted on a provision called the "reopener" clause.

6. Exxon Valdez Oil Spill Trustee Council (1999): "Gulf of Alaska Ecosystem Monitoring and Research Program", Anchorage, Alaska. www.oilspill.sate.ak.us.

lles permite ós gobernos retomar o xuízo para intentar recuperar 100 millóns de dólares máis en concepto de danos que puideron non ser descoñecidos no momento de pronunciar a primeira sentencia. O período para esta reapertura está comprendido entre os anos 2002 e 2006, e agora estase avaliando a posibilidade de presentar unha nova demanda. Sabemos que Exxon recusará calquera demanda xudicial, xa que é necesario estudiala moi detidamente.

CONCLUSIÓNS

Sabemos que os efectos da marea negra poden ser leves, indirectos, a longo prazo e, ás veces, non inmediatamente evidentes, como por exemplo o impacto de pequenas cantidades de petróleo alterado (moi a longo prazo) nas lontras de mar e nos arlequíns. As mareas negras non ocorren illadas; os efectos da marea negra súmanse ós dos cambios naturais, como por exemplo o fenómeno de *el niño* e outras accións humanas non relacionadas coas mareas negras, como a pesca. Tamén sabemos que non se poden ter todas as respostas ó principio, polo que é importante desenvolver un programa de recuperación que sexa flexible e que poida ser modificado e adaptado a medida que se adquire información adicional. Resulta absolutamente imprescindible que os residentes e os grupos de enfoque se impliquen a todos os niveis no programa de recuperación.

This allows the governments to go back to court for up to an additional $100 million for injury that might not have been known at the time of the original settlement. The time period for the reopener is 2002 – 2006, and a possible claim is now being evaluated. We know that Exxon will challenge any such claim in court, so it needs to be examined very carefully.

LESSON LEARNED

We now know that oil spill effects can be subtle, indirect, long-term, and sometimes, not immediately evident, such as the impact of small amounts of weathered oil – over a very long time – on sea otters and harlequin ducks. Oil spills don't happen in a vacuum; spill effects are added to those of natural changes, such as El Nino, and other human actions unrelated to oil spills, such as fisheries harvests. We also know that you can't possibly have all the answers at the beginning, so it's important to develop a restoration program that is flexible and that can be modified and adapted as additional information is acquired. It is absolutely critical that affected residents and focus groups be involved at all levels of the restoration program.

Por último, o Consello de Administradores Fiduciarios decidiu que, a longo prazo, serán os nosos coñecementos do medio natural mariño e a nosa capacidade de compartir información os que determinen a recuperación definitiva da rexión afectada pola marea negra e o futuro do ecosistema do golfo de Alasca e das persoas que dependen deles.

And finally, the Trustee Council has determined that for the long term, it will be our understanding of the marine environment and our ability to share information that will determine the ultimate restoration of the spill-affected region and the future of the Gulf of Alaska ecosystem and the people who depend on it.

AS PERDAS EN ACTIVIDADES RECREATIVAS E DE LECER: CONCLUSIÓNS DERIVADAS DO CASO *ERIKA*

LOST RECREATION AND AMENITIES: THE *ERIKA* SPILL PERSPECTIVES

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INTRODUCCIÓN

As mareas negras son provocadas por filtracións, emisións, vertidos ou emanacións de petróleo durante a producción e o transporte desde as refinerías ou as industrias petroquímicas e tamén polas descargas ilegais de petróleo dos barcos. A entrada do petróleo dende os ríos constitúe unha parte moi importante da carga total que entra no medio marítimo. A maioría dos vertidos accidentais implica menos dunha tonelada de petróleo e os vertidos máis importantes procedentes de petroleiros representan arredor do 3% das cargas totais. Pero estes accidentes teñen unha gran repercusión na opinión pública debido á forma en que se producen e ós diferentes danos que provocan. Ademais dos danos económicos sufridos polos profesionais, principalmente nos sectores turístico e pesqueiro, estes desastres evidencian a integración cada vez maior do ecosistema nos mecanismos económicos. Ademais, a marea negra está considerada como un ataque ós

INTRODUCTION

Oil pollution arises from natural oil seeps, emissions, spillages or effluents during the production and transportation of crude oil, from the refining and petrochemical industries and also from illegal discharges from ships. Riverine inputs of oil constitute a significant part of the overall load of oil entering the maritime area. The majority of accidental spills involve less than 1 ton of oil and larger spills resulting from tankers accidents represent about 3 % of the total loads. But these accidents have a considerable impact upon the public opinion, because of the way they occur and the types of damages they provoke. Beyond the monetary damages suffered by the professionals, mainly in tourism and fishing, these disasters witness the increasing integration of the ecosystem in economic mechanisms. Moreover, the oil spill is

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valores simbólicos e produce reaccións de carraxe e frustración.

Á hora de avaliar os efectos socioeconómicos dunha marea negra, temos que ter en conta estes tres aspectos: os danos económicos, as perdas ecolóxicas e o ataque ós valores simbólicos por medio das perdas producidas nas actividades recreativas. Neste traballo centrámonos neste último punto co fin de tratar de determinar de qué forma a marea negra do *Erika* perturbou as actividades diarias e de lecer dos habitantes das zonas afectadas.

O primeiro apartado é unha exposición xeral acerca das principais mareas negras e dos problemas derivados destas para avaliar os custos sociais. Dada a importancia dos estudios realizados a raíz do caso do *Amoco Cadiz*, este resulta de grande interese. En consecuencia, proporciónase algunha información relativa á importancia dos danos producidos.

O segundo apartado versa sobre a marea negra do *Erika* e presenta as actividades de lecer dos residentes.

Por último, no terceiro apartado inténtase valorar as perdas producidas nas actividades recreativas tomando como exemplo a práctica dunha actividade moi popular, a pesca deportiva, utilizando os métodos do custo da viaxe e da valoración continxente.

felt as an attack on symbolic values giving reactions of anger and frustration.

In evaluating the socio-economic impacts of an oil spill we have to consider these three aspects: monetary damages, ecological losses and the attack on symbolic values through the amenity losses. In this paper we focused on this latter point in an attempt to determine how people were disrupted in their daily and leisure activities by the *Erika* oil spill.

The first section is a general presentation about major oil spills and the problems to assess the social costs. Due to the importance of the studies undertaken the *Amoco Cadiz* case is of particular interest. In consequence some information concerning the importance of the damages which occurred, is given.

The second section deals with the *Erika* oil spill and presents the recreational activities of the residents;

The third section is an attempt to value the losses of amenity of the residents through the practice of a very popular leisure, fishing on foot using travel cost and contingent valuation method.

1 ANTECEDENTES DAS MAREAS NEGRAS DO *ERIKA* E DO *PRESTIGE*

No primeiro apartado ofrécese unha visión xeral das mareas negras máis importantes acontecidas ata o momento, que se utiliza para avaliar os danos sociais producidos por estas. No segundo apartado estúdiase en profundidade o caso do *Amoco Cadiz*.

1.1 Marco xeral: os desastres das mareas negras e a avaliación social das súas consecuencias

O afundimento do *Erika* en decembro de 1999 provocou o vertido de milleiros de toneladas de fuel pesado no océano Atlántico, que contaminaron centos de quilómetros de praias e milleiros de aves. Esta catástrofe lémbranos a que se produciu fronte ás costas de Bretaña en 1978 e tamén se asemella a outras mareas negras que se produciron no resto do mundo nos últimos trinta e cinco anos. Na táboa 1 faise unha compilación das principais mareas negras que aconteceron desde a provocada polo *Torrey Canion* en 1967.

Algúns destes accidentes, malia a súa envergadura, provocaron poucos danos ambientais xa que o hidrocarburo non alcanzou as costas, e este é o motivo polo que non son tan coñecidos para a opinión pública. Pola contra, a cantidade de petróleo vertido polo *Exxon Valdez* é relativamente limitada xa que ocupa o posto número 34 en cantidade pero, sen embargo, de todos os vertidos do

1 *ERIKA* AND *PRESTIGE* OIL SPILL IN RETROSPECT

In a first point we give an overview about the major oil spills and which framework use to value the social damages. In the second point the *Amoco Cadiz* case is developed.

1.1 General framework: oil spill disasters and social assessment

The sinking of the *Erika* in December 1999 caused the spill of thousands of tons of thick oil into the Atlantic Ocean staining hundreds kilometres of beaches and killing thousands of birds, a catastrophe reminiscent of the historic spill of the *Amoco Cadiz*' off the coast of Brittany in 1978. This disaster is in line with dozens of oil spill in the world during the last 35 years. Table 1 (Numbers in tables are written in latin style, that is, 29,92 in english and 287.000 would be 287,000 in english. The editors have maintained this criteria to simplify the tables) recapitulates the major oil spills, which occurred since the *Torrey Canion* in 1967.

A number of these accidents despite their large size, caused little environmental damages, as the oil did not impact coastlines, which is why the names are unfamiliar to the public.

Táboa / Table 1
Principais mareas negras
Major oil spills

Nome do barco Ship name	Ano Year	Localización Location	Cru vertido (Toneladas) Oil lost (tonnes)
Atlantic Empress	1979	Fronte a Tobago (Antillas) off Tobago, West Indies	287.000
ABT Summer	1991	A 700 millas náuticas de Angola 700 nautical. miles off Angola	260.000
Castillo de Bellver	1983	Fronte á baía de Sáldana (Sudáfrica) off Saldanha Bay, South Africa	252.000
Amoco Cadiz	1978	Fronte ás costas de Bretaña (Francia) off Brittany, France	223.000
Haven	1991	Xénova (Italia) Genoa, Italy	144.000
Odyssey	1988	A 700 millas náuticas de Nova Escocia (Canadá) 700 nautical. miles off Nova Scotia, Canada	132.000
Torrey Canion	1967	Illas Sorlinga (Reino Unido) Scilly Isles, UK	119.000
Urquiola	1976	A Coruña (España) La Coruna, Spain	100.000
Hawaiian Patriot	1977	A 300 millas náuticas de Honolulú 300 nautical. miles off Honolulu	95.000
Independenta	1979	Bósforo (Turquía) Bosphorus, Turkey	95.000
Jakob Maersk	1975	Porto (Portugal) Oporto, Portugal	88.000
Braer	1993	Illas Shetland (Reino Unido) Shetland Islands, UK	85.000
Khark 5	1989	A 120 millas náuticas da costa atlántica de Marrocos 120 nautical. miles off Atlantic coast of Morocco	80.000
Aegean Sea	1992	A Coruña (España) La Coruna, Spain	74.000
Sea Empress	1996	Milford Haven (Reino Unido) Milford Haven, UK	72.000
Katina P.	1992	Fronte ás costas de Maputo (Mozambique) off Maputo, Mozambique	72.000
Assimi	1983	A 55 millas náuticas de Muscat (Omán) 55 nautical. miles off Muscat, Oman	53.000
Metula	1974	Estreito de Magalhães (Chile) Magellan Straits, Chile	50.000
Wafra	1971	Fronte ó cabo Agulhas (Sudáfrica) off Cape Agulhas, South Africa	40.000
Exxon Valdez	1989	Estreito de Prince William (Alasca–EE.UU.) Prince William Sound, Alaska, USA	37.000

Fonte / Source: ITOPF http//www.itopf.com/stats.html

mundo ocupa o primeiro posto no que a danos ambientais se refire. En termos xerais, o impacto da marea negra depende do tipo de hidrocarburo vertido, das condicións meteorolóxicas e da susceptibilidade da rexión que a sofre.

Pero non hai dúbida de que a magnitude deste tipo de desastres depende tamén das características socioeconómicas da costa afectada pola marea negra; a avaliación dos danos sociais basearase nos datos dispoñibles e na situación dos coñecementos nese momento. Tal como se indica na figura 1, facemos unha distinción entre danos directos e indirectos. Os primeiros son de carácter monetario e os segundos son tanto monetarios coma non monetarios.

Se temos en conta os efectos directos da contaminación, os danos que se producen corresponden ós custos dos traballos de limpeza e recuperación. Estes danos son moi fáciles de calcular porque corresponden a gastos monetarios en salarios, alugamento de equipos ou manobras físicas, como a instalación de barreiras anticontaminación para protexer os estuarios. De feito, estas actividades formulan dúbidas sobre a cantidade de bens e servicios que son necesarios para recuperar o litoral. Para isto existen tres posibilidades:

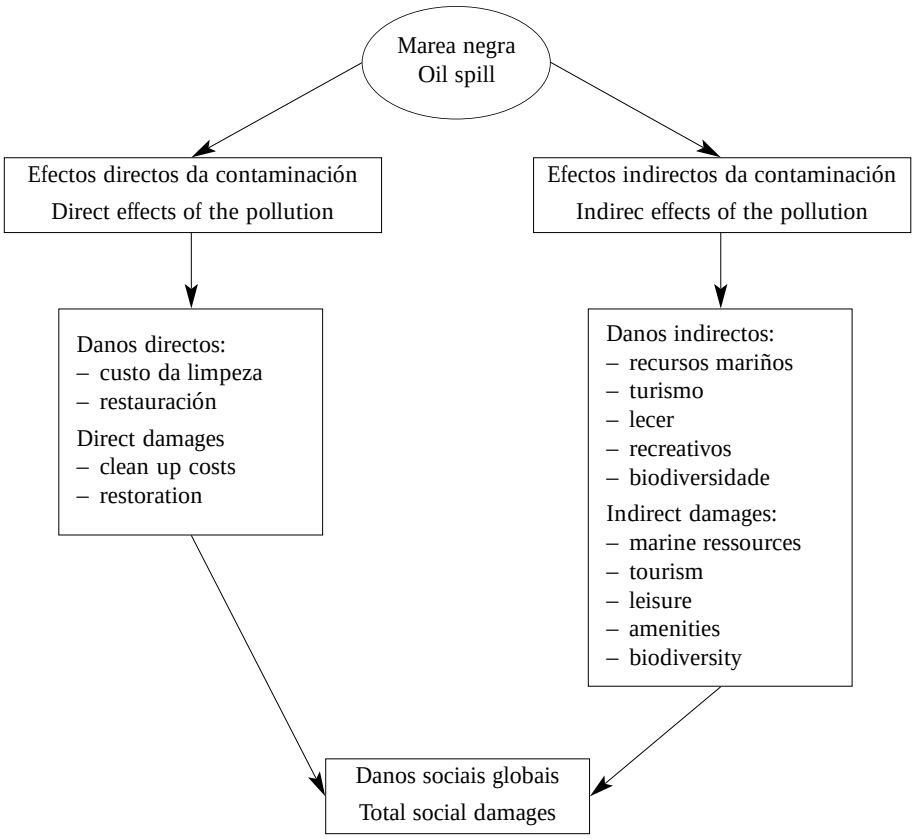
- Unha postura extrema, que constitúe a opción do *laisser-faire* (“deixar facer”), baseada na idea de que se pode conseguir unha boa autolimpeza eficaz mediante a

At the contrary, the amount of oil which flowed out of the *Exxon Valdez* is relatively limited, since this oil spill ranks to number 34, but it is considered the number one spill world-wide in terms of damage to the environment. More generally, the impact depends on the type of oil spilled, the weather conditions and the sensitivity of the region.

But, of course, the magnitude of this type of disaster depends also on the socio-economic characteristics of the impacted coastline and the assessment of the social damages will rely on the available data and the state of the art. As indicated by Figure 1 we can schematically distinguish between direct and indirect damages. The former have a monetary character, whereas the latter have both a monetary and a non-monetary character.

If we consider the direct effects of the pollution, the resulting damages correspond to clean-up efforts and restoration costs. These damages are relatively easy to estimate, because they correspond to monetary expenses in salaries hired equipment or physical operations such as the installation of booms across the estuaries to protect them. In fact, these activities raise a question about the amount of goods and services, which have to be used to restore the shoreline. Three choices are possible:

Figura / Figure 1
Tipo de danos producidos por unha marea negra
Type of damages incurred by an oil spill



acción das ondas e das correntes mariñas. Deste xeito, a intervención do home mediante a utilización de dispersantes químicos considérase prexudicial para o medio mariño. Dáse por suposto que a recuperación natural é máis eficaz desde un punto de vista ecolóxico cós traballos de limpeza. Esta é, naturalmente, a postura que sosteñen os capitáns dos petroleiros (White e Nichols, 1982).

- No outro extremo está a postura dalgúns conservacionistas, habitantes das poboacións afectadas, mariñeiros e hostaleiros, que defenden unha recuperación total. Para eles é necesaria unha limpeza total e rápida da costa para minimizar as perdas económicas e os beneficios perdidos.
- Por último, unha terceira postura defende uns esforzos razoables nos traballos de limpeza tendo en conta a compensación entre o nivel dos esforzos empregados no traballo de limpeza e a reducción das perdas no uso e non uso dos recursos costeiros. A determinación do nivel óptimo dos traballos de limpeza está baseada na productividade marxinal por unidade de persoa implicada nos traballos de limpeza e o fluxo marxinal de servicios producidos pola zona contaminada. Sen embargo, esta compensación crea moitos problemas teóricos e empíricos.

No tocante ós efectos indirectos da contaminación, enfrontámonos a dous tipos de danos: por unha banda, as perdas económi-

- An extreme position is the laisser-faire option based on the idea that a good self-cleaning can be obtained by the action of the waves and the tide. Man's intervention using chemical dispersants is considered to be harmful to marine life. Natural recovery is supposed to be more efficient from an ecological point of view than clean-up efforts. Unsurprisingly, it is the position of the tanker owners (White and Nichols, 1982).
- At the other extreme is the position of some conservationists, residents, fishermen and hotel and restaurant owners for a full restoration. In order to minimise the profit foregone and the economic losses these people are in favour of a rapid and total cleanness of the coast.
- Last, a rational clean-up effort can be imagined considering the trade-off between the level of clean-up efforts and the losses reduction in use and non-use of the shoreline and coastal resources. The determination of the optimum level of the clean-up efforts is based on the marginal productivity per unit of person involved in the clean-up operations, and the marginal flow of services produced by the polluted area. Such a trade-off raises many empirical and theoretical problems.

cas sufridas pola industria e as empresas turísticas e pesqueiras, que realizan unha actividade económica vinculada ó turismo; e por outra, os danos non derivados de actividades comerciais. Estes últimos teñen en conta as perdas persoais de benestar a partir da interrupción de actividades de lecer relacionadas co mar e as perdas ocasionadas en actividades recreativas. Tamén se producen perdas ecolóxicas ocasionadas pola perturbación do ecosistema e unha perda da biodiversidade como consecuencia da marea negra. Unha cuestión moi importante que cómpre ter en conta á hora de cuantificar os danos ocasionados no ecosistema é a capacidade de recuperación dos recursos en relación cos servicios básicos, é dicir, o tempo de resposta ás condicións que existirían de non ocorrer o accidente.

O ecosistema restablécese a un ritmo de recuperación natural, que depende da magnitude e da toxicidade do cru vertido. Este ritmo pode verse acelerado mediante actividades humanas (Ward e Duffield, 1992). A figura 2 presenta diversas posibilidades de aceleración da taxa de recuperación. De acordo cos esforzos empregados para a recuperación dos recursos naturais, o fluxo do servicio perdido diferirá cun mínimo correspondente ás áreas A+B cando existe un esforzo importante, e cun máximo cando é unha recuperación natural cunha suma das áreas A+B+C+D.

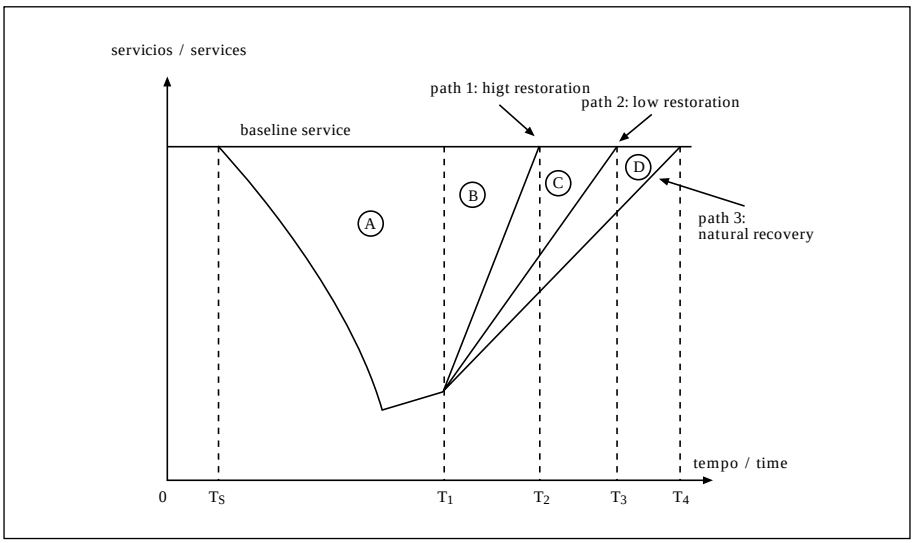
Os posibles efectos da contaminación nos recursos naturais poden ser considerados

Considering the indirect effects of the pollution, we are confronted with two sorts of damages: the economic losses suffered by tourist and marine industries and firms whose activity is linked to the tourism, and the non-market damages. These latter recover personal losses of welfare through the disruption of seaside leisure activities and amenity losses. There are also ecological losses following the perturbation of the ecosystem and biodiversity decrease resulting of the oil spill. An important point in quantification of damage to the ecosystem is the resource recoverability in reference to the baseline services, i. e. the time to return to the conditions that would have existed had the spill not occurred.

The ecosystem recovers at natural recovery rate, which depends on the magnitude and the toxicity of the oil discharge. This rate can be accelerated by human operations (Ward and Duffield, 1992). Figure 2 presents various possibilities of accelerating the recovery rate. According to the efforts to restore the natural resources the lost service flow will differ with a minimum corresponding to areas A+B, when there is an important effort, and a maximum when it is a natural recovery with the sum of the areas A+B+C+D.

The possible effects of pollution upon natural resources can be seen as

Figura / Figure 2
Perda dos servicios de recursos naturais e índice de recuperación
Loss of natural resource services and their recovery rate



como un descenso no fluxo de servicios prestados por un activo. Se puidesemos calcular os distintos productos dese capital, o total daría como resultado os danos ecolóxicos. Pero a medición directa de intanxibles como os servicios ou a biodiversidade, por exemplo, presenta moitas dificultades. Outra forma de calcular este valor consiste en determinar o número de persoas que estarían dispostas a pagar para evitar mareas negras no futuro. Dado que os recursos danados desempeñan un papel importante que se corresponde cos valores de existencia, e estes só se poden medir mediante o método de valoración continxente.

a decrease in the flow of services provided by an asset. If we could estimate the various outputs produced by this capital, the total would give the ecological damages. But the direct measure of intangible as services as biodiversity for instance, raises many difficulties. Another way to estimate this value, or the decrease of the value, is to elicit how much people would be willing to pay to prevent future oil spills. Because injured resources have an important part corresponding to existence values, it can only be measured by the contingent valuation method.

1.2 Cálculo dos custos sociais

Utilizando o marco xeral presentado na figura 1, avaliamos o custo social da marea negra do *Amoco Cadiz* (Bonnieux e Rainelli, 1991). Este petroleiro, propiedade da compañía petrolífera Amoco International e fretado por Shell International Petroleum, ía cargado con 223.000 toneladas de petróleo con rumbo a Rotterdam desde o golfo Arábico cando tocou nun baixo rochoso o 16 de marzo de 1978 pola mañá. Quedou encallado despois de ir á deriva durante case doce horas por un problema no casco. Na figura 3 indícanse a localización do naufraxio e a costa que resultou contaminada.

Malia as dificultades de atopar financiamento para sufragar os gastos dunha investigación sobre o custo social, foi posible facer unha avaliación global (Bonnieux e Rainelli, 1980). Pero entre os diferentes tipos de custos implicados, o traballo centrouse principalmente nas perdas económicas debido ás características da zona contaminada. No momento do naufraxio, aínda que a costa definida desde un punto de vista administrativo representaba o 30% do territorio da rexión, esta concentraba case un 54% dos habitantes, o que supón unha densidade de poboación de 165 persoas por km^2 fronte ás 64 persoas por km^2 de densidade de poboación no interior. A estructura económica da costa está dominada polas actividades marítimas e as vinculadas ó turismo.

1.2 Estimating the social costs

Using the general framework presented in Figure 1, we assessed the social cost of the *Amoco Cadiz* oil spill (Bonnieux and Rainelli, 1991). En route to Rotterdam from the Arabian Gulf, the *Amoco Cadiz*, owned by Amoco International Oil Company and chartered by Shell International Petroleum, loaded with 223 000 tons, was wrecked on a reef in the morning of March 16, 1978. She stranded after being adrift for about 12 hours by a trouble with a helm. Figure 3 indicates the location of the wrecking and the soreline polluted.

In spite of difficulties to fund a research dealing with the social cost, a global assessment has been done (Bonnieux and Rainelli, 1980). But among the different types of costs involved, the focus has been mainly put on economic losses because of the characteristics of the polluted area. At the moment of the wrecking, although the coast defined from an administrative way represents 30 % of the territory of the region, it concentrated almost 54 % of the inhabitants leading to a density of 165 persons per km^2 opposed to 64 inland. The economic structure of the coast is very strongly marked by maritime activities and activities associated with tourism.

Figura / Figure 3
Naufraxio do *Amoco Cadiz* e costa contaminada
Amoco Cadiz wrecking and polluted shoreline

No tocante ás actividades marítimas, Bretaña ocupa, sen ningunha dúbida, o primeiro posto en Francia, dado que a pesca marítima representa un 35% da man de obra activa e un 46% dos traballadores asalariados. O descenso da producción trala marea negra, xustificado polo esgotamento dos recursos, chegou ata un 21% nos casos do peixe e do marisco. A acuicultura, que se concreta fundamentalmente na cría da ostra, representaba arredor do 28% da producción francesa en toneladas. A enorme marea negra provocou un aumento da cantidade de hidrocarburos na

Concerning maritime activities, Brittany is by far the number one in France, sea-fishing accounting for 35 % of the active workers and 46 % of salaried workers. The decline in production after the pollution, explained by the depletion of stocks, reached 21 % for fish and crustaceans. Shellfish breeding, which mainly consists of oyster-breeding represented about 28 % of the French production in tons. The massive oil spill caused an increase in the amounts of

carne das ostras, o que fixo que parte das existencias deixase de ser apta para o consumo.

En canto ó sector turístico, Bretaña representa o 20% da ocupación hoteleira no verán en todas as zonas costeiras de Francia, é dicir, case setenta millóns de visitantes en días de vacacións. Calculamos a reducción de visitas turísticas empregando indicadores que reflectisen a variación na temporada alta e chegamos á conclusión de que este descenso chegou a 11,6 millóns de visitas, é dicir, un 17% menos, o cal provocou enormes perdas económicas.

Ademais, a caída do turismo e das actividades marítimas tivo consecuencias nas empresas relacionadas con estas actividades e a diminución dos ingresos dos representantes, que se sentiron discriminados, afectou á demanda e ó consumo final das familias residentes en Bretaña. Estes prexuízos económicos indirectos, que se poden valorar mediante unha táboa input-output adaptada, alcanzaron un nivel importante, xa que a ratio entre os efectos totais e os efectos directos equivale a 1,5.

Entre os efectos da marea negra, un dos máis notables é a perda de diversións por parte da poboación afectada. Na medida en que a situación cerca da costa proporciona satisfacción en actividades de lecer ós habitantes do lugar, calquera dano que afecte á costa trae consigo unha distorsión do seu benestar. Así o demostra unha enquisa realizada durante o verán de 1979 para determinar as perdas nas actividades recreativas sufri-

hydrocarbons in the flesh of the oysters making a part of the stock unfit for consumption.

Concerning the tourism industry, Brittany represents 20 % of summer nights spent on French coastal zones, or nearly 70 million vacation days. Using indicators reflecting the variation of tourist days we have estimated the reduction in tourist visitation we estimated to 11.6 million which corresponds to a 17 % drop leading to impressive monetary losses.

Furthermore, the drop in tourism industry and maritime activities had consequences on businesses in connection with these activities, and the decrease in revenue of agents who were victimised affected the final demand and the consumption of resident families in Brittany. Those indirect monetary damages, which can be assessed through an adapted input-output table, reach an important level since the ratio between the total effects and the direct effects amounts 1.5.

Among the effects of the pollution, one of the most noteworthy is the loss of enjoyment suffered by the population concerned. Insofar as location near the coast affords recreational satisfaction to individuals, any damage in the quality of the shoreline brings on the degradation of their welfare. A survey has been conducted during the summer of 1979

das polos habitantes. Case a metade da poboación da costa (concretamente o 44%) afirma que se viu persoalmente perturbada ou moi perturbada polo accidente. Os residentes da costa que afirmaban que se viron perturbados e que tamén practicaban actividades de lecer na costa constitúen o 33% da poboación. Ademais, esta enquisa demostrou que en agosto de 1979, máis dun ano despois do naufraxio, entre o 25% e o 30% das persoas enquisadas opinaba que a calidade das praias empeorara en comparación coa situación destas antes do naufraxio.

No momento de realizar este estudio, o uso de métodos de valoración de beneficios económico-ambientais, especialmente da valoración continxente, víase limitado por diversos factores. Desde un punto de vista ético-filosófico, en Francia sempre se mostrou e se segue a mostrar unha gran resistencia á idea de calcular valores económicos para a saúde humana, a paisaxe ou o patrimonio natural. O criterio da disposición a pagar é rexeitado tanto polos conservacionistas coma polos economistas opostos ó marco neoclásico. Desde un punto de vista político, os atrancos van unidos ó feito de que as técnicas de valoración resultan completamente descoñecidas para os políticos. Por último, cómpre lembrar que os aspectos metodolóxicos estiveron sometidos a debate desde que a "comisión do lazo azul", nomeada polo NOAA, emitiu o seu informe en 1992 sobre o uso do método de valoración continxente (MVC). Leváronse a cabo investigacións que empre-

to determine the amenity losses suffered by the inhabitants. Nearly one half of the population of the coast (44 % exactly) states that it was disturbed or very disturbed personally by the accident. Residents of the coast who stated they were disturbed and who also go to the shore for recreational activities constitute 33 % of the population. Moreover, the survey showed that in August 1979, more than a year after the wrecking, 25 to 30 % of the persons questioned thought that the quality of beaches has degraded in comparison with the situation before the oil spill.

At the moment of the study, several types of factors limited the use of monetary environmental benefit valuation methods, particularly contingent valuation. From a philosophical/ethical point of view there was in France, and there is always, considerable resistance to the idea of estimating monetary values for human health, landscape or natural heritage. The willingness-to-pay criterion is rejected both by conservationists and also by economists opposed to the neo-classical framework. From a political point of view obstacles are linked to the fact that valuation techniques are largely unknown by policy-makers. Last, we have to recall that methodological aspects were under discussion, since the "blue ribbon panel" commissioned by NOAA, gave its report in

gan o MVC para calcular a disposición por parte dos residentes a pagar para evitar a contaminación (NOAA, 1983). A forma de pagamento empregada consistía na posibilidade de mercar un contrato de seguros. Por desgracia a mostra foi moi limitada, con soamente 200 fogares dispostos a pagar, e o índice de resposta moi baixo (un 10%). En consecuencia, cómpre dicir que os resultados non son fiables.

Para calcular a perda de satisfacción sufrida pola poboación supuxemos que o excedente dos residentes era igual ós gastos por día dos turistas. Posto que coñeciamos a frecuencia das visitas á costa e o número de semanas en que non era posible ir á costa, resultou doado facer un cálculo das perdas totais en actividades recreativas e de lecer. De feito, os turistas que viñeron a Bretaña e que ían á praia mesmo baixo condicións desfavorables por mor da marea negra tamén experimentaron un descenso no benestar, pero este descenso non foi valorado. Na táboa 2 resúmense os custos sociais da marea negra do *Amoco Cadiz*.

Tal como se indica na táboa 2, os custos de limpeza e de recuperación representan a maior parte dos custos sociais da marea negra provocada polo *Amoco Cadiz* (máis do 46%). O segundo posto ocúpano as perdas na industria turística e as perdas indirectas no resto da economía rexional cun 17%, seguido das perdas ecolóxicas (16%) tal como foron calculadas. Pódese comprobar que nesta avaliación as perdas nos recursos

1992 about the use of contingent valuation method (CVM). Investigations using CVM have been conducted to estimate the willingness to pay of the residents to avoid the pollution (NOAA, 1983). The payment vehicle used was the possibility to purchase an insurance contract. Unfortunately the sample was limited, with 200 households, and the rate of response very low: 10 %. In consequence the results are not reliable.

To estimate the loss of enjoyment suffered by the population we supposed that the surplus of the residents was equal to the expense budget of the vacationer per day. Because we knew the frequency of visits to the seashore and the number of weeks it was not possible to go to the seashore it was easy to have an estimate of the total amenity losses. In fact, there is also a welfare decrease suffered by tourists who came to Brittany in 1978 who were using the beach even at the low level of quality due to pollution. But this decrease has not been assessed.

As indicated in table 2, clean up and restoration costs represent the major part of the social costs of the *Amoco Cadiz* oil spill (more than 46 %). The second item is tourist industry losses and indirect losses on the rest of the regional economy with 17 % followed by ecological losses (16 %) as they are estimated. We can see that in

Táboa / Table 2
Custos sociais da marea negra provocada polo *Amoco Cadiz*
Social costs of the *Amoco Cadiz* oil spill

	Millóns de FF 1978 Million FF 1978		Millóns de euros 2003 Million Euros 2003
Custos de limpeza e recuperación Clean up and restoration costs		559,0	230,5 (46,2)
Dos cales: / Of which			
– no mar – at-sea component	65,5		27,0
– na terra – land-based component	270,2		111,4
– recuperación de subestructuras e outros – substructures restoration and other	223,3		92,1
Perdas en recursos mariños Marine resources losses		122,9	50,6 (10,1)
Das cales: / Of which			
– industria pesqueira – fishing industry	54,9		22,6
– cría de moluscos – shellfish breeding	68,0		28,0
Perdas en actividades de lecer Recreation and amenity losses		125,6	51,7 (10,4)
Perdas na industria turística Tourist industry losses		208,3	85,7 (17,2)
Das cales: / Of which			
– perdas directas (valor engadido) – direct losses (value added)	134,6	55,4	
– perdas indirectas noutros sectores – indirect losses to the other sectors	73,7	30,3	
Perdas ecolóxicas* Ecological losses*		195,0	80,2 (16,1)
TOTAL		1210,8	447,0 (100)

*As perdas ecolóxicas foron valoradas de acordo co valor de especies comerciais correspondente á perda de biomasa non comercial (Bonnieux e Rainelli, 1993).

*Ecological losses have been assessed on the basis of the value of commercial species corresponding to the loss of the non-commercial biomass (Bonnieux and Rainelli, 1993).

mariños son equivalentes á reducción do benestar dos residentes.

A magnitude dos distintos elementos depende dos métodos de valoración empregados e tamén das condicións xeográficas en que acontece o naufraxio. No caso do *Exxon Valdez*, os danos máis importantes foron os ecolóxicos, posto que a costa contaminada se viu moi afectada, con 160 km forte ou moderadamente petroleados e uns 900 km algo ou moi pouco petroleados. Esta é unha zona de gran beleza paisaxística, caracterizada por unha enorme riqueza en fauna salvaxe. Ademais é unha zona en que existe unha gran dispersión de poboación e na que o sector turístico é relativamente reducido en comparación co do litoral francés. O valor do uso pasivo perdido, que corresponde á disposición do público a pagar para evitar outra marea negra como a do *Exxon Valdez*, ascende a 2.800 millóns de dólares (Carson *et al.*, 1992). A compañía Exxon dixo que gastara 2.100 millóns de dólares nas técnicas de tratamento de limpeza do litoral (Ministerio de Conservación do Medio Ambiente de Alasca, 1993). Outros danos son moi reducidos en comparación coas cifras que se presentan no cadro anterior. Por exemplo, as perdas producidas na pesca deportiva ascenderon a trinta e un millóns de dólares (Carson e Hanemann, 1992).

this assessment marine resources losses are equivalent to the decrease of the welfare of the residents.

The magnitude of the various items depends on the methods of valuation used and also on the geographic conditions where the wrecking is occurring. In the *Exxon Valdez* case, the most important damages were the ecological ones, since the polluted shoreline is very important with 160 km heavily or moderately oiled and about 900 km lightly or very lightly oiled. It is an area of great natural beauty characterised by a rich wild fauna. Moreover it is a sparsely populated area in which tourist industry is relatively limited compared to the French coast. The lost passive use value, corresponding to the public's willingness to pay to prevent another *Exxon Valdez* oil spill, amounts 2.8 billion dollars (Carson et *al.*, 1992). Exxon said it spent 2.1 billion dollars on the clean up effort shoreline treatment techniques (Alaska Department of Environmental conservation, 1993). Other damages are very low compared to these figures. For instance, the recreational fishing losses reached 31 million dollars (Carson and Hanemann, 1992).

2 A MAREA NEGRA DO *ERIKA*: RUTAS DE ACTIVIDADES DE LECER DOS RESIDENTES

2.1 Os feitos

O 16 de decembro de 1999 o petroleiro *Erika* encallou ó sur da costa de Bretaña. Verteuse fuel no mar pero a contaminación chegou á costa a finais de mes, despois de seguir unha ruta complexa como resultado da influencia das correntes e do vento (figura 4). Despois de seis meses ou máis, esta marea castigou 400 km de costa, entre os que se atopan lugares moi valiosos (especialmente desde a península de Quiberon ata o norte de Vendée) para a actividade da pesca deportiva, tal como demostrou a única prospección aérea dispoñible dos lugares de pesca levada a cabo en 1997 durante un período de marea alta. O impacto físico do vertido variaba ó longo do litoral, xa que o norte se viu menos afectado có centro, onde chegou unha gran mancha de fuel.

Os danos causados foron calculados en 914 millóns de euros. Esta cifra aproximada proporcionouna unha consultora. As perdas en número de visitas recibidas no sector turístico chegan ós 400 ou 500 millóns de euros. A relación entre o consumo medio e as vendas totais obtidas no estudio do *Amoco Cadiz* dá un descenso no valor engadido que chega a 107-307 millóns de euros. As perdas no sector marítimo alcanzan os 52-73 millóns de euros, pero non hai ningunha

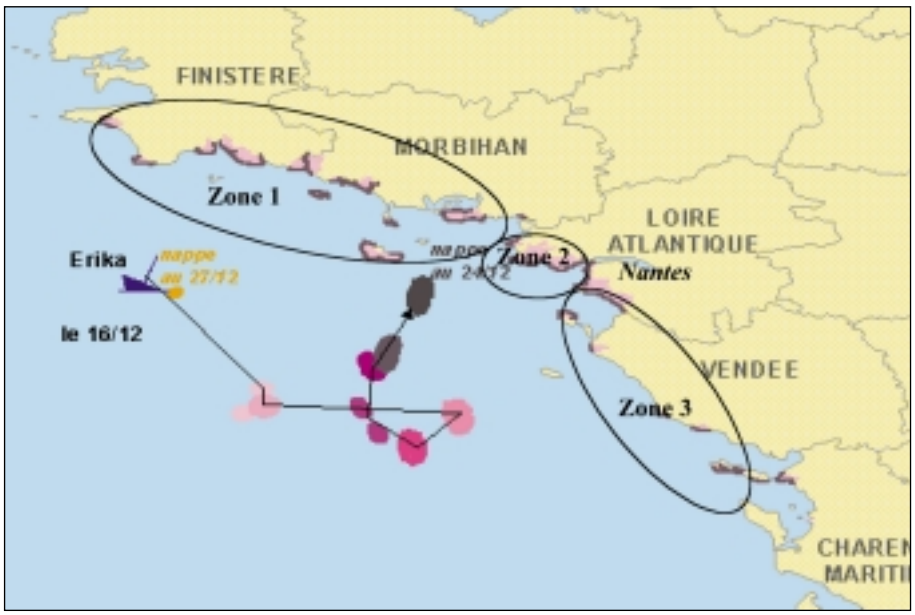
2 THE *ERIKA* OIL SPILL: RESIDENTS' RECREATIONAL PATTERNS

2.1 Facts of the case

On December 16, 1999, the tanker *Erika* was ruptured off the South coast of Brittany. Oil was spilled into the waters but the pollution only reached the coastline by the end of the month, after a complex path resulting from the combined influence of currents and winds (Figure 4). Over the next six months or more, this oil spill resulted in physical injury along 400 km of a coastline which includes valuable spots (specially from the Quiberon peninsula to the North of Vendée) for fishing on foot as it was shown by the single available aerial survey of fishing sites run in 1997 during a high tide period. The physical impact of the release varied along the coast, the Northern section was less affected than the central one where a significant share of the crude oil cargo ended up.

The total damages have been estimated, to 914 million Euros. It is a rough estimate made by a consulting firm. Losses in receipts to the tourist industry amount about € 400 and 500 million. The ratio between intermediate consumption and total sales obtained in the *Amoco Cadiz* study

Figura / Figure 4
Mapa de localización do litoral afectado pola marea negra do *Erika*
Location map of the shoreline impacted by the *Erika* oil spill



cifra para calcular as perdas en actividades recreativas e de lecer.

2.2 Planificación e organización das enquisas sobre a actividade da pesca deportiva

O estudio das zonas afectadas non proporciona información sobre a xente que practica a pesca deportiva, e polo tanto tiveron que levarse a cabo dous estudios tralo vertido durante a primavera do ano 2000. O obxectivo xeral de ambos os dous estudios era dobre:

gives a value added decrease reaching € 107-134 million. The marine losses amount € 52-73 million. But there is no estimate about amenity losses.

2.2 Planning and organisation of sport fishing surveys

The aerial survey of sites does not provide information about people involved in sport fishing, so two surveys were conducted after the spill, during the Spring of 2000. Their general

por unha banda, avaliar o cambio de actividade, incluídas as perdas sufridas nas actividades recreativas, e, por outra, calcular o número de persoas afectadas (Bonnieux e Rainelli, 2001). De feito, a información dispoñible indicaba un descenso nesta modalidade de pesca relacionado cos danos causados pola marea negra do *Erika*. Pero como algunhas zonas resultaron contaminadas, as enquisas *in situ* non eran relevantes. Seleccionouse estatisticamente unha mostra dos pescadores que vivían na zona costeira a partir da lista de membros do Sindicato Nacional de Pesca Deportiva e realizáronse quiñentas entrevistas persoais casa por casa.

Hai acceso libre a estas zonas para actividades recreativas e non existen licencias de pesca deportiva. Como a xente se fai socia deste club voluntariamente, a lista de socios non proporciona un marco de mostra completo. Para corrixir o nesgo da selección, tamén se levou a cabo unha enquisa por teléfono na que se lle aplicou unha mostraxe aleatoria a partir do directorio telefónico. Elaboráronse dúas submostras, unha para o litoral e outra para Nantes, que é unha zona metropolitana importante próxima á costa máis afectada. Os directorios que serviron como marco de referencia están constituídos polas listas de abonados á compañía de telefonía, nos que se inclúen tanto pescadores coma non pescadores. Deste xeito, esta enquisa permite calcular a proporción da poboación que participa nesta modalidade de pesca. O cuestionario foi

objective was twofold: assess the change in use including amenity losses, and estimate the number of affected people (Bonnieux and Rainelli, 2001). Indeed, available information indicated a decline in sport fishing related to the injury caused by the *Erika* oil spill. But since a number of sites were polluted, on-site surveys were not relevant. A sample of fishermen living in the impacted coastal area was randomly selected from the list of the members of the National Union of Recreational Fishermen. The questionnaire was administered in 500 face-to-face interviews at home.

There is a free access to sites for recreational purposes and there is no license for fishing on foot. Since people voluntary join this club, the list of members does not provide a complete sampling frame. In order to correct the underlying selection bias, a telephone survey was also carried out. A systematic random sampling was applied to the directory frame. Two sub-samples were drawn up, one for the shoreline and one for Nantes which is a major metropolitan area close to the most impacted coastline. Directory frames are telephone subscribers lists; they include both fishing and no fishing households. So this survey allows to estimate the proportion of the population participating in fishing on foot. The questionnaire

realizado en 2.128 chamadas telefónicas e entre os que responderon ó cuestionario 692 eran pescadores.

Para considerar unha posible influencia da gravidade da marea negra, tivéronse en conta tres zonas costeiras:

- Zona 1, que se estende desde a desembocadura do río Valaine ata o límite norte da zona contaminada (Point Croix, no departamento de Finistère), e inclúe dúas áreas metropolitanas (Lorient e Vannes).
- Zona 2, que é a zona costeira máis afectada e se estende desde a desembocadura do río Vilaine ata a do río Loire.
- Zona 3, que se estende desde a desembocadura do río Loire ata o límite sur da zona contaminada (Angoulins en Charente--Maritime) e inclúe dúas áreas metropolitanas (Saint-Nazaire e La Rochelle).

A área metropolitana de Nantes atópase no interior e concentra un tercio da poboación total, e polo tanto está considerada á parte das zonas costeiras.

Ambos os dous cuestionarios teñen un marco de referencia común, pero o que se fixo por teléfono é máis curto có empregado nas enquisas persoais feitas polas casas.

Unha serie de preguntas está relacionada coa participación en actividades de lecer ó aire libre antes e despois da marea negra. Estas preguntas diríxense especificamente ós modelos de participación na pesca deportiva e revisan as seguintes cuestións: lista de luga-

was administered in 2128 phone interviews; 692 people among the respondents are fishermen on foot.

In order to take into account a likely influence of the severity of the spill, three coastal areas are considered:

- Zone 1 extends from the mouth of the Vilaine river to the Northern limit of the pollution (Pont-Croix in the Finistère) and includes two metropolitan areas (Lorient and Vannes),
- Zone 2 is the most affected coastline and extends from the mouth of the Vilaine river to the mouth of the Loire river,
- Zone 3 extends from the mouth of the Loire river to the Southern limit of the pollution (Angoulins in the Charente Maritime) and includes two metropolitan areas (Saint-Nazaire and La Rochelle).

The Nantes metropolitan area is located inland and concentrates one-third of the total population so it is considered apart from the coastal zones.

Both questionnaires have a common framework, but the one administered in phone interviews is shorter than the one used in face-to-face interviews. A series of questions are related to participation in outdoor recreational

res onde se practica a pesca, especies buscadas, motivacións, índice de visitas, distancia percorrida, medios de transporte e actitude en relación co tempo empregado para o desprazamento. Unha serie de preguntas céntrase na influencia das distintas fontes de información sobre o comportamento individual así como sobre a actitude persoal cara á seguridade alimentaria. A receptividade cara a fontes de información concretas e a impresión de autenticidade da información proporcionada polos xornais, as canles de televisión e os organismos oficiais é avaliada a través de escalas Likert. Á xente pídeselle que informe sobre a súa experiencia persoal en relación coa intoxicación de marisco. Os datos persoais (idade, ocupación, nivel de estudios e ingresos) pregúntanse ó final das entrevistas.

2.3 Cambio de actividades recreativas

A pesca deportiva é unha actividade de lecer moi popular entre a xente que vive no litoral e tamén no interior, na área metropolitana de Nantes. O índice de participación é alto xa que se corresponde con case un tercio da poboación total (táboa 3). A táboa clasificatoria de actividades de lecer preferidas polos pescadores é similar nas diferentes zonas (táboa 4). No inverno e na primavera os paseos pola costa e polo campo son as principais actividades que realizan para substituír a pesca deportiva. Sen embargo, a vela e os paseos en barco son actividades

activities before and after the oil spill. They specifically emphasise the participation patterns in sport fishing and review the following issues: list of fishing places, species sought, motivations, visit rate, distance travelled, means of transportation and attitude related to travel time. A series of questions focus the influence of the various sources of information on individual behaviour as well as personal attitude towards food safety. Openness to specific sources of information, and impression of authenticity of information given by newspapers, TVs, official bodies are assessed trough Likert scales. People are also asked to report personal experience with a shellfish poisoning. Personal questions (age, occupation, education level and household income) are asked at the end of the interviews.

2.3 Change in recreational activities

Sport fishing is a very popular recreational activity among people living along the shoreline and also inland in the Nantes metropolitan area. The participation rate is high since it amounts almost one-third of the whole population (Table 3). The ranking of recreational activities by fishermen is similar among the different areas (Table 4). In Winter and Spring walking along the shoreline or in the countryside is the

que tamén atraen un número importante de afeccionados durante a época máis fría do ano.

Sen embargo, existen grandes diferencias con respecto á asiduidade na práctica da pesca deportiva entre as zonas costeiras e de interior (táboa 5). Aínda que o índice de participación é constante, o número de visitas diminúe canto maior é a distancia ó lugar onde se practica a pesca. En conxunto, as dúas categorías dos que van pescar unha vez á semana ou varias veces ó mes chegan a un 26% na zona costeira, pero só se achegan ó 7,5% na área de Nantes. Esa gran diferencia na asiduidade na práctica da pesca indica claramente que, sendo iguais outras cousas, é

main substitute of fishing on foot. However, boating and sailing also attract a significant number of practitioners during the coldest period of the year.

There are however significant differences with respect to fishing on foot effort between coastal and inland areas (Table 5). Participation rate being constant, the number of visits decreases with the distance to the fishing place. Together, the two categories of those fishing at least one time a week or several times a month amount 26% in the coastal area but only 7.5% in the Nantes area. That big difference in fishing effort clearly indicates, that

Táboa / Table 3
Participación na pesca deportiva (enquisa telefónica)
Participation in sport fishing (phone survey)

	Poboación total Total population	Número de entrevistas Number of interviews	Número de pescadores Number of fishermen	Pescadores (%) Fishermen (%)
Zona 1 Zone 1	411.188	655	164	25,0
Zona 2 Zone 2	205.687	646	239	37,0
Zona 3 Zone 3	357.327	582	195	33,5
Nantes Nantes	544.932	245	94	38,4
Total Total	1.519.134	2.128	692	32,5

Fonte: Bonnieux e Rainelli (2001) / Source: Bonnieux and Rainelli (2001).

probable que as perdas ocasionadas nas actividades recreativas e de lecer sexan maiores para os habitantes da costa ca para os que viven no interior.

Os datos sobre índices de participación e de visitas permiten calcular a asiduidade durante o semestre en que o litoral se viu afectado pola marea negra. Co fin de facer un cálculo polo baixo, consideráronse os límites inferiores para as distintas categorías referidos á asiduidade na práctica da pesca deportiva (táboa 4):

other things being equal, lost recreation use and amenities are likely to be greater for coastal residents than for those living inland.

Data on participation and visit rates allow to estimate the usual frequentation for the six-month period during which the shoreline was impacted by the spill. In order to get a conservative estimation, lower bounds were considered for the various categories of fishing effort (Table 4):

Táboa / Table 4

Táboa clasificatoria de actividades de lecer ó aire libre (enquisa telefónica) en %

Ranking of outdoor recreational activities (phone survey) in %

Posto Rank	Zona Area	Pesca deportiva Fishing on foot	Paseos pola costa Walking along the shoreline	Paseos polo campo Walking in the countryside	Paseos en barco Boating	Vela Sailing
1º/1st	Zona costeira Coastal area	31,9	43,9	10,4	9,0	4,8
	Área de Nantes Nantes area	30,9	35,1	29,8	2,1	2,1
2º/2nd	Zona costeira Coastal area	36,6	28,5	17,5	8,7	1,7
	Área de Nantes Nantes area	25,5	39,4	19,1	10,6	4,3
Non contesta/ Not quoted	Zona costeira Coastal area		17,2	52,1	76,5	91,2
	Área de Nantes Nantes area		16,0	30,9	77,7	92,6

- 26 visitas para os que foron pescar polo menos unha vez á semana.
- 12 visitas para os que foron pescar varias veces ó mes.
- 6 visitas para os que foron pescar unha vez ó mes.
- 1 visita para ós que foron pescar en mareas equinocciais.

- 26 visits for those fishing at least one time a week,
- 12 visits for those fishing several times a month,
- 6 visits for those fishing one time a month,
- 1 visit for those fishing at equinoctial tides.

Táboa / Table 5

Asiduidade na práctica da pesca deportiva:
distribución de pescadores (%) de acordo co índice de visitas

Sport fishing effort: distribution of fishermen (%) according to the visit rate

Índice de visitas Visit rate	Polo menos unha vez á semana At least one time a week	Varias veces ó mes Several times a month	Unha vez ó mes One time a month	En mareas equinocciais At equinoctial tides	Non contesta Non response
Zona costeira Coastal area	7,3	18,7	22,4	34,2	17,4
Área de Nantes Nantes area	1,1	6,4	18,1	43,6	30,8

Segundo as porcentaxes que se mostran na táboa 5 e dado que os que non responderon teñen a mesma distribución cás respostas declaradas, esas cifras foron aplicadas por separado ó total da poboación de pescadores da zona costeira e da área de Nantes. Resulta en 2,8 millóns de visitas, repartidas entre 2,163 millóns da área de costa e 0,634 millóns

According to the percentages in Table 5 and providing non-responses have the same distribution as stated responses, those numbers were applied separately to the total population of fishermen in the coastal and Nantes areas. It results into 2.8 million visits, divided into 2.163 million from the coastal area

da área de Nantes. O número total de visitas infravalora a asiduidade habitual para o semestre que nos interesa, xa que non considera os visitantes doutras zonas do interior, como Rennes.

A maior parte da xente (98,6%) que foi enquisada persoalmente é consciente de que a contaminación por fuel pode afectar á saúde humana. Pero máis do 56% considera que se dá demasiada importancia a este impacto e o 61% non se fía dos xornalistas e afirman que "están a facer unha montaña dun gran de area". Esta actitude concorda coa demanda xeneralizada de información exacta e fiable sobre os riscos que implica a marea negra. Ademais, o 98% dos entrevistados afirma que o público en xeral ten dereito a ser informado axeitadamente. A principal fonte de información é a televisión, seguida dos xornais. O feito de seren receptivos ás distintas fontes de información, xunto coas crenzas relativas á seguridade alimentaria, deu lugar a cambios á hora de realizar actividades de tempo libre que se viron acelerados pola prohibición de pescar na zona contaminada. De acordo coa enquisa realizada polas casas, identificáronse catro tipos de comportamentos:

- Os que deixaron de practicar a pesca deportiva e non substituíron esta actividade por outra.
- Os que deixaron de practicar a pesca pero substituíron esta actividade por unha actividade ó aire libre.

and 0.634 million from the Nantes area. That total number of visits underestimates the usual frequentation for the six-month period of interest since visitors from other inland areas such as Rennes are not taken into account.

Most people (98.6%) asked in face-to-face interviews are aware that oil pollution may affect human health. But over 56% consider that this impact is overestimated and 61% do not trust journalists stating that they '*make a mountain out of a molehill*'. This attitude is consistent with a strong demand of a reliable and accurate information related to expected risks. In addition 98% of the interviewees state that the general public has a right to be inform in a proper way. The main sources are TVs followed by newspapers. Openness to the various sources of information combined with beliefs related to food safety have led to changes in recreational activities which have been accelerated by the ban of fishing on foot in the polluted area. Based on the face-to-face survey, four types of behaviours were identified:

- people gave up and did not substitute any outdoor activity to fishing on foot,
- people gave up but replaced fishing on foot by one or several other outdoor activities,

- Os que continuaron pescando nos mesmos lugares.
- Os que continuaron pescando pero noutras zonas.

- people continued to fish on foot in the same places,
- people continued to fish on foot but in other places.

Táboa / Table 6
Pescadores que se viron prexudicados (enquisa telefónica) e pescadores que deixaron de pescar (enquisa persoal) en %
Fishermen who were disturbed (phone survey) and fishermen who gave up (face-to-face survey) in %

% %	Zona 1 Zone 1	Zona 2 Zone 2	Zona 3 Zone 3	Litoral Coastal area	Área de Nantes Nantes area
Con dificultades Trouble	50,0	78,6	72,1	68,5	41,5
Abandonaron a pesca Stop	44,1	93,6	93,0	75,0	

No cuestionario que se realizou persoalmente nos fogares, preguntóuselles ós entrevistados sobre se a súa asiduidade na práctica da pesca cambiara despois da marea negra. Esta pregunta proporciona unha información fiable para calcular o número de persoas que deixaron de practicar a pesca deportiva nas zonas costeiras (táboa 6). Para evitar respostas incorrectas, a redacción desta pregunta é diferente no cuestionario que se fai por teléfono e a pregunta está relacionada cun problema provocado polo vertido. Tal como se agardaba, as porcentaxes son maiores nas zonas 2 e 3 ca na zona 1, que se viu menos afectada. Por outra

In the face-to-face questionnaire, interviewees were asked their actual change in fishing effort after the oil spill. That question provides a reliable information to estimate the number of people who gave up and stop fishing on foot in coastal zones (Table 6). To avoid inaccurate answers, the wording is different in the phone questionnaire and the question is related to a trouble due to the spill. As it was expected percentages are greater in zones 2 and 3 than in zone 1 which has been less impacted. Otherwise the relatively low figure for

parte, a cifra relativamente baixa que se reflicte para a área de Nantes débese á súa situación no interior e, polo tanto, a xente que vive máis lonxe da costa viuse menos afectada pola contaminación. Sen embargo, existe unha certa inconsistencia digna de salientar entre os resultados obtidos nas dúas enquisas relativas ás zonas costeiras. Na zona 1, o número relativo de persoas que declaraban que lles supuxera un problema é maior có número de persoas que deixaron de practicar a pesca, mentres que nas zonas 2 e 3 aconteceu xustamente o contrario. Este resultado pódese deber á forma en que foron levadas a cabo as enquisas, dado que o impacto físico da marea negra cambiou durante o período estudiado e ó longo do litoral. Por razóns prácticas as entrevistas persoais duraron varias semanas, mentres que as entrevistas telefónicas foron realizadas na mesma semana durante o mes de maio do ano 2000, cando a gravidade da contaminación era baixa comparada coa do inverno e principios da primavera. Á hora de responder ás enquisas, a xente non tiña a penas referencias na mente. Ademais algúns tiveron que facer uso da memoria para responder ó cuestionario telefónico. Estes son factores incontrolados que explican a presencia destas discrepancias. Como non se dispón de información directa relativa ó número de persoas que deixaron de practicar a pesca na área de Nantes, calculouse esta cifra. A relación entre os que deixaron de pescar e os que atoparon dificultades na zona costeira foi aplicada ó número de persoas perturbadas na área de

the Nantes area is due to its inland location so people living farer from the seaside were less affected by the pollution. However there is some noticeable inconsistency between the results of the two surveys concerning the coastal zones. In zone 1, the relative number of people who stated a trouble is greater than the number of those who stopped fishing while the opposite holds for zones 2 and 3. This may result from the way in which the surveys have been carried out providing that the physical impact of the spill changed during the period of interest and along the coastline. For practical reason, face-to-face interviews took several weeks whereas phone interviews were conducted within a single week in May 2000, when the severity of the pollution was low compared with Winter and early Spring. When answering the surveys, people had likely different references in mind. In addition some of them had to rely on memory recall to answer the phone questionnaire. These are uncontrolled factors which explain these reported discrepancies. As there is no direct information regarding the number of people who stopped fishing in the Nantes area, it was estimated. The ratio between those who gave up and those who were disturbed in the coastal area was applied to the number of disturbed people in the Nantes area. This leads to

Nantes, o cal dá como resultado que un 45,4% dos pescadores deixou de practicar a pesca na área de Nantes.

Entre os que deixaron de pescar, o 75% substituíu esta actividade por outra ó aire libre. A preferida foi a do paseo, xa que foi elixida polo 60%; os paseos pola costa e polo campo atraeron un número similar de adeptos. Arredor do 30% preferiu outras actividades, mentres que é minoritaria a cifra dos que decidiron practicar paseos en barco (7%) e a vela (2%). A elección de actividades distintas á pesca deportiva é coherente coa puntuación recibida polas actividades de lecer ó aire libre (táboa 4). O cálculo da perda de visitantes está baseado nesta información e divídese en dúas categorías de acordo coa posibilidade de realizar outra actividade ou non (táboa 7).

45.4% of fishermen who gave up in the Nantes area.

Among those who stopped fishing, 75% have substituted an other outdoor recreational activity. Walking is the main substitute since it was favored by 60% of them, walking along the shoreline and walking in the countryside attracting a similar number of practitioners. About 30% preferred other activities, the share of boating (7%) and of sailing (2%) being small. The selection of substitutes is consistent with the ranking of of outdoor recreational activities (Table 4). The estimation of lost visits relies on this information and is broken down into two categories according to whether there was a substitute or nor (Table 7).

Táboa / Table 7
Número de visitas perdidas (en millóns)
Number of lost visits (in million)

	Zona costeira Coastal area	Área de Nantes Nantes area	Total Total
Abandono sen outra actividade Give up & no substitute	0,405	0,072	0,477
Abandono con outra actividade Give up with substitute	1,217	0,216	1,433
Total Total	1,622	0,288	1,910

Malia a prohibición decretada polo Goberno, outras persoas continuaron practicando a pesca deportiva nos mesmos lugares. De feito, non existe ningún indicativo de que un número importante de xente escóllese outro lugar que puidese ser máis seguro có habitual. Só o 18% informou sobre un descenso no índice de visitas. Este descenso non foi considerado e, polo tanto, as cifras indicadas na táboa 7 proporcionan unha cifra de visitas perdidas inferior á que corresponde.

3 CONTABILIZACIÓN DE BENEFICIOS E DANOS PARA OS PESCADORES RECREATIVOS

Tense dedicado gran cantidade de traballos á pesca fluvial, pero hai moi poucos que traten sobre a pesca deportiva no mar (Loomis, 1997; Rosenberger e Loomis, 2000). Coa excepción dunha avaliación limitada dos danos producidos pola marea negra do *Amoco Cadiz* (Bonnieux e Rainelli, 1991), non hai ningún traballo de investigación publicado do que teñamos coñecemento que trate sobre a pesca deportiva. Para calcular a demanda de pesca deportiva e o excedente do consumidor por visita, empréganse os resultados dun estudio realizado durante o primeiro trimestre do ano 2000 en toda a costa bretona, fóra da zona afectada ou antes de que a marea negra chegase á costa.

Despite the prohibition issued by the government, other people continued to fish on foot in the same places. Indeed, there is no indication that a significant number select a substitute site which could have been safer than the usual one. Only 18% reported a decrease in visiting rate. This drop was not estimated so figures in Table 7 provide an underestimation of lost visits.

3 MEASURING BENEFITS AND DAMAGES OF SPORT FISHERMEN

A great number of papers are devoted to freshwater recreational fishing, but only a very few deals with marine recreational fishing (Loomis, 1997; Rosenberger and Loomis, 2000). With the exception of a limited assessment of the damages due to the *Amoco Cadiz* oil spill (Bonnieux and Rainelli, 1991) there is no published research, to our knowledge, dealing with recreational fishing on foot. The results of a survey conducted during the first quarter 2000, along the coast of Brittany, outside the impacted area or before the spill reached the shoreline, are used to estimate the demand of fishing on foot and the consumer's surplus per visit.

3.1 Principais características da pesca deportiva

Realizouse unha enquisa baseada nunha mostra de lugares e horas de pesca a 501 pescadores. Os lugares encádranse en tres zonas principais: a costa norte (164 pescadores), a costa occidental (138 pescadores) e a costa sur (199 pescadores). Os pescadores son entrevistados xusto ó saíren do lugar onde pescan. Estas entrevistas *in situ* permiten que os entrevistadores verifiquen a información sobre a asiduidade na práctica da pesca e as capturas. Así, este método de contacto non depende tanto de datos autoinformados, incertezas da memoria, coñecementos e fiabilidade dos pescadores.

En primeiro lugar, os datos dispoñibles refírense ás principais características dos que practican a pesca deportiva e á súa experiencia nesta actividade. En comparación coa media da poboación, esta mostra sofre un nesgo cara ós homes (56%) e ás persoas maiores, cunha idade media de 51 anos e un 41% de xubilados. Por outra banda, a distribución de ingresos (o 89% informou sobre os seus ingresos mensuais) sofre un nesgo cara a categorías de baixos ingresos, xa que o 53% indicou un nivel de ingresos inferior a 10.000 FF (1.524 €) e só o 22% máis de 15.000 FF (2.287 €). Os ingresos medios roldan os 8.750 FF (1.336 €).

A pesca deportiva é a típica actividade de lecer dun só día e normalmente as persoas que a practican non pasan a noite fóra. O

3.1 Main features of fishing on foot

Data on 501 fishermen on foot are available from an on-site survey which has been based on a sampling of fishing places and times. Fishing places are pooled into three main areas: the North coast (164 interviews), the West coast (138 interviews) and the South coast (199 interviews). People were interviewed just as they came off the site. On-site survey allows more information to be verified by the survey agent regarding fishing effort and the catch. This contact method is less dependent on self-reported data and from the vagaries of the fishermen's memory, knowledge and truthfulness.

First of all, available data refer to the main characteristics of recreational fishermen and to their fishing experience. Compared with the average population, the sample is biased towards males (56%), and elderly people, with a mean age equals to 51 years, and 41% of retired people. Otherwise, the income distribution (89% gave their household's monthly income) is biased toward low-income categories, since 53% reported an income level smaller than 10 000 FF (1524 €) and only 22% over 15 000 FF (2287 €). Median income is around 8750 FF (1336 €).

Sport fishing is typically a single day outing activity and people rarely take an

lugar elixido para ir pescar atópase normalmente cerca do seu lugar de residencia: o día que se fixo a enquisa, o 26% dos entrevistados percorrera menos de 5 km desde a súa casa e o 64% menos de 20 km. Máis da metade dos enquisados (53%) dixo que facía dúas viaxes ó mes pero, sen embargo, hai picos estacionais de participación na época das mareas equinocciais. O 10% das persoas que percorreron máis de 50 km dixo que ía pescar menos dunha vez ó mes. Polo tanto, dáse unha relación inversa entre a distancia percorrida desde a casa ata o lugar onde se vai pescar e o índice de visitas, que concorda co método de custo da viaxe.

overnight trip. The fishing place is usually located nearby the place of residence: the day of the survey, 26% had covered less than 5 km from home, and 64% less than 20 km. Over half of the sample (53%) reported one or two trips every month, there are however seasonal peaks in participation at equinoctial tides. The 10% of individuals having travelled more than 50 km, reported less than one visit per month. There is therefore an inverse relationship between the distance travelled from home to the fishing place and visit rate, that is consistent with the travel-cost method.

Táboa / Table 8
Principais características dos pescadores
Mean characteristics of sport fishermen

	Costa norte North coast	Costa occidental West coast	Costa sur South coast	Total Total
Número de visitas anuais Yearly number of visits	18,9	14,5	13,3	15,5
Distancia desde a casa ata o lugar de pesca (km) Distance from home to site (km)	15,3	9,9	37,5	22,6
Idade (anos) Age (years)	49,1	46,9	54,8	50,8
Ingresos anuais (FF) Monthly income (FF)	11.122	9.445	10.167	10.285
Ingresos mensuais (€) Monthly income (€)	1.696	1.440	1.550	1.568

Fonte: Appéré e Bonnieux (2002) / Source: Appéré and Bonnieux (2002).

A media de visitas anuais ascende a 15,5 e varía das 13,5 na costa sur ás 18,9 na costa norte (táboa 8). Estas diferencias non se deben á distancia percorrida senón máis ben ó resultado da repercusión doutros factores combinados. En primeiro lugar, cómpre salientar as diferencias de idade e de distribución de ingresos. Por outra banda, a densidade de poboación varía moito en toda a costa, xa que varias áreas urbanizadas están moi próximas a zonas de pesca moi apreciadas (especialmente a área metropolitana de Brest), que implican unha distancia curta desde as zonas costeiras: a metade dos pescadores percorreu menos de 5 km no oeste, menos de 10 km no norte e menos de 25 km no sur. Estas dúas últimas zonas atraen xente de cidades máis afastadas como Nantes e Rennes e, excepcionalmente, de París, mentres que os que van á costa occidental nunca percorren máis de 100 km. Hai que ter en conta as variables ficticias para apreciar estas diferencias.

3.2 Uso dos métodos do custo da viaxe e da valoración continxente

O día que se levou a cabo a enquisa, o 60% dos entrevistados afirmou que fora pescar no seu lugar habitual, mentres que o 40% dixo que o fixera nun lugar diferente. Estas dúas categorías de pescadores contrastan en termos de asiduidade da práctica da pesca e a distancia percorrida. A xente entrevistada no seu lugar habitual percorría 19 km e declarou

The yearly average number of visits is 15.5. It ranges from 13.5 on the South coast to 18.9 on the North coast (Table 8). These differences are not only due to differences in distance travelled but also result from the combined impact of other factors. First of all differences related to age and income distribution have to be mentioned. Otherwise, population density greatly varies along the shoreline. Several urbanised areas are very close to valuable fishing places, specially the Brest metropolitan area, involving a very short distance to cover from home to the nearest site. Indeed, the distance distribution significantly varies among the three coastal areas: half of the fishermen have covered less than 5 km in the West, less than 10 km in the North and less than 25 km in the South. The last two areas attract people from farer towns such as Nantes and Rennes, and marginally from Paris, while visitors to the West never travel more than 100 km. Dummy variables have to considered to account for these differences.

3.2 Use of travel-cost and contingent valuation methods

The day of the survey, 60% reported they had fish in their usual place, while 40% stated it was a substitute site. These two categories of fishermen contrast in terms of fishing effort and

unhas 16,4 visitas ó ano, mentres que os outros declararon 14 visitas. Debe mencionarse que unha visita ten sempre un único propósito.

O método individual do custo da viaxe foi aplicado ós datos xuntando todos os lugares onde se practica a pesca nun só, o que dá lugar a un cálculo da demanda da actividade da pesca deportiva en Bretaña, sendo a variable dependente o número de visitas anuais (táboa 8). O 92% desprázase en coche ata o lugar onde practica a pesca, mentres que o restante 8% vai a pé ou en bicicleta. Máis de tres cuartos dos entrevistados goza da viaxe e considéraa unha experiencia agradable. Só o 7% dos que contestaron indicou que a viaxe lles resultaba aburrida. O custo de oportunidade do tempo da viaxe considerouse cero e o custo da viaxe foi calculado en 2 FF/km (0,34 €/km), incluídos os custos operativos e a depreciación dun coche de tamaño medio.

distance travelled. People interviewed in their usual place covered 19 km and reported 16.4 visits per year, while the others reported 28 km and 14 visits. It must be mentioned that a visit is always a single purpose one.

The individual travel-cost method has been applied to the data by pooling all sites into a single one. This leads to an estimation of the demand for fishing on foot in Brittany, the dependent variable being the yearly number of visits (Table 8). 92% drive to the fishing place while the remaining 8% walk or cycle to the site. More than three-quarters of the sample enjoy their travel time and consider it is a pleasant experience. Only 7% of the respondents stated a disamenity associated with the travel. The opportunity cost of travel time has been assumed to be zero and travel-cost has been estimated to 2 FF/km (0.34 €/km) including operating costs and depreciation of a medium size car.

Táboa / Table 9
Demanda da actividade de pesca deportiva (número de visitas anuais)
Demand for sport fishing (yearly number of visits)

Modelo Model	Constante Constant	Custo (100 FF) (152 €) Cost (100 FF) (152 €)	Norte* North*	Lugar habitual* Usual site*	Renda*/ Income*		R^2 (%)
					NR (1)	> 10.000 FF (1.524 €)	
Modelo lineal / Linear model							
1	16,47 (32,55)	- 2,6554 (4,37)					4
2	13,27 (15,82)	- 2,1132 (3,53)	4,8417 (5,16)	2,3304 (2,59)			9
3	17,37 (27,16)	- 2,6277 (4,32)			- 6,9277 (2,35)	-1,7628 (1,94)	5
4	14,31 (15,26)	- 2,0964 (3,50)	4,8714 (5,21)	2,0976 (2,33)	- 6,2838 (2,19)	- 1,8031 (2,02)	11
Modelo lineal-logarítmico / Log-linear model							
1	2,63 (76,32)	- 0,3077 (7,42)					10
2	2,46 (42,61)	- 0,2780 (6,73)	0,2793 (4,32)	0,1135 (1,83)			14
3	2,68 (61,52)	- 0,3069 (7,44)			- 0,5767 (2,87)	- 0,0813 (1,31)	12
4	2,52 (39,03)	- 0,2780 (6,77)	0,2782 (4,32)	0,0996 (1,61)	- 0,5436 (2,75)	- 0,085 (1,39)	15

(1) NR significa que non contesta á pregunta sobre os ingresos / (1) NR is non-response to the income question
Os estatísticos t sinálanse entre parénteses / Student t statistics are given between brackets

Fonte: Appéré e Bonnieux (2002) / Source: Appéré and Bonnieux (2002)

Se se observa a táboa 9, pódese comprobar que existe unha clara coherencia entre os resultados obtidos coas dúas especificacións do modelo. O número absoluto de visitas por ano é a variable dependente coa especificación lineal, mentres que o logaritmo desta variable é utilizado no modelo logarítmico. Polo tanto, cómpre facer unha síntese desta táboa para revisar a influencia das diferentes variables nas viaxes de pesca. En primeiro lugar, o custo da viaxe ten un efecto negativo moi importante, que concorda coa teoría da demanda e coas observacións empíricas. Con respecto ás variables socioeconómicas (idade, ingresos, nivel de estudios e ocupación), a influencia non lineal dos ingresos merece algún comentario adicional. Os demais elementos quedan iguais, aínda que é probable que o número de visitas sexa menor entre a xente que se beneficia duns ingresos superiores a 10.000 FF (1.524 €). Este efecto específico está asociado a unha elasticidade da renda negativa na demanda da pesca deportiva. Polo tanto, esta actividade de lecer consideraríase un ben inferior. No caso da pesca fluvial, xa se mencionaron as principais diferencias entre as actividades de pesca deportiva (Bonnieux e Vermersch, 1993). Para a maioría delas, se a renda aumenta e os prezos non cambian, haberá un aumento da participación. Sen embargo, canto maior sexa o nivel de riqueza da xente, máis diminúe a súa demanda de determinadas clases de actividades de pesca porque se poden permitir actividades máis atractivas, como por exemplo a

A rapid inspection of Table 9 shows a clear consistency between the results obtained with the two specifications of the model. The absolute number of visits per year is the dependent variable with the linear specification while its logarithm is used with the log-linear one. So let us make a synthetic comment of this table in order to review the influence of the different variables on fishing trips. First of all, there is a significant, negative effect of travel-cost which is consistent with demand theory and with empirical observations. With respect to socio-economic variables (age, income, education and occupation), a non-linear influence of income deserves some additional comment. All other things remaining equal, the number of visits is likely to be smaller among people who benefit an income over 10 000 FF (1524 €) than among others. This specific effect is associated with a negative income elasticity of the demand of sport fishing. So this recreational activity would be an inferior good. For freshwater, major differences among recreational fishing activities have been already mentioned (Bonnieux and Vermersch, 1993). For most of them, if incomes rise and prices do not change, there will be an increase in participation. Otherwise, as people become wealthier they reduce their demand of certain types of fishing activities because a more desirable activ-

pesca da troita. O efecto da variable "non contesta", que está asociada á xente que non informou sobre a súa renda, resulta algo desconcertante ata o punto de que estas persoas non están ben identificadas.

A introducción de variables ficticias permite verificar unha influencia específica da localización dos lugares onde se vai pescar. Os resultados econométricos confirman os resultados empíricos xa que se mostra un efecto positivo da variable ficticia asociada coa costa norte. Isto significa que é probable que as persoas que estaban pescando no seu lugar habitual o fagan con máis frecuencia ca outros.

A táboa 10 proporciona o excedente do consumidor por visita para as diferentes zonas costeiras. O cálculo está baseado no modelo 4, que inclúe as seguintes variables independentes: a do custo da viaxe, a do

ity such as trout angling is available. The effect of the NR variable, which is associated with people who did not report their income, is somewhat puzzling to the extent that these people are not well identified.

The introduction of dummy variables allow to test a specific influence of the location of fishing places on demand. Econometric results confirm empirical findings since a positive effect of the dummy associated with the North coast is shown. In addition, there is also a positive effect of the dummy associated with the usual site. It means that those who were fishing in their usual site are likely to fish more often than others.

Table 10 provides consumer's surplus per visit for the different coastal

Táboa / Table 10
Comparación dos excedentes do consumidor por visita
Comparison of consumer's surplus per visit

Modelo 4 Model 4	Zona Area	Excedente (FF) Surplus (FF)	Excedente (€) Surplus (€)
Lineal Linear	Norte / North	451	68,76
	Oeste / West	345	52,60
	Sur / South	317	48,33
	Total	370	56,41
Logaritmo lineal Log-linear	Total	360	54,89

Fonte: Appéré e Bonnieux (2002) / Source: Appéré and Bonnieux (2002).

nivel da renda e dúas ficticias que caracterizan a costa norte e o lugar habitual respectivamente. Coa forma funcional lineal-logarítmica, o excedente unitario non depende de visitas, mentres que co modelo lineal é proporcional a este número (Garrod e Willis, 1999). Ademais, os excedentes son proporcionais ó custo da viaxe. Todos os cálculos están feitos no punto medio da área de interese e, polo tanto, as diferencias entre as zonas só son o resultado das diferencias observadas no índice de visitas. As dúas especificacións dan como resultado cifras comparables para toda a costa de Bretaña. Os valores presentados na táboa 10 son relativamente altos en comparación cos valores obtidos para a pesca fluvial (Amigues *et al.*, 1995), xa que son similares ós da pesca do salmón e do reo. Pero a pesca deportiva no mar ten dúas características específicas: non se pagan taxas para obter a licencia e o custo do equipamento é insignificante, e sen embargo o número de visitas anuais é moito menor para esta modalidade de pesca e, polo tanto, os excedentes anuais son notablemente inferiores ós da pesca do salmón e do reo.

Os riscos para a saúde asociados ó consumo de marisco dependen da calidade ambiental do lugar onde se capture. Para reducir a magnitude dalgunhas enfermidades débese escoller e cocer o marisco, pero estas medidas resultan ineficaces para outras. Como non existen oportunidades reais de seguridade persoal, a autoprotec-

areas. Estimation is based on the model 4 which includes the following independent variables: travel-cost, income level and two dummies which respectively characterise the North coast and the usual site. With the log-linear functional form, the unitary surplus does not depend on the number of visits while, with the linear functional form, it is proportional to this number (Garrod and Willis, 1999). In addition, the surplus is proportional to travel-cost. All estimation are made at the mean point of the area of interest, so differences among areas only result from observed differences in visit rate. Both specifications result in comparable figures for the whole coast of Brittany. The values presented in Table 10 are relatively high compared with values obtained for freshwater recreational fishing (Amigues *et al.*, 1995) since there are similar with those for salmon and sea trout angling. But, two specific features of fishing on foot are to be mentioned: there is no license fees and the cost of equipment is negligible, and otherwise the yearly number of visits is much smaller for fishing on foot, so annual surplus is significantly lesser than for salmon and sea trout.

Shellfish-related health risks depends on the environmental quality of the spot where shellfish are gathered. Sorting and boiling them are expected to

ción consiste en marchar dun lugar contaminado e gastar máis tempo e máis cartos en ir pescar a un lugar máis seguro. Supoñamos que o pescador ten a posibilidade de modificar o seu consumo de productos habituais para mellorar as posibilidades de pescar nun lugar máis seguro. Dada a falta de datos relevantes, empregouse o método da valoración continxente para calcular o prezo de opción por reducir a probabilidade de contaminación no sitio habitual de pesca. En vez de pedirlles directamente que asignen un valor monetario á provisión dun lugar hipotético, ós pescadores preguntóuselles na enquisa realizada *in situ* qué distancia estarían dispostos a percorrer para iren a esoutro lugar (Appéré, 2002). Tivéronse en conta dúas situacións: a primeira refírese a unha degradación limitada do lugar habitual, que implica unha baixa probabilidade de padecer unha enfermidade tóxica. A segunda está relacionada cunha degradación importante que dá lugar a unha prohibición de pescar xa que o consumo de marisco produciría con toda probabilidade unha enfermidade grave. A disposición a pagar (WTP) por un lugar hipotético dedúcese do custo de percorrer esa distancia extra realizando un axuste para incorporar a reducción do número de viaxes (táboa 11). Dependendo da situación, a WTP varía do 16-20% do excedente do consumidor procedente da recollida de marisco.

Dada a ausencia de estudios comparables, consideremos dous cálculos da WTP

reduce the magnitude of some diseases but are inefficient for some others. As there are no credible opportunities for self-insurance, self-protection consists in leaving a polluted site and spending extra time and money to fish a safer place. Let us assume that the fisherman has the opportunity to rearrange his consumption of ordinary goods in order to improve his chances of fishing in a safer place. Given the lack of relevant data, the contingent valuation method has been used to estimate the option price for reducing the probability of an adverse pollution of people's usual site. Instead of being asked directly to place a monetary value on the provision of a hypothetical site, respondents were asked, in the on-site survey, how far they would drive to use such a site (Appéré, 2002). Two scenarios have been considered. The first scenario refers to a limited degradation of the usual site, which implies a low probability to experience a toxic disease. The second scenario is associated to an important degradation leading to a ban of fishing because shellfish consumption would likely result into a severe illness. Willingness-to-pay (WTP) for a hypothetical site is implied by cost of driving that extra distance providing an adjustment for a reduction in the number of trips (Table 11). Depending on the scenario, WTP ranges from 16% to 20% of the consumer's sur-

Táboa / Table 11
Distribución da disposición a pagar (WTP) mensual
Monthly willingness-to-pay (WTP) distribution

	1º escenario 1st scenario		2º escenario 2nd scenario	
Número de observacións Number of observations	396		415	
Número de ceros Number of zeros	58		51	
	FF	€	FF	€
Media / Mean	73,06	11,14	92,23	14,06
Mediana / Median	31,69	4,83	44,37	6,76
Erro estándar Standard error	112,94	17,22	156,37	23,84
Mínimo / Minimum	0	0	0	0
Máximo / Maximum	1.000	152,46	1.600	243,94

Fonte: Appéré (2002) / Source: Appéré (2002).

para mellorar a calidade da auga mariña cerca de Brest. O primeiro cálculo (Bonnieux *et al.*, 1995) fundaméntase nun estudio de valoración continxente levado a cabo en 1993, que tratou todos os tipos de usuarios de augas mariñas. Preguntóuselles *in situ* a súa disposición a pagar para poder nadar no exterior e comer marisco seguro. A disposición a pagar media é de 85 FF (12,96 €) a prezos do ano 2000. Como se poden decatar, é unha cantidade baixa comparada cos dous estudios levados a cabo nos Estados Unidos e en Noruega. De feito, a dispoñibilidade a pagar é 2,3 veces superior para nadar no exterior no Chesapeake e 4,3 veces

plus derived from recreational shellfish gathering.

Given the lack of comparable studies let us consider two estimations of the WTP to improve the quality of coastal water nearby Brest. The first estimation (Bonnieux *et al.*, 1995) relies on a contingent valuation survey conducted in1993, which dealt with all types of coastal water users. People were asked on-site their WTP for outdoor swimming and safe eating of shellfish. Mean WTP is 85 FF (12.96 €) at 2000-prices. As it was noticed, that is a low amount compared with two studies carried out

para eliminar a contaminación do fiordo interior de Oslo.

O segundo cálculo interesante foi realizado en 1995 e extraído dunha comparación entre unha curva de demanda observada e unha curva de demanda hipotética. A variación no excedente por visita está baseada nas diferencias de custo da viaxe (Le Golfe, 1999). Segundo prezos do ano 2000, unha mellora da calidade da auga mariña ascende a 33 FF/mes (5,03 €/mes) para todos os usos (paseos pola costa, natación no exterior, tomar o sol, vela, mergullo, pesca).

3.3 Avaliación dos danos ocasionados ós pescadores

Un modelo de comportamento dos pescadores que combina os criterios de autoseguro e autoprotección foi utilizado para calcular os danos sufridos trala marea negra (Appéré e Bonnieux, 2002). Como a disposición a pagar pola autoprotección é moi limitada como para querer desprazarse a un lugar máis seguro (táboa 10), a maioría da xente abandonou a pesca. No caso de que a contaminación se limitase a un só lugar, as persoas afectadas comportaríanse de forma diferente, dado que habería un lugar non contaminado cerca. En canto ós que abandonaron a actividade da pesca e non iniciaron ningunha outra actividade ó aire libre, os danos por visita perdida equivalen ó excedente de consumidor por visita.

in the United States and in Norway. Indeed, WTP is 2.3 times that amount for outdoor swimming in the Chesapeake and 4.3 times to eliminate pollution from the Oslo inner fjord.

The second estimation of interest was done in 1995 and derived from a comparison between an observed demand curve and a hypothetical demand curve. The variation in surplus per visit is based on travel-cost differences (Le Goffe, 1999). At 2000-prices, an improvement in coastal water quality amounts 33 FF/month (5.03 €/month) for all uses (walking along the shore line, outdoor swimming, sun bathing, sailing diving, fishing). That value is

3.3 Assessment of recreational fishermen's damages

A model of fishermen's behaviour combining self-insurance and self-protection has been used to derive the damages suffered after the oil spill (Appéré and Bonnieux, 2002). Since, WTP for self protection is too small to drive to a safer place (Table 10), most people gave up fishing. In the case of a pollution limited to a single spot, people involved would have behave in a different way, because a non-polluted site would have been available nearby. For those who gave up and did not substituted any outdoor activity to

Para os que abandonaron a pesca pero iniciaron outra(s) actividade(s) ó aire libre, os danos por visita perdida equivalen á diferencia no excedente por consumidor para a pesca deportiva e para as outras actividades recreativas ó aire libre. Entre as persoas que continuaron pescando no mesmo lugar, só os que diminuíron o índice de visitas sufriron danos. Dada a falta de información, esta compoñente non se tivo en conta. Por último, cómpre lembrar que o número de persoas que continuaron pescando noutro lugar diferente ó habitual foi insignificante, o cal resulta bastante consistente dada a disposición a pagar para trasladarse a un lugar máis seguro.

Para substituír as actividades de lecer ó aire libre empregouse o método da transferencia de beneficios, que consiste no proceso de tomar información dun contexto determinado (o lugar de estudio) para aplicalo a outro contexto (o lugar onde se aplica a medida). Tendo en conta unha serie de restriccións, a transferencia de beneficios está aceptada polas guías oficiais de avaliación económica (Ministerio de Facenda, 1991). Ó abeiro da Lei de Responsabilidade, Compensación e Resposta Ambiental Global (CERCLA) de 1980 aprobada nos Estados Unidos e da lexislación sobre contaminación provocada por petróleo, recoméndase a transferencia de beneficios para procedementos simplificados (tipo A). As avaliacións detalladas e individualizadas requiridas só se recomendan para accidentes do tipo B, os que se supón que van provocar consecuencias máis graves (Ward e Duffield, 1993).

fishing on foot, damage per lost visit equals the consumer surplus per visit.

For those who gave up but replaced fishing on foot by one or several other outdoor activities, damage per lost visit equals the difference in consumer surplus for fishing on foot and for the other outdoor recreational activities. Among people who continued to fish in the same place, only those who decreased their visit rate suffered a damage. Due to the lack of information this component will not be taken into account. Finally, let us recall that the number of people who continued to fish but in an other place was negligible. That is consistent, given the WTP to drive to a safer place.

Benefit transfer has been used for substitute outdoor recreational activities. Benefit transfer is the process of taking information from one context (the study site) and applying it to another context (the policy site). Providing a series of restrictions benefit transfer is accepted by official guides for economic valuation (H.M. Treasury, 1991). Under the United-States 1980-CERCLA (Comprehensive Environmental Response, Compensation and Liability Act) and the subsequent legislation on oil pollution benefit transfer is recommended for simplified procedures (type A). Detailed

Débense cumprir determinadas condicións para que se leve a cabo unha transferencia de beneficios válida (Rainelli, 2001). As principais características son:

- O cambio na prestación do servicio que se está a valorar nos dous lugares debe ser similar.
- As características do lugar deben ser as mesmas ou ben axustar polas diferencias.
- As características da poboación deben ser as mesmas ou ben axustar polas diferencias.
- Os dereitos de propiedade deben ser os mesmos en todos os lugares.
- Os prezos deben ser os mesmos en todos os lugares.

Non se pode empregar a transferencia de beneficios de forma extensiva para obter estimacións de valor que sexan estatisticamente similares ós verdadeiros valores. Sen embargo, no tocante ó excedente do consumidor derivado da recollida de marisco como actividade de lecer, mantéñense a maioría das condicións para unha transferencia válida. O valor unitario derivado da enquisa realizada *in situ* (táboa 10) foi utilizado para valorar os danos producidos ós pescadores que abandonaron esta actividade e non iniciaron ningunha outra ó aire libre. Para estas actividades (paseos, sendeirismo, ciclismo, *footing*), dispoñemos de datos sobre bosques nas aforas das cidades (Bonnieux e Guerrier, 1992) que proceden dunha enquisa realizada *in situ*, na que foron entrevistados 621 grupos de

and individualised assessments are only required for type B accidents whose impacts are likely to be large (Ward and Duffield, 1993).

Certain conditions should be met for a valid benefit transfer to take place (Rainelli, 2001). Main points are:

- The change in the provision of the good being valued at the two sites should be similar,
- Site characteristics should be the same, or differences should be accounted for,
- Population characteristics should be the same, or differences should be accounted for,
- Property rights should be the same across the sites,
- Prices should be the same across the sites.

Benefit transfer cannot be extensively relied upon to produce valuation estimates which are statistically indistinguishable from the true values. However, as far as consumer's surplus derived from recreational shellfish gathering is concerned, most conditions for a valid transfer hold. Unitary value derived from the on-site survey (Table 10) has been used to value damages of those who gave up and did not substitute any outdoor activity to fishing on foot. For other outdoor recre-

visitantes formados por 1700 persoas. O tamaño medio dun grupo de visitantes é de 2,7, mentres que o dos grupos de pescadores é de 2,6. Todas estas actividades ó aire libre están relacionadas con viaxes moi curtas e saídas dun día. O modelo do custo da viaxe zonal foi utilizado para calcular o excedente do consumidor derivado dunha visita a este bosque. En prezos do ano 2000 e utilizando 2 FF/km (0,34 €/km), sae a uns 30 FF (4,57 €). Sábese que o excedente unitario derivado das actividades ó aire libre, como paseos polos arredores, é bastante baixo (Amigues *et al.*, 1995), pero debido ó gran número de visitantes esta actividade tan popular produce un valor engadido moi alto.

O resultado do cálculo de avaliación de danos reflíctese na táboa 12, na que se pode observar que as perdas ocasionadas nas actividades recreativas e de lecer da poboación residente ascenden a 644,6 millóns de FF (98,3 millóns de €). A avaliación procede da combinación de diversas fontes. O cambio de actividade debido ós danos causados pola marea negra do *Erika* foi calculado a partir de dúas enquisas levadas a cabo tralo naufraxio. O número de visitas perdidas constitúe un cálculo conservador por dous motivos: empregáronse os límites máis baixos no cálculo e non se tiveron en conta os visitantes procedentes das zonas de interior. Por outra banda, non se consideran os danos producidos á xente que continuaba pescando (pero que provocaron o descenso do índice de visitas), o cal tamén supón un cálculo á baixa. A

ational activities (walking, nature walks, bicycling, jogging) data concerning an outskirt forest are available (Bonnieux and Guerrier, 1992). They provide from an on-site survey, in which 621 groups of visitors amounting 1700 individuals, have been interviewed. The average size of a group of visitors is 2.7 while it is 2.6 for fishing on foot. All these outdoor activities are associated with very short trip and relate to a day outing. The zonal travel-cost model has been used to estimate the consumer's surplus derived from a visit to this forest. In 2000-prices and using 2 FF/km (0.34 €/km), it equals 30 FF (4.57 €). It is well known that the unitary surplus derived from outdoor activity such as walking in the neighbourhood is quite low (Amigues *et al.*, 1995), but due to the great number of visitors this common activity amounts a huge aggregated value.

The output of the damage assessment calculation is given in Table 12, lost recreation and amenities of the resident population amount 644.6 million FF (98.3 million €). This assessment results from the combination of several sources. Change in use due to the injury caused by the *Erika* oil spill has been estimated from two surveys conducted after the wreck. The number of lost visits is a conservative estimate for two reasons: lower bounds have been used in

Táboa / Table 12
Avaliación de danos
Damage assessment

Comportamento da xente People's behaviour	Perda de visitas Lost visits	Valores unitarios Unitary values		Cantidade total por danos Total damages	
	10^6	FF	€	10^6 FF	10^6 €
Abandono da pesca sen iniciar outra actividade Stop fishing & no substitute	477	360	54,89	171,7	26,2
Abandono da pesca e inicio doutra actividade Stop fishing with a substitute	1.433	330	50,32	472,9	72,1
Continúa sen cambios Continue & no change	0	0	0	0	0
Continúa cunha caída Continue but decreases	?	?	?	?	?
Total Total	1.910	690	105,2	644,6	98,3

Fonte: Bonnieux e Ranielli (2001) / Source: Bonnieux and Rainelli (2001).

valoración en termos económicos está baseada no procedemento da transferencia de beneficios. As condicións para unha transferencia de beneficios válida equivalen ó excedente do consumidor procedente da recollida de marisco como actividade de lecer. Pero a fiabilidade deste método cuestiónase máis para outras actividades recreativas ó aire libre xa que as características da poboación son lixeiramente diferentes. Malia a limitación de

the calculation and all inland visitors have not been taken into account. Otherwise damages incurred by people who continued to fish but lowered their visit rate, are not considered. It is another source of underestimation. Valuation in monetary terms relies on the benefit transfer procedure. The conditions for a valid benefit transfer hold for the consumer's surplus derived from

datos dispoñibles, unha gran desvantaxe débese ó cálculo do modelo do custo da viaxe. Os modelos calculados son consistentes coa teoría económica pero, por outra parte, o valor dos excedentes depende moito máis da elección de variables independentes e dos gastos incluídos no custo da viaxe. Desde o noso punto de vista, neste tipo de contexto, é fundamental un test externo de validez, que require que se fagan estudios comparables e metaanálises (Rainelli, 2001; Rosenberger e Loomis, 2000).

CONCLUSIÓNS

Esta avaliación, malia as súas limitacións, demostra a importancia dunha categoría de danos que case nunca se ten en conta. No caso do *Erika*, estas perdas orfas equivalen a unha cantidade comparable á dos gastos que suporían a limpeza e recuperación do litoral. Estas perdas supoñen arredor de 100 millóns de euros mentres que no ano 2000 se gastaron 124 millóns ó abeiro do programa *Polmar Terre* (a compoñente terrestre dos traballos de limpeza), que inclúe todas as actividades de limpeza e recuperación levadas a cabo na costa e no interior. Este resultado confirma a importancia das perdas ocasionadas en actividades de lecer para a poboación residente, que foron calculadas a grandes trazos no caso do *Amoco Cadiz* (Bonnieux *et al.*, 1980). Pero a xente que sufriu estas perdas reais debido á falta de actividade recreativa non pode facer ningunha reclamación porque non se pode

recreational shellfish gathering. But the reliability of the procedure is more questionable for other outdoor recreational activities because population characteristics are slightly different. Despite available data limitation, a major drawback stems from the estimation of the travel-cost model. Estimated models are consistent with economic theory but on the other hand the value of surpluses are highly dependent on the choice of independent variables and on the expenditures included in the cost of travel. From our standpoint, in that type of context, an external validity test is crucial. It requires that comparable studies and meta-analyses are available (Rainelli, 2001; Rosenberger and Loomis, 2000).

CONCLUSION

Despite its limitations, this assessment demonstrates the share of a category of damages which is often not taken into account. In the *Erika* case, these orphan losses account for a comparable amount than the cleaning and restoration expenditures. There are about 100 million Euros whereas 124 million was spent in 2000, under the 'Polmar Terre' programme (land-based component of the clean up operations) which includes all cleaning and restoration activities carried on the

presentar ningunha proba perante a xustiza. Deste xeito, o obxectivo do convenio internacional de 1971, que estableceu un fondo de compensación por danos causados polas mareas negras, serve para compensar as víctimas co fin de que manteñan o mesmo nivel de riqueza ca se non se producise a marea negra. Só é posible obter compensacións por danos civís que poidan ser valorados estrictamente en termos económicos. Toda reclamación debe estar apoiada por contas claras e, polo tanto, as perdas ocasionadas nas actividades recreativas e de lecer non están consideradas neste convenio. Sen embargo, si permite reembolsar gastos referidos á recuperación de ecosistemas. No tocante á doutrina da compensación, ¿sería posible imaxinar unha evolución a favor destas perdas orfas? Durante os anos 80, unha evolución similar beneficiou a compensación por danos ecolóxicos. Con esta perspectiva, temos a esperanza de que a avaliación feita co caso *Erika* sirva para incrementar a concienciación e o interese público.

shoreline and inland. This result confirms the significance of recreational and amenity losses of the resident population which were roughly estimated in the *Amoco Cadiz* case (Bonnieux *et al.*, 1980). But people who suffered these actual losses due to a decline in their recreational experience cannot assert a claim because no exhibit can be presented to a court. Thus, the objective of the 1971 international convention which established an indemnification fund for the damages caused by an oil spill, is to compensate the victims in order to make them as well off as if the pollution had not occurred. Only torts which can be evaluated in strictly financial terms are likely to be redressed. Every claim must be supported by relevant accounts therefore recreational and amenity losses are not considered by the convention. Otherwise it allows to reimburse expenditures related to the restoration of ecosystems. Regarding the compensation doctrine, can we imagine an evolution in favour of these orphan losses? During the 1980s, a similar evolution benefited the compensation of ecological losses. In this perspective, the *Erika* assessment is expected to increase public awareness and interest.

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O CUSTO DAS MAREAS NEGRAS: UNHA ANÁLISE DO PROCESO DE AVALIACIÓN E COMPENSACIÓN DOS DANOS QUE PROVOCAN AS MAREAS NEGRAS

THE COST OF OIL POLLUTION AT SEA: AN ANALYSIS OF THE PROCESS OF DAMAGE VALUATION AND COMPENSATION FOLLOWING OIL SPILLS

Olivier Thébaud, Denis Bailly**, Julien Hay**, José Pérez**

INTRODUCCIÓN

A avaliación dos custos provocados polas mareas negras en termos económicos pode ter varios propósitos. Na práctica esta avaliación lévase a cabo co obxectivo fundamental de establecer os niveis de indemnizacións que se pagarían ós afectados pola marea negra, polo menos en termos económicos. O custo das mareas negras constitúe tamén

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INTRODUCCIÓN

Assessing the costs of oil spills in monetary terms may serve several purposes. In practice, it is generally carried out with the primary view to establish the levels of compensation that would leave the victims of a spill whole, at least in financial terms. The cost of oil spills is also a key figure in debates on

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unha cifra clave nos debates sobre o desenvolvemento de medidas preventivas que sirvan para reducir os riscos de contaminación en tres niveis: en primeiro lugar, a información sobre os custos das mareas negras pódese contrastar cos datos sobre os medios empregados na prevención de accidentes, para avaliar a adecuación e a eficacia das devanditas medidas (véxase por exemplo Barde, 1991). En segundo lugar, a información sobre os custos das mareas negras pódese contrastar cos datos relativos ós dos traballos de limpeza nun accidente determinado co fin de establecer estratexias de resposta eficaces (véxase por exemplo Ward e Duffield, 1992). E, por último, a valoración dos custos económicos dos danos provocados polas mareas negras e a identificación dos culpables constitúe tamén unha información clave nos debates sobre o papel da responsabilidade e, en termos máis xerais, sobre os incentivos económicos á hora de acadar niveis de prevención da contaminación eficaces (véxase por exemplo Shavell, 1987).

A valoración de danos preséntase, deste xeito, como un exercicio fundamental, tanto nos debates sobre as indemnizacións correctas concedidas ás víctimas nun accidente detectado como en debates sobre a definición das políticas axeitadas de prevención da contaminación. Sen embargo, o estudio de exemplos prácticos demostra que normalmente resulta difícil identificar un só cálculo global do custo social dunha marea negra, ou mesmo un único cálculo económico dos custos parciais.

the development of preventive measures limiting the risks of pollution, and this at three levels. First, information on the costs of oil spills can be confronted with data on the means devoted to the prevention of accidents, in assessing the adequacy and effectiveness of such measures (see e.g. Barde, 1991). Second, information on the costs of oil spills can be confronted with data regarding the amount of effort devoted to cleanup operations in any particular incident, in order to determine efficient response strategies (see e.g. Ward and Duffield, 1992). Third, measuring the monetary costs of damages caused by oil spills and identifying who they are charged to is also a key piece of information in discussions on the role of liability, and more generally of economic incentives, in achieving efficient levels of pollution prevention (see e.g. Shavell, 1987).

Damage valuation thus appears as a key exercise, both in debates on the proper compensation of victims in any particular accident, and in discussions related to the definition of appropriate pollution prevention policies. However, the study of practical examples shows that it is usually difficult to identify a single, global estimate of the social cost of an oil spill, or even single monetary estimates of its partial costs.

Na práctica, semella que polo menos se poden elaborar tres categorías de cifras para responder á cuestión do custo económico das mareas negras: (i) cifras sobre danos calculados aplicando metodoloxías de valoración económica, (ii) reclamacións de indemnizacións presentadas tralo vertido e (iii) indemnizacións concedidas finalmente ás víctimas do accidente. Con frecuencia, estas cifras difiren na práctica xa que, de feito, gran parte dos custos calculados poden non ser indemnizados mediante o sistema de responsabilidade civil, de acordo coa indemnización polos danos que se aplique.

O obxectivo deste traballo consiste en analizar os principais factores que explican as diferencias entre as tres categorías de cifras que se poden observar tralas mareas negras e, de acordo con estes resultados, avaliar ata que punto pode permitir o sistema internacional de compensación e responsabilidade de danos producidos por mareas negras que os custos sociais destes accidentes de contaminación sexan internalizados. Este debate baséase nunha análise retrospectiva de varias mareas negras acontecidas nos últimos vinte anos en augas europeas. No primeiro apartado faise un breve resumo da información dispoñible sobre cada un destes casos, prestando especial atención ós cálculos elaborados sobre os custos dos danos, as reclamacións de indemnizacións e as cantidades efectivamente pagadas. No segundo apartado realízase unha análise preliminar dos principais factores que explican a diverxencia entre

In practice, at least three categories of numbers seem to be produced in response to the question: “what was the (monetary) cost of this oil spill?”: (i) estimates of damages calculated applying economic valuation methodologies; (ii) claims for compensation following the spill; and (iii) compensation eventually paid to the victims of the accident. These figures often seem to diverge in practice. Indeed, it appears that a significant part of the estimated costs may not be internalized via the liability system under which the compensation of damages is carried out.

The objectives of the paper are to look at the main factors explaining the differences between the three categories of numbers as they can be observed following oil spills and, based on these results, to assess the extent to which the international system of liability and compensation of oil spill damages can allow the social costs of such pollution events to be internalized. The discussion is based on a retrospective analysis of several major oil spills that took place in European waters in the past twenty five years. In the first section, the information available on these cases is briefly summarized, with particular emphasis on existing estimates of the costs of damages, claims for compensation and compensation paid. The second section

estas cifras. Finalmente conclúese este traballo cun debate sobre os cambios que se poden esperar dos debates que tiveron lugar recentemente en Europa sobre a evolución do sistema de responsabilidades e compensación de danos.

OS CUSTOS DALGUNHAS GRANDES MAREAS NEGRAS ACONTECIDAS EN EUROPA

Nos últimos trinta anos, a multiplicación de mareas negras provocadas por petroleiros que deron lugar á contaminación do medio natural mariño orixinaron o desenvolvemento progresivo dun marco institucional para a compensación polos danos ocasionados por estes sucesos. Tralo suceso do *Torrey Canion* en 1967, establecéronse dous convenios internacionais: o Convenio sobre Responsabilidade Civil (CRC) de 1969 e o Convenio sobre a constitución dun Fondo de Indemnización de Danos (CID) de 1971. O primeiro establecía un marco de responsabilidade moi rigoroso para os armadores dos buques en caso de accidente, que se limitaba a unha cantidade relacionada coa tonelaxe do buque e asociada a un seguro obrigatorio. O segundo convenio estableceu un fondo suplementario financiado pola industria petrolífera, para a compensación por danos ocasionados por contaminación de hidrocarburos, que non poden ser completamente compensados segundo o réxime da CRC (e, ó mesmo tempo, para indemnizar parte da súa responsabilidade moi rigoroso para os armadores dos buques en caso de accidente, que se limitaba a unha cantidade relacionada coa tonelaxe do buque e asociada a un seguro obrigatorio. O segundo convenio estableceu un fondo suplementario financiado pola industria petrolífera, para a compensación por danos ocasionados por contaminación de hidrocarburos, que non poden ser completamente compensados segundo o réxime da CRC (e, ó mesmo tempo, para indemnizar parte da súa respon-

is devoted to a preliminary analysis of the main factors explaining the divergence between these figures. The paper concludes with a discussion of the changes that can be expected from recent debates in Europe on the evolution of the liability and compensation system.

THE COSTS OF SELECTED MAJOR OIL SPILLS IN EUROPE

In the past thirty years, the multiplication of oil spills from tankers in the marine environment has led to the progressive development of an institutional framework for the compensation of damages arising from these pollution events. After the *Torrey Canyon* incident in 1967, a strict liability-based compensation regime was set up in two international conventions: the Convention on Civil Liability (CLC) of 1969, and the Fund Convention of 1971 (1971 Fund). The former established the strict liability of ship-owners in case of an incident, limited to an amount which is linked to the tonnage of the vessel, and associated to compulsory insurance. The latter established a supplementary fund financed by the oil industry, for the compensation of oil pollution damages that could not be fully compensated under the CLC regime (and, at the time, to also indemnify ship-owners for

sabilidade ó abeiro do CRC). Ó amparo do Convenio sobre o Fondo creouse un organismo internacional, o Fondo Internacional de Indemnización de Danos Debidos á Contaminación por Hidrocarburos (FIDAC), para que administre de xeito unitario e a escala internacional a compensación dos custos ocasionados polos danos producidos pola contaminación[1].

O debate que segue sobre a avaliación e compensación de danos está baseado na análise dos seis accidentes principais que provocaron mareas negras en augas europeas ó abeiro deste réxime, que son os seguintes: o *Amoco Cadiz*, o *Tanio*, o *Mar Exeo*, o *Braer*, o *Sea Empress* e o *Erika*. As principais características destes accidentes resúmense de seguido.

O *AMOCO CADIZ* encallou o 16 de marzo de 1978 fronte á costa norte de Bretaña (Francia). Todo o seu cargamento, constituído por 220.000 toneladas de hidrocarburo, verteuse ó mar, o que provocou a maior marea negra da historia, xa que contaminou 350 km de litoral. Ó abeiro do réxime do CRC daquela época, a responsabilidade do armador limitouse a 77 millóns de francos franceses[2]. As autoridades francesas e os afec-

1. Estados Unidos desenvolveu un réxime diferente de responsabilidade e compensación de danos, independente destes convenios internacionais. Para máis información sobre as diferencias entre este réxime e os convenios sobre o CRC e o FIDAC, véxase De la Rue (1993) e Chao (1996).

2. Fontaine (1993); Francia aínda non ratificara o convenio sobre o Fondo de Compensación que permitía solicitar un fondo a maiores.

part of their liability under the CLC. The Fund Convention set up an international organization, The International Oil Pollution Compensation Fund (IOPC Fund), to administer this unique international regime for the compensation of the costs of pollution damage[1].

The following discussion of damage assessment and compensation is based on the analysis of six major oil spills that took place in European waters under this regime, namely the *Amoco Cadiz*, the Tanio, the *Aegean Sea*, the Braer, the *Sea Empress*, and the *Erika* accidents. The main features of these spills are summarized below.

The *AMOCO CADIZ* went aground on 16 March 1978, off the coast of Northern Brittany in France. All its cargo, 220 000 tons of oil, were lost at sea, causing the largest ever oil spill, with over 350 kilometers of coastline contaminated. Under the CLC regime of the time, the liability of the shipowner was limited to 77 million French Francs (20,4 million 2001 Pounds)[2]. Rather than attempting to establish the

1. The United States have developed a different regime of liability and compensation, outside these international Conventions. For a discussion of how this regime compares to the CLC and IOPC Fund Conventions see De La Rue (1993) and Chao (1996).

2. Fontaine (1993); France had not ratified the 1971 Fund convention providing access to a supplementary Fund.

tados, en vez de tratar de establecer a culpa do armador perante a xustiza francesa, denunciaron a empresa matriz nos tribunais dos Estados Unidos, o que deu lugar a un litixio moi longo e custoso.

Dous anos máis tarde, o 7 de marzo de 1980, o *TANIO* partiu en dous, unha vez máis fronte á costa norte de Bretaña (Francia), no medio dunha forte ondada. Vertéronse 13.500 toneladas ó mar, que contaminaron 200 km do litoral francés, así como as illas británicas de Jersey e Guernsey. O 90% das solicitudes de indemnizacións presentadas a raíz deste accidente estaban relacionadas cos custos de limpeza e recuperación do fuel que tiveron que sufragar as autoridades francesas. Este foi o primeiro sinistro ó que tivo que facer fronte o FIDAC. Neste caso, a responsabilidade do armador limitouse a 11,8 millóns de francos franceses e a aprobación do FIDAC chegou a 244,7 millóns de francos franceses, de acordo co establecido nos convenios. O proceso de avaliación e compensación de danos foi tramitado en moito menos tempo ca no caso do *Amoco*, xa que se conseguiu pagar todas as indemnizacións entre 3 e 5 anos despois do accidente. Parte das cantidades pagadas polo Fondo foron recuperadas nos tribunais por terceiras partes implicadas no accidente.

O *MAR EXEO* encallou na entrada do porto da Coruña o 3 de decembro de 1992. Este buque transportaba 80.000 toneladas de hidrocarburo e descoñécese a cantidade que se verteu ó mar, xa que a maior parte ou ben

ship-owner's fault before French courts in order to overcome the liability limit, the French authorities and the victims took action against the parent company in American courts, leading to a long and costly litigation process.

Two years later, on 7 March 1980, the *TANIO* broke in two off the coast of North Brittany in France, in heavy sea. 13 500 tons of oil were spilt in the marine environment, contaminating 200 kilometers of French coast as well as the British Isles of Jersey and Guernsey. 90% of the claims arising from the spill were related to oil recovery and clean-up costs incurred by the French authorities. This was the first large spill which the IOPC Fund had to deal with. The ship-owner's liability was in this case limited to 11,8 million French Francs (2,5 million 2001 Pounds), and the IOPC Fund's intervention to 244,7 million French Francs (51,4 million 2001 Pounds) under the Conventions. The process of damage assessment and compensation was handled in a much shorter period of time than in the *Amoco* case, with most of the payments being made within three to five years after the accident. Part of the amounts paid by the Fund was recovered in court from third parties involved in the accident.

The *AEGEAN SEA* ran aground at the entrance of the port of La Coruna in Spain on the 3rd of December 1992.

resultou queimada no incendio que se produciu tralo accidente ou ben se dispersou no mar. Aproximadamente 100 km do litoral noroccidental español resultaron contaminados, afectando especialmente ás actividades da pesca e ó marisqueo, que desempeñan un papel moi importante na economía desta rexión. Neste caso, a responsabilidade do armador limitouse a 1121 millóns de pesetas. O proceso de cobro de indemnizacións por parte dos afectados aínda non rematou, xa que se presentaron moitas reclamacións tanto ó abeiro do réxime do CRC coma do FIDAC e tamén perante os tribunais españois.

O *BRAER* encallou o 5 de xaneiro de 1993 ó sur das illas Shetland (Reino Unido). Neste accidente vertéronse 86.500 toneladas de cru, que non chegaron a afectar moito ó litoral gracias ás condicións meteorolóxicas. Sen embargo, si resultaron contaminados 40 km^2 de pastos na costa sudoccidental das illas. Por mor desta marea negra prohibíronse a captura e a venda de pescado e marisco en toda a costa occidental das illas, zona onde a economía depende fortemente da pesca e da acuicultura. A responsabilidade do armador neste caso limitouse a 4,9 millóns de libras esterlinas e o límite da contribución do FIDAC estableceuse en 50,6 millóns de libras esterlinas. O cobro de indemnizacións tramitouse con bastante celeridade perante os tribunais escoceses, de acordo co establecido nos réximes do CRC e do FIDAC ata o terceiro ano despois de se producir a marea negra, cando se presentaron enormes e

The ship carried 80 000 tons of oil, of which an unknown amount was spilt, most of the oil being either burnt in the fire that followed the accident, or dispersed at sea. Approximately 100 kilometers of coastline in North-West Spain were contaminated, with particular impacts on the fishing and shellfishing activities that play an important economic role in this region. The liability of the ship-owner is in this case limited to Pesetas 1 121 million (5,4 million 2001 Pounds). The IOPC Fund intervention is limited to Pesetas 9 513 million (36,8 million 2001 Pounds). Compensation for the damages caused by the accident is on-going, with a large number of claims dealt with both under the CLC and IOPC Fund regime and in Spanish courts.

The *BRAER* went aground on the 5th of January 1993, South of the Shetland islands in the United Kingdom. 86 500 tons of oil were spilt in this accident, with little direct impact on the coastline due to the action of the weather. Some 40 square kilometers of pastures were contaminated on the South-Western coast of the islands. The spill led to a ban on the catch and sale of fish and shellfish along the Western coast of the islands, the economy of which is strongly dependent on the fishing and aquaculture industry. The ship-owner's liability in this case was limited to 4,9 million

numerosas reclamacións contra o FIDAC nos tribunais escoceses. Estas reclamacións orixinaron a interrupción do pagamento de todas as indemnizacións aos solicitantes ata o ano 2000. Un vez rematados os litixios, semella que será posible cobrar as indemnizacións establecidas polo límite do FIDAC.

O *SEA EMPRESS* encallou o 15 de febreiro de 1996 na entrada do porto de Milford Haven, no sur de Gales (Reino Unido). Neste accidente vertéronse 72.000 toneladas de hidrocarburo, que contaminaron 150 km de litoral dunha rexión moi turística e na que se practican moitas actividades de lecer e que ademais ten varias zonas protexidas tanto mariñas coma no interior. Ó igual ca no accidente do *Braer*, impúxose unha prohibición de pesca comercial e deportiva trala marea negra. A responsabilidade do armador limitouse a 7,5 millóns de libras e a contribución do FIDAC ascendeu a 51 millóns de libras. O cobro da maioría das indemnizacións reclamadas a raíz deste accidente tramitouse nun período de tempo relativamente curto, de acordo co establecido nos réximes do CRC e do FIDAC.

O *ERIKA* partiu en dous fronte á costa atlántica de Bretaña (Francia) o 12 de decembro de 1999. Vertéronse ó mar aproximadamente 19.800 toneladas de fuel, que comezaron a chegar á costa a finais do mes de decembro e contaminaron 400 km de litoral. Nestes momentos aínda se está a tramitar o cobro das indemnizacións de acordo co establecido no réxime modificado do CRC e do FIDAC en 1992, que garante

British Pounds (equivalent to 5,7 million 2001 Pounds, based on the official UK price index). The limit to the IOPC Fund's intervention in this case was set at 50,6 million Pounds (62,3 million 2001 Pounds). Compensation operated fairly rapidly under the CLC and IOPC Fund regime, until the third year after the spill, when large claims were logged against the IOPC Fund in Scottish courts. This lead to the interruption of all payments to claimants until 2000. With litigation procedures coming to a conclusion, it appears that compensation will be possible within the Fund limit.

The *SEA EMPRESS* ran aground on the 15th of February 1996, at the entrance of the port of Milford Haven, in South Wales in the United Kingdom. 72 000 tons of oil were spilt in this accident, contaminating 150 km of coastline in a region popular for tourism and recreational activities, and holding several land-based and marine protected areas. As in the *Braer* accident, a ban on commercial and recreational fishing was imposed following the spill. The shipowner's liability was limited to 7,5 million pounds (8,5 million 2001 pounds), and the IOPC Fund's intervention to 51 million pounds (57,9 million 2001 pounds). Compensation of most of the claims arising from this accident was dealt with in a relatively short period of time, under the CLC and IOPC Fund regime.

unhas indemnizacións maiores cás establecidas nos textos orixinais dos convenios. A responsabilidade do armador neste caso limitouse a 84,2 millóns de francos franceses e a contribución do FIDAC ascendeu a 1212 millóns de francos franceses.

Baseándonos en traballos publicados, noutros que non están publicados e que foron realizados a raíz destes accidentes, e en informes dispoñibles sobre o proceso de indemnización por danos provocados polas mareas negras, compilamos estatísticas globais relativas ás cantidades reclamadas e ás indemnizadas, ademais dos cálculos sobre custos das mareas negras, cando estaban dispoñibles. Na táboa 1 resúmense as cifras atopadas para cada un dos accidentes mencionados.

The *ERIKA* broke in two off the Atlantic coast of Brittany in France, on the 12th December 1999. Approximately 19 800 tons of oil were spilt in the marine environment. The oil started reaching the coast at the end of December, polluting 400 kilometers of coastline. Compensation for the damages arising from this accident are currently under way within the revised CLC and IOPC Fund regime of 1992, which provides for higher levels of payments than under the original texts of the Conventions. The ship-owner's responsibility in this case is limited to 84,2 million French Francs (8,1 million 2001 Pounds), and the IOPC Fund's intervention to 1 212 million French Francs (116,8 million 2001 Pounds).

Based on published and unpublished economic studies that were carried out with respect to these accidents, and available reports on the compensation process that followed the spills, we compiled global statistics concerning the amounts claimed and compensated, along with spill cost estimates where these were available. Table 1 (Numbers in tables are written in latin style, that is, 29,92 in english and 287.000 would be 287,000 in english. The editors have maintained this criteria to simplify the tables) summarizes the numbers found for each accident.

Táboa / Table 1

Estimación do custo global, das indemnizacións reclamadas e das indemnizacións pagadas nos seis principais accidentes que provocaron unha marea negra en Europa, a finais do 2001 (millóns de £)

Global cost estimates, compensation claimed and compensation paid in six major oil spills in Europe, at the end of 2001 (£ million)

	Amoco Cadiz	*Tanio*	*Mar Exeo*	*Braer*	*Sea Empress*	*Erika*
Data do accidente Date of acciden	1-3-78	7-3-80	1-12-92	1-1-93	1-2-96	12-12-99
Cantidade de fuel vertido (toneladas) Quantity of oil spilt (tons)	220.000	13.500	80.000	86.500	72.000	19.800
Litoral contaminado (km) Contaminated coastline (km)	350	200	100	40 km²	150-200	400
Duración do proceso de cobro de indemnizacións Duration of compensation process	13 anos	8 anos	≥ 9 anos	8 anos	≥ 5 anos	≥ 2 anos
Número de reclamacións Number of claims	n.d.*	≅ 100	≅ 4600	≥ 2270	≅ 1200	≅ 5600
(a) Estimación do custo global dos danos (a) Estimated global cost of damages	[430,6-496,2]	n.d.*	n.d.*	n.d.*	[68,1-129,3]	[526,2-611,0]
(b) Total das indemnizacións reclamadas (b) Total compensation claimed	469,9	11,7	233,1	154,4	56,0	83,2
(c) Total das indemnizacións aboadas (c) Total compensation paid	91,4	34,3	11,0	57,8	34,7	15,1

*n.d.: non dispoñible.

(a) e (b): valores para o ano en que se produciu a marea negra, convertidos a unidades monetarias de 2001 baseadas nos índices de prezos oficiais para España, Francia e Gran Bretaña, e millóns de £, supoñendo as seguintes cotizacións:

1£ = 10,5521 FF e 1£ = 267,6575 ptas.

(a) = cálculos globais existentes sobre o custo total a terceiros, excluído o custo do cargamento perdido e do buque.

(c): valores na data que se aboaron os pagamentos durante o progreso de cobro de indemnizacións, convertidos a unidades monetarias do ano 2001, baseados nos índices oficiais de prezos para España, Francia e Gran Bretaña.

Fontes:

– *Amoco Cadiz:* compilados das seguintes fontes: anónimo (1982); NOAA (1984); Bonnieux e Rainelli (1991); Henry, comunicación persoal; arquivos da Unión Departamental de Asociacións Familiares de Finistère.
– *Tanio:* compilados dos informes das reunións do FIDAC.
– *Mar Exeo:* compilados do informe anual (2000) e de informes das reunións do FIDAC; (c) = indemnizacións aboadas a finais do ano 2001 polo FIDAC e polo P&I Club.
– *Braer:* compilados do informe anual (2000) e de informes das reunións do FIDAC; (b) = pagamentos realizados polo FIDAC e polo P&I Club a finais de 1995, e reclamacións feitas nos tribunais a principios de 1996; (c) = indemnizacións aboadas a finais de 2001 polo FIDAC e polo P&I Club.
– *Sea Empress:* compilados do informe anual (2000) e dos informes de reunións do FIDAC. O cálculo de danos foi realizado por Moore, L.Y., Footitt, A.J. *et al.* (1998); (b) = número total de reclamacións presentadas ó Fondo e reclamacións perante os tribunais; (c) = indemnizacións aboadas a finais do ano 2001 polo FIDAC e o P&I Club.
– *Erika:* compilados do informe anual (2000) e dos informes de reunións do FIDAC; (b) = número total de reclamacións presentadas ó Fondo; (c) = indemnizacións pagadas a finais do ano 2001 polo FIDAC e polo P&I Club.

*n.a.: not available.

(a) and (b): values for the year of the spill, converted to 2001 monetary units based on official price indexes for Spain, France and Great Britain, and into £ million assuming the following average exchange rates: £1 = FF10,5521 and £1 = Pta267,6575.

(a) = existing global estimates of total cost to third parties, excluding the cost of lost cargo and ship.

(c): values at the date of payments made during the process of compensation, converted to 2001 monetary units based on official price indexes for Spain, France and Great Britain.

Sources

– *Amoco Cadiz:* compiled from the following sources: Anonymous (1982); NOAA (1984); Bonnieux and Rainelli (1991); Henry, personal communication; archives of the Union Départementale des Associations Familiales du Finistère.
– *Tanio:* compiled from IOPC Fund reports of meetings.
– *Aegean Sea:* compiled from IOPC Fund annual report (2000) and reports of meetings; (c) = compensation paid at the end of 2001 by the IOPC Fund and the P&I Club.
– *Braer:* compiled from IOPC Fund annual report (2000) and reports of meetings; (b) = payments by the IOPC Fund and the P§I Club at the end of 1995, and claims in courts early 1996; (c) = compensation paid at the end of 2001 by the IOPC Fund and the P&I Club.
– *Sea Empress:* compiled from IOPC Fund annual report (2000) and reports of meetings. Estimate of damages by Moore L.Y., Footitt A.J. et al. (1998); (b) = total claims to the Fund and claims in courts; (c) = compensation paid at the end of 2001 by the IOPC Fund and the P&I Club.
– *Erika:* compiled from IOPC Fund annual report (2000) and reports of meetings; (b) = total claims to the Fund; (c) = compensation paid at the end of 2001 by the IOPC Fund and the P&I Club.

A información proporcionada nesta táboa confirma que normalmente existe unha diverxencia entre as tres categorías de cifras e o feito de que as cantidades reclamadas e pagadas son normalmente máis baixas cós custos estimados.

Pódense observar resultados similares en relación con efectos máis concretos derivados das mareas negras. De aí que no caso do *Amoco Cadiz* a análise detallada do proceso de avaliación e compensación de danos (Hay e Thébaud, 2003) demostre que, mentres que os custos de limpeza e recuperación do litoral foron calculados en 169,8 millóns de libras esterlinas, só 157,9 millóns foron reclamados en concepto de indemnizacións perante os tribunais, dos que se pagaron ó final soamente 78,6 millóns de libras esterlinas.

Do mesmo xeito, as perdas exclusivamente económicas foron calculadas en 65,5 millóns de libras esterlinas, pero só se reclamaron como indemnizacións perante os tribunais 38,0 millóns, das que só se lles concederon ós solicitantes 11,0 millóns. O custo total da marea negra provocada polo *Amoco Cadiz* no sector turístico foi calculado entre 32,8 e 66 millóns de libras esterlinas. As empresas do sector turístico reclamaron indemnizacións que ascendían a 3,9 millóns perante os tribunais; o Estado francés tamén reclamou indemnizacións de 0,9 millóns de libras esterlinas correspondentes ós pagamentos realizados ó sector turístico trala marea negra (Tribunal do Distrito dos Estados Unidos, 1988). A cantidade finalmente recibi-

Information in this table confirms that there is usually a divergence between the three categories of figures, the amounts claimed and paid being usually lower than the estimated costs.

Similar results can be observed with respect to more specific impacts of oils spills. Hence, in the *Amoco* case, detailed analysis of the process of damage assessment and compensation (Hay and Thébaud, 2003) shows that, while cleanup and restoration costs were estimated at £169,8 million, only £157,9 million were claimed for compensation in court, of which £78,6 million were eventually paid.

Similarly, pure economic losses were estimated at £65,5 million but only £38,0 million were claimed in court, and £11,0 million eventually granted to claimants. The total cost of the *Amoco* oil spill to the tourism industry was estimated at between £32,8 and £66 million. Firms from the tourism industry claimed compensation of approximately £3,9 million in court; the French State also claimed compensation of £0,9 million corresponding to payments made to the tourism industry following the spill (United States District Court, 1988). The final payments received by these claimants were respectively of £0,6 and £0,4 million.

da por estes solicitantes ascendeu a 0,6 e 0,4 millóns de libras esterlinas respectivamente.

Tomando como referencia a cifra menor calculada para o sector turístico, a asignación deste custo pode entón calcularse en 1,1; 0,5 e 31,2 millóns de libras esterlinas para a compañía petrolífera, o Estado francés e as empresas privadas do sector turístico respectivamente.

FACTORES QUE EXPLICAN A EXISTENCIA DE DIVERXENCIAS NO CÁLCULO DOS CUSTOS: ANÁLISE PRELIMINAR

Unha análise máis profunda dos casos estudiados permitiu identificar dúas categorías de factores, que explican as diferencias que existen entre estas cifras en distintas etapas do proceso de avaliación e compensación dos danos producidos pola marea negra. Estes factores refírense a: (i) problemas atopados á hora de determinar os valores económicos das compensacións, (ii) o comportamento estratéxico dos axentes implicados no proceso de pago de indemnizacións.

En primeiro lugar, o contexto en que se levan a cabo os estudios económicos, polo menos os referidos a grandes mareas negras, é normalmente un contexto de crise que require respostas rápidas ó problema da cuantificación de danos baseándose en datos de desigual calidade. Nun contexto coma este, máis ca en calquera outro, a avaliación de danos vese limitada pola dispoñibilidade de información empírica básica sobre as actividades que se viron afectadas e, polo tanto, con con-

Taking the lowest estimate of the total cost to the tourism industry as a reference, the final allocation of this cost can then be calculated as £1,1; £0,5 and £31,2 million for the oil company, the French State and the private firms in the tourism business respectively.

FACTORS EXPLAINING THE EXISTENCE OF DIVERGING COST ESTIMATES: PRELIMINARY ANALYSIS

Further analysis of the case studies allowed to identify two categories of factors explaining the diverging numbers found, at various stages in the process of damage assessment and compensation. These relate to (i) problems encountered in determining the monetary values of compensation; (ii) the strategic behavior of agents involved in the compensation process.

First, at least in large spills, the context in which economic studies are carried out is usually one of crisis requiring quick answers to the question of damage quantification, on the basis of data of variable quality. More than anywhere else, damage valuation in such context is constrained by the availability of basic empirical information on the activities affected, with consequences in terms of cost estimates.

secuencias en termos de cálculos económicos. Ademais, a avaliación e as indemnizacións polos custos orixinados por estas mareas negras realízase nun contexto institucional *ad hoc* seguindo as normas establecidas polos convenios internacionais.

En segundo lugar, a avaliación de danos pode levarse a cabo co obxectivo de establecer unha base para a indemnización ás víctimas, e, neste caso, a información só conta como información no proceso de indemnización de danos. Nos accidentes estudiados, as víctimas individuais manifestaron diversas estratexias con respecto á decisión de reclamar indemnizacións e ás cantidades solicitadas, que poden revelar unha diferencia importante entre o cálculo dos custos, as indemnizacións reais e as cantidades pagadas.

A continuación preséntase un debate sobre ambos os factores.

Problemas de avaliación e limitacións institucionais

Neste nivel están implicados dous tipos de problemas relacionados entre si. En primeiro lugar, os problemas empíricos á hora de aplicar metodoloxías de valoración económica trala marea negra poden axudar a explicar en parte a existencia de diferencias nas estimacións dos custos. En segundo lugar, o contexto institucional no que se tramita a indemnización de danos tamén desempeña un papel clave xa que define practicamente o tipo de danos que poden ser obxecto de indemniza-

Furthermore, the assessment and compensation of costs arising from these oils spills is carried out in an *ad hoc* institutional context following rules established by the international conventions.

Second, while damage valuation may be carried out with the purpose to establish a basis for the compensation of victims, it only enters as information in the compensation process. In the accidents studied, individual victims display various strategies with respect to the decision to claim for compensation and to the amounts claimed, which may lead to substantial divergence between cost estimates, and actual claims and compensation paid.

A preliminary discussion of both factors is presented below.

Valuation problems and institutional constraints

Two sets of related issues are involved at this level. First, empirical problems in applying economic valuation methodologies following the spill can help explain in part the existence of diverging cost estimates. Second, the institutional context in which the compensation of damages is processed also plays a key role as it defines practically the type of damages qualifying

ción e os principios que se aplican á hora de sufragar os seus custos.

Dificultades empíricas á hora de valorar os custos producidos polos danos

Á parte dos custos relacionados coa perda do barco e do seu cargamento, o impacto das mareas negras pode clasificarse dentro dunha das seguintes categorías:

(i) En xeral, incórrese en gastos relacionados coas medidas preventivas e cos traballos de limpeza no litoral. As medidas preventivas adóptanse para evitar que o hidrocarburo chegue á costa e para que se disperse no mar, mentres que os traballos de limpeza pretenden reducir os danos unha vez que o cru chegou ó litoral.

(ii) O petróleo pode contaminar a propiedade pública e a privada, o que comporta unha reducción do seu valor (normalmente medida, para os bens producidos, polos custos de limpeza ou os custos de substitución se a limpeza da propiedade contaminada non é viable; véxase Shavell, 1987).

(iii) As empresas comerciais poden verse afectadas pola contaminación independentemente de se a súa propiedade resultou contaminada ou non, e os consumidores poden verse afectados pola marea ou ben directamente (por exemplo pola perda dalgún dos servicios

for compensation, and the principles applying to their costing.

Empirical difficulties in valuing the costs of damages

Aside from the costs linked to loss of ship and cargo, economic impacts of oil spills can relate to one of several categories:

(i) Expenses are usually incurred in relation to preventive measures and clean-up operations on the coast. The former are taken to prevent oil from reaching the coast and to disperse oil at sea, while the latter aim at limiting damages once the oil has reached the coast.

(ii) Oil may pollute private and public property, entailing a reduction in the value of property (usually measured, for produced goods, by cleanup costs or costs of replacement if cleaning of the polluted property is not feasible; see Shavell, 1987).

(iii) Commercial businesses may be affected by the pollution, independently of whether they own property that has been polluted; and consumers may be affected by the spill either directly, e.g. loss of amenity or health effects

prestados por estas empresas ou pola súa repercusión na saúde dos residentes das zonas costeiras) ou ben indirectamente (por exemplo os efectos da marea negra nos mercados de peixe ou no turismo).

(iv) Por último, os impactos ecolóxicos dunha marea negra poden provocar cambios no benestar das persoas, xa que normalmente levan á instauración de medidas que implican custos e que intentan acelerar o proceso da recuperación ecolóxica (e limitar as perdas de benestar) producido trala contaminación.

O enfoque xeral para valorar os danos *individuais* provocados por un accidente en calquera destas categorías semella bastante simple. En principio, debería basearse na información económica individual relativa ás características e ás actividades de cada axente e á relación cos mercados de bens e servicios na economía afectada pola marea negra (véxase por exemplo Ward e Duffield, 1992). Comparando só datos observados antes, durante e despois dun episodio típico de contaminación por marea negra co que puido ocorrer se non se producise, teoricamente é posible establecer cambios individuais no benestar debidos ó episodio de contaminación. En relación cos cambios non relacionados con actividades mercantís, pode recorrerse a metodoloxías de valoración específicas (véxase por exemplo Bonnieux e Rainelli, 1991, para o caso do *Amoco Cadiz* e Moore

for coastal residents, or indirectly, e.g. impacts of the pollution event on markets for fish food or tourism.

(iv) Finally, the ecological impacts of an oil spill may in themselves entail welfare changes. Such impacts often lead to undertake reinstatement measures attempting, at some cost, to accelerate the process of ecological restoration (and limit the welfare losses) following a pollution event.

The general approach to valuing *individual* damages caused by an accident in any of these categories appears fairly straightforward. In principle, it should be based on individual economic information concerning each agent's characteristics and activities, and how they relate to markets for goods and services in the economy impacted by the spill (see e.g. Ward and Duffield, 1992). By comparing what is observed before, during and after the spill to a baseline scenario of what should have taken place had the spill not occurred, it is then theoretically possible to establish individual welfare changes due to the pollution event. For non-market changes, recourse to specific valuation methodologies may be warranted (see e.g. Bonnieux and Rainelli (1991) for the *Amoco Cadiz*, and Moore L.Y.,

L.Y., Footitt, A. J. *et al.*, 1998, para o caso do *Sea Empress*).

Na práctica, este enfoque enfróntase a dúas dificultades empíricas importantes que en parte explican a existencia de cálculos diferentes dos custos dos danos.

1. Ausencia de información empírica

En primeiro lugar, na maioría dos casos estudiados, a valoración de danos enfróntase a unha falta de fundamento empírico axeitado, xa que a información que se precisa ou ben é demasiado fragmentaria ou ben é demasiado difícil obter a de todos os axentes afectados nas áreas contaminadas, sobre todo no caso dos datos económicos básicos. Nos casos en que se levaron a cabo estudios económicos do valor dos danos, a falta de información económica a nivel individual levou con frecuencia ós autores a empregar métodos de valoración baseados en supostos globais sobre a estructura económica dunha actividade determinada. Por exemplo, no caso do *Amoco Cadiz*, a falta de información detallada sobre o nivel de actividade económica de empresas que traballan no sector turístico obrigou os economistas a empregar indicadores relativos ós salarios pagados polas empresas ou ás vendas locais de fariña para avaliar o impacto global da marea negra neste sector. Un enfoque similar requiriuse no caso da acuicultura, xa que non existen datos individuais sobre empresas implicadas neste tipo de producción.

Footitt A.J. et al. (1998) in the *Sea Empress* case).

In practice, the approach is confronted to two major empirical difficulties which partly explain the existence of diverging estimates of the costs of damages.

1. Lack of empirical information

First, in most of the cases studied, valuation of damages is confronted with a lack of adequate empirical foundation, the information needed being either too fragmentary, or too costly to collect for all the agents affected in all the areas impacted by the spill. This seems to be particularly the case for basic economic data. In those cases where economic studies of the value of damages were carried out, the lack of economic information at the individual level often led authors to use indirect valuation methods, based on global assumptions about the economic structure of a particular activity. For example, in the case of the *Amoco Cadiz*, lack of detailed information on the level of economic activity of firms operating in the tourism industry led economists to use indicators such as wages paid by firms or local sales of flour to assess the global impact of the oil spill on this sector. A similar approach was required in the case of the shellfish growing industry, in the

2. Elección do escenario de partida "sen marea negra"

Aínda que se dispoñía de información económica no ámbito individual, os resultados da avaliación resultan bastante sensibles á elección do escenario de partida sobre o que podería ter acontecido se non se producise a marea negra. Isto ocorre sobre todo no caso dos cambios económicos debidos á contaminación que son de ámbito limitado, en comparación cos procesos económicos e ecolóxicos claves que determinan a dinámica das actividades na zona contaminada. A partir da análise dos casos estudiados, dedúcese que pode resultar especialmente difícil distinguir os efectos locais da marea negra doutros factores de variación nos ecosistemas (por exemplo factores meteorolóxicos ou factores hidrolóxicos que afectan ós bancos de pesca) e das actividades humanas (por exemplo fluctuacións nas divisas, que afectan ó sector turístico nos ámbitos nacional e internacional). Como consecuencia disto, resulta difícil seleccionar un de varios supostos baseados nas probas dispoñibles, aínda que estes supostos produzan cambios significativamente diferentes en termos de custos dos danos avaliados.

absence of individual data on companies involved in this production.

2. Choice of the baseline scenario "without spill".

Even where economic information is available at the individual level, results of the assessment prove highly sensitive to the choice of the baseline scenario on what would have occurred had the spill not taken place. This is all the more the case as economic changes due to pollution are of limited scale, in comparison to key ecological and economic processes determining the dynamics of activities in the polluted area. From the analysis of the case studies, it appears that it may prove particularly difficult to distinguish local effects related to the spill from other factors of variation in ecosystems (e.g. meteorological factors or hydrological factors affecting fisheries) and human activities (e.g. fluctuations in exchange rates affecting the tourism industry at national or European level). The consequence is that it may prove difficult to select one of several assumptions based on the available evidence, although these assumptions lead to significantly different results in terms of costs of the damages assessed.

3. A elección de metodoloxías de valoración

Nalgúns casos, unha variación adicional no cálculo de custos na etapa de avaliación pode xurdir da elección das propias metodoloxías de valoración, máis ca a partir de cuestións relacionadas coa dispoñibilidade de datos ou da elección do escenario. Isto ocorre especialmente coa valoración dos impactos das mareas negras non relacionados con actividades económicas, para os que se poden aplicar diferentes metodoloxías. Dado que estes danos non foron tidos en conta nas normas de cobro de indemnizacións aplicadas ós casos estudiados (por razóns diferentes ás dificultades de avaliación, véxase o seguinte apartado), semella que os debates sobre este aspecto seguiron sendo sobre todo académicos nestes casos, o cal tivo como consecuencia a producción de cálculo de intervalos de custos mais non de cantidades exactas.

Normas establecidas para o pagamento de indemnizacións

Agás no caso do *Amoco Cadiz*, as indemnizacións pagadas polos danos producidos nos casos estudiados foron levadas a cabo ó abeiro do establecido nos convenios do CRC e do FIDAC, que definen diversas normas e diversos procedementos para a tramitación de reclamacións.

Estas normas e estes procedementos explican en parte a diferencia entre o cálculo dos custos, as cantidades reclamadas e as

3. The choice of valuation methodologies

In some cases, additional variation in cost estimates at the assessment stage may arise from the choice of valuation methodologies themselves, rather than from issues of data availability or choice of scenario. This seems to be particularly the case with respect to the valuation of the non-market impacts of spills, for which different methodologies can be applied. To the extent that such damages were not taken into account in the compensation rules applied to the cases studied (for reasons other than assessment difficulties, see infra), it appears that debates on this aspect of the assessment remained mostly academic in those cases, the only consequence being the production of bracket, rather than target, cost estimates.

Established rules for compensation

Except for the *Amoco* case, compensation for the costs of damages in the cases studied was carried out under the CLC and IOPC Fund Conventions, which define a number of rules and procedures for the treatment of claims.

These rules and procedures partly explain the divergence between cost

que se pagaron finalmente ás víctimas das mareas negras consideradas neste estudio. Pódense usar dous exemplos para demostrar isto. O primeiro refírese á interpretación da noción de dano producido pola contaminación e o segundo ás consecuencias da limitación dos pagamentos previstos polos convenios.

1. *Definición de dano orixinado pola contaminación*

O sistema de indemnizacións funciona baseándose nunha definición da noción de "dano orixinado pola contaminación", que serve para delimitar o alcance das reclamacións admisibles[3]. Tal como insistiu Jacobsson (1993, p. 48), mentres que a definición de "dano orixinado pola contaminación" (tal como o expresan os convenios do CRC e do FIDAC orixinarios) non estaba totalmente clara, o FIDAC desenvolveu determinados principios relativos á interpretación deste termo na práctica, baseados na experiencia. En concreto, os debates sobre este asunto con respecto ás reclamacións determinadas e en grupos de traballo tempo-

3. O termo defínese nos convenios de 1992 como "perda ou danos causados fóra do buque pola contaminación resultante do escape ou da descarga de hidrocarburos procedentes dese buque, en calquera lugar onde se produza tal escape ou descarga, a condición de que a indemnización por deterioración do medio natural que non sexa a perda de beneficios resultante da devandita deterioración estará limitada ó custo das medidas razoables de restauración efectivamente tomadas ou que se vaian tomar" (*Manual de reclamaciones* do FIDAC de 1992).

estimates, the amounts claimed, and those eventually paid to the victims of the oil spills considered in this study. Two examples can be used to illustrate this. The first relates to the interpretation of the notion of pollution damage; the second to the consequences of the limitation of payments instituted by the Conventions.

1. *Definition of pollution damage*

The compensation system operates on the basis of a definition of the notion of pollution damage which serves to delimit the domain of admissible claims[3]. As stressed by Jacobsson (1993, p48), while the definition of 'pollution damage' under the original CLC and Fund Conventions was not entirely clear, the IOPC Fund developed certain principles as regards the interpretation of this term in practice, based on its experience. In particular, debates on this issue with respect to particular claims and in intersessional working

3. The term is defined in the 1992 conventions as "loss or damage caused outside the ship by contamination resulting from the escape or discharge of oil from the ship, wherever such escape or discharge may occur, provided that compensation for impairment of the environment other than loss of profit from such impairment shall be limited to costs of reasonable measures of reinstatement actually undertaken or to be undertaken" (1992 IOPC Fund claim manual).

rais do Fondo[4] deron lugar ó establecemento de determinados principios relativos ás reclamacións debidas a perdas estrictamente económicas e por danos ecolóxicos.

Ao abeiro do establecido polo sistema do FIDAC, as reclamación por perdas estrictamente económicas (por exemplo perdas de ingresos sufridas por persoas con propiedades que non resultaron contaminadas) poden ser aceptadas só se existe un grao razoable de proximidade entre o suceso que provocou a contaminación e o prexuízo polo que se formula a reclamación. Este factor, entre outros, é avaliado en termos de proximidade xeográfica entre a actividade desenvolvida polo demandante, a contaminación producida e o grao de integración da actividade desenvolvida polo demandante na economía da zona afectada polo vertido. Este feito pode levar a rexeitar reclamacións de indemnizacións de empresas que teñen a súa sede moi lonxe do lugar onde se produciu o vertido ou que non contribúen substancialmente á economía local, independentemente da capacidade que teñen as empresas de estableceren un vínculo causal entre a contaminación e o prexuízo económico[5].

4. Véxanse os informes do 7º grupo de traballo do Fondo, dedicados á análise de criterios xerais de admisión de reclamación de indemnizacións, publicados polo FIDAC en 1993 e 1994.

5. No caso do *Sea Empress*, por exemplo, as demandas formuladas polos mariscadores e polas conserveiras de marisco que desenvolvían a súa actividades a varios centos de quilómetros do lugar onde se produciu a marea negra foron desbotadas en aplicación deste principio.

groups of the Fund[4] have led to the establishment of certain principles as regards claims for pure economic loss, and for ecological damage.

Under the IOPC Fund system, claims for pure economic loss (ie loss of earning sustained by persons whose property has not been polluted) may be accepted only if there is a reasonable degree of proximity between the contamination and the prejudice for which compensation is claimed. Amongst other factors, this is assessed in terms of the geographical proximity between the activities of the claimant and the contamination, and the degree of integration of the claimant's activity in the economy of the area affected by the spill. This can lead to reject the claims for compensation of firms that are either based too far away from the spill area, or that do not contribute substantially to the local economy, independently of the capacity for the firms to establish a causal link between the contamination and an economic prejudice[5].

4. See reports of the 7th working group of the Fund, devoted to the analysis of general criteria for the admissibility of claims for compensation, published by the IOPC Fund in 1993 and 1994.

5. In the *Sea Empress* case, for example, claims for shellfish dealers and processors based several hundred kilometers away from the spill area were rejected in application of this principle.

Por outra banda, ó abeiro do establecido polo sistema do FIDAC, as demandas relacionadas cos danos ecolóxicos son aceptadas se se poden medir en termos de custos económicos contraídos en conxunción con medidas (razoables) de recuperación do contorno trala marea negra. Isto implica que non se poden aceptar as reclamacións por danos sen mercado baseadas no uso de técnicas de valoración (como por exemplo o método do custo da viaxe ou a valoración continxente) ou baseadas en cálculos globais dos custos dos cambios no ecosistema empregando técnicas de transferencia de beneficios (tal como foron calculados no estudio de valoración económica global no caso do *Sea Empress*)[6]. Un problema similar ten que ver con outros custos non monetarios, como as perdas de actividades de lecer[7]. Unha condición para que poidan aceptarse as demandas é que procedan de axentes que efectivamente soportaron os custos de medidas de recuperación do contorno. Un problema semellante xurdiu no caso do *Amoco Cadiz*, que foi xulgado nun tribunal dos

Under the IOPC Fund system, claims related to ecological damage are accepted if they can be measured in terms of financial costs incurred in association with (reasonable) measures of re-instatement of the environment following a spill. This implies that claims for non market losses based on the use of valuation techniques such as the travel cost method or contingent valuation, or on global estimates of the costs of ecosystem changes using benefit transfer techniques (such as were calculated in the global economic valuation study carried out in the *Sea Empress* case) can not be accepted[6]. A similar problem applies to other non monetary costs such as losses of amenity and recreational benefits[7]. A related condition for claims to be acceptable is that they originate from agents who effectively supported financial costs in relation to reinstatement measures. A similar issue arose in

6. Nunha resolución adoptada pola Asemblea Xeral do FIDAC na súa sesión extraordinaria de outubro de 1980, chegouse ó acordo de que as indemnizacións que debía pagar o FIDAC non deberían basearse na "cuantificación abstracta dos danos calculados de acordo con modelos teóricos".

7. Por exemplo, no caso do *Erika*, o custo da marea negra para as persoas que practicaban a pesca deportiva foi calculado por Bonnieux e Rainelli (2003) en aproximadamente 100 millóns de euros, como se revisa no capítulo anterior deste libro. Este custo non é tido en conta polo sistema internacional de responsabilidade civil e compensación por danos producidos polas mareas negras.

6. In a resolution adopted by the General Assembly of the Fund in its first extraordinary session in October 1980, it was agreed that compensation payable by the Fund should not be based on « abstract quantification of damage calculated in accordance with theoretical models».

7. For example, in the *Erika* case, the cost of pollution to recreational fishermen was estimated by Bonnieux and Rainelli (2003) at approximately 100 million euros. This cost is not taken into account by the international liability and compensation system of oil spill damages.

Estados Unidos. Neste caso, a reclamación de 160 millóns de francos franceses de 1978 (equivalentes a 42,4 millóns de libras esterlinas con valor de 2001) por parte das administracións locais, en concreto pola perda de biomasa provocada pola marea negra, foi rexeitada xa que esta biomasa foi considerada *res nullius* polo xuíz, dado que non existía ningún demandante lexítimo ó que se lle puidese pagar esa indemnización.

2. Os efectos das compensacións limitadas

A existencia dun límite global nas cantidades que paga o FIDAC converteuse nun atranco no proceso de cobro de indemnizacións cando se produciron mareas negras moi grandes. O principio aplicado nestes casos consiste en que todos os demandantes reciben o mesmo tratamento con respecto ás consecuencias destas limitacións ás súas reclamacións individuais. Na práctica, isto implica que as reclamacións aceptadas reciben unha indemnización correspondente a unha porcentaxe máxima definida pola proporción do límite da cantidade total indemnizable con respecto a todas as reclamacións aceptadas. No caso do *Tanio,* este método de pagamento tivo como consecuencia que só se aboasen dúas de cada tres indemnizacións das reclamacións aceptadas. En accidentes máis recentes como os do *Mar Exeo* ou do *Erika,* o feito de prever que se podería exceder o límite por pagamento deu lugar a que o FIDAC limitase as indemnizacións ás primeiras etapas do proceso de pagamento destas, ata que se chegou á certeza de

the *Amoco Cadiz* case, which was dealt with in American court. In this case, the claim for 160 million 1978 French Francs (42,4 million 2001 Pounds) by the local authorities in relation to lost biomass due to the spill was rejected since this biomass was considered *res nullius* by the judge, hence no legitimate claimant existed to whom such compensation could have been paid.

2. The impact of limited compensation

The existence of a global limit to the amounts payable by the IOPC Fund has only become a constraint on the compensation process in very large oil spills. The principle applied in these cases is that all claimants should be treated equally with respect to the consequence of this limitation on their individual claims. In practice, the implication is that accepted claims are only compensated up to a percentage defined by the ratio of the global payment limit to the total accepted claims. In the case of the Tanio, this led to payments of two thirds only of the accepted claims. In more recent accidents such as the cases of the Aegean Sea or the *Erika*, anticipating that the payment limitation might be exceeded has led the Fund to limit payments in the early stages of the compensation process, until it became fairly certain what the total amount

cal sería a cantidade total que pagaría o FIDAC e a porcentaxe de reclamacións aceptadas que recibiría a indemnización.

payable by the fund would be, and what final percentage of accepted claims could be safely paid.

Actitudes estratéxicas dos axentes implicados no proceso de pagamento de indemnizacións

Strategic behavior of agents involved in the compensation process

Un segundo factor importante que explica a diverxencia entre os cálculos de custos, as indemnizacións solicitadas e as cantidades aboadas finalmente está relacionado co comportamento dos axentes implicados no proceso de pagamento de indemnizacións. Este comportamento refírese tanto á decisión por parte das víctimas de solicitar indemnizacións coma á repercusión nas demandas das limitacións en canto á proba material dos danos.

A second important factor explaining the divergence between cost estimates, claims and final payments relates to the behaviour of agents involved in the compensation process. This concerns both the decision by victims to claim compensation, and the impacts on claims of constraints relating to the material proof of damage.

A decisión de solicitar indemnizacións

The decision to claim for compensation

De acordo co réxime do FIDAC, as solicitudes de indemnizacións son consideradas individualmente, aínda que os demandantes traballen como un colectivo para solicitar as indemnizacións[8]. A un demandante esíxelle que demostre a súa reclamación presentando varios documentos que apoien a súa demanda (Jacobsson, 1993, p. 47). A análise de distintos casos demostra que a cantidade global de indemnizacións reclamadas polas víctimas de mareas negras tende a ser, en xeral, máis baixa có calculo total de custos orixinados

Under the IOPC Fund regime, claims for compensation are treated individually, although claimants can work collectively to establish their claims[8]. A claimant is required to prove his claim by producing various documents to support his position (Jacobsson, 1993, p47). The analysis of the case studies shows that the global amount of compensation claimed for by victims of oil spills tends to be regularly lower than the total cost estimates aris-

8. Coma no caso do *Amoco Cadiz*.

8. As in the *Amoco* case.

nos estudios de valoración. Agás nos casos en que os estudios de valoración son empregados explicitamente para presentar demandas de indemnizacións, ocorre o mesmo cos danos específicos sufridos polas víctimas.

Un simple modelo da decisión de solicitar indemnizacións cando se ven afectados por unha marea negra pode ser postulado para explicar este caso[9]. A decisión pode ser interpretada en función de:

– Os custos anticipados que deben sufragar as víctimas particulares á hora de presentar unha reclamación. Estes custos poden ser de carácter económico (por exemplo os custos ocasionados polo asesoramento xurídico ou de expertos, dos que dependen algúns dos resultados dos procedementos de pagamento de indemnizacións)[10] e en termos de tempo e molestias que implican.
– Os beneficios que esperan as víctimas particulares do procedemento, que están en función de oportunidades de éxito anticipadas ou do nivel de indemnizacións esperadas se prospera a reclamación.

ing from valuation studies. Except where valuation studies are used explicitly as a basis for establishing claims for compensation, the same applies to specific damages sustained by victims.

A simple model of the decision to claim compensation when affected by an oil spill can be postulated to explain this[9]. The decision can be interpreted as a function of:

– the anticipated costs to be supported by individual victims when making a claim. These costs can be financial (e.g. costs of legal assistance or of expertise, some of which may depend on the outcome of the compensation procedure)[10], and in terms of the time and trouble involved;
– the benefits expected by individual victims from the procedure, these being a function of the anticipated chances of success, and of the level of compensation expected if the claim is successful.

9. Véxase Shavell (1987, cap. 11) para un debate sobre este tema no contexto da lexislación que afecta ós accidentes.

10. De acordo coas normas do FIDAC, os custos económicos sufragados para tramitar reclamacións poden ser solicitados polo menos en parte para a súa devolución polo FIDAC.

9. See Shavell (1987, chap. 11) for a discussion of this issue in the context of accident law.

10. Under the IOPC Fund rules, the financial costs incurred to substantiate claims may at least partly be claimed back from the Fund.

Os demandantes potenciais poden abandonar a idea de solicitar indemnización cando os beneficios esperados exceden os custos esperados. Mentres que este problema semella ser un elemento importante á hora de comprender por que os cálculos difiren das solicitudes de indemnizacións nos casos estudiados, houbo un número limitado de estudios empíricos que trataron de cuantificar o seu papel na práctica[11].

Os custos e os beneficios anticipados polas víctimas a título individual con respecto á solicitude de indemnizacións poden verse influídos por varios elementos que pertencen ó contexto en que se adoptan as decisións. Estes elementos inclúen as normas que definen os procedementos de pagamento de indemnizacións, o nivel de información das víctimas sobre estas normas, a posibilidade de que as persoas se beneficien e reciban influencias por axuda externa e a capacidade que teñen os afectados de traballar coma un colectivo á hora de presentar as reclamacións, aínda que estas se presenten de xeito individual.

As estratexias agrupadas en relación coa presentación de reclamacións, como a creación dunha asociación de afectados ou a representación de diversos afectados por unha soa consultora, permiten que os afectados dispoñan de mellor información e da posibilidade de que se poidan compartir os

11. Véxase por exemplo Hay, Thébaud *et al.*, 2002, para unha análise do caso *Erika*.

Potential claimants may abandon the idea of claiming compensation, where the expected benefits exceed the expected costs. While this problem seems an important element in understanding why cost estimates differ from compensation claims in the cases studied, there has been a limited number of empirical studies attempting to quantify its role in practice[11].

The costs and benefits anticipated by individual victims with respect to claiming compensation may be influenced by various elements pertaining to the context in which such decisions are taken. These elements include the rules defining compensation procedures, the level of information of victims on these rules, the possibility for individuals to benefit from and be influenced by external assistance, and the capacity of victims to work collectively in establishing their claims, even if these are then submitted individually.

Grouped strategies as regards the establishment of claims, such as the creation of an association of victims, or the representation of several victims by a single consulting firm allow better information of the victims, and a possibility for representation costs to be shared. But the existence of these

11. See e.g. Hay, Thébaud et al., 2002 for an analysis in the *Erika* case.

gastos de representación. Pero a existencia destas iniciativas depende da capacidade dos axentes individuais de comprometer ós demais nunha acción colectiva. A análise dalgúns casos demostrou que esta actuación pode resultar difícil na práctica cando o número de axentes implicados é alto e (ou) cando os axentes se ven afectados de xeito bastante heteroxéneo polo suceso da marea negra[12].

Tamén semella que nalgúns casos os demandantes potenciais prevén que terán poucas posibilidades de triunfar á hora de probaren que existe un vínculo directo entre a marea negra e os danos que tiveron que sufrir, especialmente cando as súas actividades se levan a cabo lonxe da zona que resultou contaminada ou lonxe da cadea de actividades económicas afectadas pola poboación. Isto afecta especialmente ó sector servicios en ramas como o turismo ou a comercialización de productos mariños.

A existencia dunha indemnización limitada de acordo co convenio do FIDAC tamén repercute na decisión de presentala. No caso de grandes mareas negras, aínda que algunhas víctimas se puidesen inclinar por solicitar indemnizacións excesivas, a anticipación da norma *pro rata* que se describiu anteriormente tamén disuadiu a algúns afectados á hora de presentar a reclamación, tendo en conta que as necesidades

12. Véxase Hay e Thébaud, 2003, para un debate no caso do *Amoco Cadiz*.

initiatives depends on the capacity for individual agents to engage in collective action. Analysis of the case studies showed that this may prove difficult in practice when the number of agents concerned is high and/or when the agents are affected in a fairly heterogeneous way by the pollution event[12].

It also appears that in a number of cases, potential claimants anticipate that they have little chances of being successful in proving the existence of a direct link between the oil spill and the damages they may have sustained, particularly when they are located far from the polluted area, or far down the chain of the economic activities affected by the pollution. This seems to be particularly the case for the service industry, in sectors such as tourism or trading in seafood products.

The existence of limited compensation under the IOPC Fund Convention also has an impact on the decision to make a claim. Whereas it could, in the case of very large oil spills, incline some victims to claim excessive amounts of compensation, anticipating the pro rata rule as described before, it has also constrained some victims to make a claim, considering other persons needed priority. In the aftermath of the *Erika* oil spill,

12. See Hay and Thébaud, 2003, for a discussion of this issue in the *Amoco* case.

doutras persoas eran prioritarias. No período que seguiu á marea negra do *Erika*, tanto o Estado francés como a empresa Total Fina Elf anunciaron que non solicitarían indemnizacións polos gastos realizados mentres as víctimas individuais non fosen totalmente indemnizadas, tal como anunciou o Estado inglés trala marea negra do *Braer*.

Asimetría da información e probas dos danos

As variacións no cálculo dos custos (xunto coa elección de escenarios base), os supostos feitos cando faltan datos individuais ou a elección dunha metodoloxía de valoración económica tamén teñen consecuencias directas na presentación de reclamacións de indemnizacións. Dada a natureza controvertida do proceso de pagamento de indemnizacións, a incerteza polo pagamento de danos aumenta a posibilidade de utilizar cifras de xeito estratéxico. Como consecuencia disto, normalmente esíxeselle ó demandante que achegue probas para demostrar os danos sufridos e para xustificar a cantidade solicitada. Canto mellor sexa a calidade das probas achegadas, máis oportunidades ten de que a reclamación sexa aceptada.

both the French state and TotalFina Elf company announced they would not ask compensation for the costs incurred as long as private victims were not fully compensated, as announced the English state after the *Braer* oil spill.

Information asymmetry and proof of damage

Variations in cost estimates, linked either to the choice of the baseline scenario, to the assumptions made where individual data is lacking or to the choice of an economic valuation methodology, also have direct consequences on the presentation of claims for compensation. Given the debated nature of the compensation process, uncertainty in the costing of damages increases the possibility of using numbers strategically. As a consequence, it is usually required from the claimant to produce pieces of evidence in order to prove the damage and to justify the amount claimed. The better the quality of the evidence provided, the higher the chances that the claim will be accepted.

In practice, this can introduce a degree of heterogeneity in the status of claims, some of them (clean up and removal costs for instance) being more likely to be well documented (in terms of both existence and extent of the cost) than others (e.g. pure economic

CONCLUSIÓN

A análise preliminar do proceso de avaliación e compensación de danos que seguiu ós seis principais episodios de mareas negras acontecidos en augas europeas confirma que pode resultar difícil chegar a un acordo sobre un só cálculo dos custos dunha marea negra na práctica. Como consecuencia disto, semella que unha parte dos custos calculados a partir dunha marea negra non se internaliza a través do sistema de responsabilidade civil internacional.

Dúas categorías de factores axudan a comprender por que ocorre isto: (i) as dificultades empíricas e as normas reguladoras relativas á contabilidade dos danos e (ii) as actitudes estratéxicas dos axentes implicados no proceso de pagamento de indemnizacións. Estes factores non son independentes. O feito de medir as dificultades representa a posibilidade de empregar cifras estratexicamente, e de aí o recurso a varios procedementos para tramitar as reclamacións, que poden influír nas decisións individuais de solicitar indemnizacións.

Este coñecemento resulta esencial nos debates sobre a eficacia das normas de responsabilidade civil "na práctica". Ademais dunha investigación maior sobre a importancia das diferentes cifras que xorden dunha marea negra particular, unha investigación máis profunda da influencia destes factores proporciona un marco de referencia analítico moi útil para avaliar as posibles consecuen-

losses), and the latter being more difficult to sustain as a result.

CONCLUDING REMARKS

Preliminary analysis of the process of damage assessment and compensation following six major oil spills in European waters confirms that it may prove difficult to agree on a single estimate of the costs of an oil spill in practice. The consequence appears to be that part of the estimated costs of the spill are not internalized via the international liability system.

Two categories of factors help to understand why this may occur: (i) empirical difficulties and regulatory rules as regards the costing of damages, and (ii) the strategic behavior of agents involved in the compensation process. These factors are not independent. Measurement difficulties make for the possibility to use numbers strategically, hence the recourse to various procedures for substantiating claims, which may themselves influence individual decisions to claim compensation.

Such knowledge is essential in discussions concerning the effectiveness of liability rules *in practice*. In addition to greater insight regarding the signification of the different numbers that arise from any particular spill, further exploration of the influence of these

cias dos debates sobre a revisión do sistema actual de responsabilidade civil e compensación por danos.

En primeiro lugar, trala marea negra do *Erika*, o debate centrouse concretamente en dous aspectos do réxime de indemnizacións:

- Aumento das cantidades máximas pagadas por responsabilidades civís dispoñibles para unha determinada marea negra; un aumento da responsabilidade máxima actual nun 50% será implantado en novembro de 2003, e a creación dun nivel complementario de carácter voluntario está sendo obxecto de debate non só no FIDAC. Esta cantidade pode reducir a posibilidade de que, en mareas negras excepcionalmente custosas, a suma de custos indemnizables supere o límite por responsabilidade civil dispoñible.
- A definición e a interpretación das categorías de custos aceptados polo sistema internacional. Os debates centráronse especialmente na interpretación dos custos relativos ós danos ecolóxicos (custos de avaliación de danos de medidas de recuperación en particular). A ampliación das categorías de danos aceptados que son susceptibles de recibiren indemnizacións poden permitir que se responda nunha maior proporción dos custos das mareas negras, independentemente da magnitude global dos danos causados.

factors provides a useful analytical framework to assess the possible consequences of current debates on the revision of the existing liability and compensation system.

First, following the *Erika* spill, debate has centred in particular on two aspects of the compensation regime:

- Increase of the maximum liability payments available for any particular spill: an increase of the existing maximum liability by 50% will be effective in November 2003, and the creation of a complementary level on a voluntary basis is currently being discussed within IOPC. This can reduce the possibility that, in exceptionally costly spills, the sum of compensable costs be above the available liability limit;
- Definition and interpretation of the categories of costs accepted for consideration by the international system: discussions have in particular focused on the interpretation of costs related to ecological damage (costs of damage assessment and restoration measures in particular). Extending the categories of damages accepted for compensation under the existing regime can allow a greater proportion of the costs of oil spills to be internalized, irrespective of the global magnitude of damages caused.

Unha segunda dimensión dos debates que seguiron a recentes episodios de mareas negras, polo menos en Francia, ten que ver coa calidade dos sistemas nacionais en vigor para o control dos ecosistemas e das actividades costeiras. Aínda que sempre quedará un grao de descoñecemento no exercicio de valoración dos impactos ecolóxicos e económicos dunha marea negra, a mellora da calidade da información básica que se pode empregar nestas valoracións pode desempeñar un papel moi significativo. Á hora de limitar as incertezas sobre este problema hai que ter en conta a posibilidade de que as devanditas actividades de control permanente sexan polo menos consideradas á hora de avaliar os custos da contaminación.

Por último, os primeiros resultados deste estudio tamén apuntan a importancia de medidas de acompañamento que teñen como obxectivo mellorar a información recibida polos demandantes sobre o proceso de pagamento de indemnizacións e facilitar a presentación de reclamacións (conciliación) nun funcionamento axeitado do sistema de responsabilidade civil.

A second dimension of the debates that followed recent spills, at least in France, has to do with the quality of national systems in place for the monitoring of coastal ecosystems and activities. While there will always remain a degree of unknown in the exercise of valuing the ecological and economic impacts of a spill, improving the quality of baseline information that can be used in such assessments can play a significant role in narrowing uncertainty around the estimates, and limiting the ensuing difficulties in dealing with compensation claims. An issue here concerns the possibility that such permanent monitoring activities be at least partly taken into account in assessing the costs of pollution.

Finally, the first results of this study also point to the importance of accompanying measures that aim at improving the information of claimants on the process of compensation, and at easing the settlement of claims (conciliation), in the proper functioning of the liability system.

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SEGUNDA PARTE: A SITUACIÓN ACTUAL
SECOND PART. THE CURRENT SITUATION

ESTRATEXIA ANGLOSAXONA FRONTE A ESTRATEXIA LATINA DE AVALIACIÓN DE IMPACTOS: O CASO DA RIADA TÓXICA EN DOÑANA (1998)

ANGLO-SAXON AS COMPARED TO LATIN STRATEGIES FOR IMPACT ASSESSMENT: THE CASE OF THE TOXIC FLOOD IN DOÑANA (1998)

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Entre a xente grega de mar hai un vello dito: "O biscoito máis duro tócalle sempre ó mariñeiro con menos dentes". Penso que, entre as intervencións programadas neste intenso seminario, a miña é "o biscoito máis duro" e, entre os meus distinguidos colegas, eu son o máis desdentado. Pídolles, xa que logo, benevolencia, desexando vivamente que a miña intervención teña, polo menos, unha miguiña de verdadeiro interese para cada un de vostedes, ós que, anticipadamente, lles agradezo a súa presencia.

O título deste relatorio, proposto polos meus colegas da Universidade de Vigo e que eu acepto con gusto, vén dunha pescuda contida no artigo titulado "Renta y Naturaleza en Doñana" escrito por Pablo Campos e mais eu mesmo no rebufo do grave asolagamento tóxico acontecido no contorno protexido do Parque Nacional de Doñana (1998, abril) e publicado na revista *Mundo Científico* (Campos e Linage, 1998). Alí, cunha explícita e inevitable simplificación, caracterizáronse dúas reaccións ou respostas xurídico-políticas e sociais á hora de enfron-

There is an old saying among seagoing Greeks: "The sailor with the fewest teeth always gets the hardest biscuit". I believe that, of the various talks programmed for this intensive seminar, mine is the "hardest biscuit" and among my distinguished colleagues, I am the most toothless. So I ask for your indulgence, with the hope that my paper will hold at least a touch of genuine interest for each one of you, to whom I would like to express my thanks in advance for your presence here.

The title of this presentation, provided by my colleagues at the University of Vigo and which I am happy to accept, comes from a conceptualisation found in the article titled "Renta y Naturaleza en Doñana" ("Income and Nature in Doñana"), written by Pablo Campos and myself after the serious inundation of toxics that occurred in the protected environment of the Doñana National Park (1998, April) and published in the journal *Mundo Científico* (Campos and Linage, 1998). In it, albeit with an explicit and unavoidable simplification, we described two legal-political and social reactions or responses when confronting an environmental

tar un desastre ambiental de grandes magnitudes.

Unha é a que chamamos estratexia anglosaxona (exemplificada no caso do petroleiro *Exxon Valdez*), na que entendemos que se busca "determinar con el mayor rigor científico posible el daño causado a los ecosistemas afectados teniendo en cuenta tanto las lesiones (obvias) infligidas a las eventuales rentas de explotación como las lesiones al patrimonio natural, que afectan al dominio público". Nin as autoridades, nin as comunidades, nin os individuos fan desleixo dos seus dereitos, e contrasta ben o cumprimento dos deberes de cadaquén. Todo isto nun marco institucional e xurídico onde os valores dun pleno *Estado de Dereito Democrático* abranguen todos os recantos da vida social; onde hai, recordémolo con ledicia aquí e agora, un poder xudicial relativamente independente do Goberno vixente, comezando por esa principalísima figura que é o fiscal de distrito, un cargo público xudicial elixido directa e democraticamente polo pobo.

A outra estratexia é a latina, na que principalmente "se busca ocultar con rapidez el conflicto social o amortiguarlo con cantidades arbitrarias de dinero público bajo el pretexto de indemnizar rentas de trabajo y de explotación a agentes económicos potencialmente problemáticos". No artigo citado faciamos un claro prognóstico (¡só 15 días despois da catástrofe!) no senso de que o Goberno da nación (do Partido Popular) traballaría cunha estratexia *latina* en Doñana. Case cinco anos

disaster of great importance. One is what we call the "Anglo-Saxon" strategy (exemplified in the case of the *Exxon Valdez* oil tanker), in which we consider that an attempt is made "to establish, with the highest possible degree of scientific precision, the damage caused to the ecosystems affected, taking into account both the (obvious) injuries inflicted on potential income from development and the injuries to the natural heritage, which affect the public domain". Neither the authorities, nor communities, nor individuals renounce their rights and the obligations of each one are well defined. All of that within an institutional and legal framework in which the values of a full *Democratic Rule of Law* reach every area of social life; in which there is, let us remember here and now, celebrating the fact, a legal power that is relatively independent of the government in office, commencing with that fundamental figure that is the district attorney, a public office within the judicial system which is directly and democratically elected by the people.

The other strategy is Latin, in which, mainly, "an attempt is made to quickly conceal social conflict or to stifle it with arbitrary amounts of public money under the pretext of providing compensation for income from work and development to potentially problematic economic agents". In the article cited we made a clear prediction (only 15 days after the catastrophe!) to the effect that the government of the nation (in the hands of the Partido Popular) would adopt a *Latin* strategy in Doñana. Almost five years later we consider that the legal-administrative

despois, entendemos que a evolución xurídico-administrativa do caso nos deu de cheo a razón: Doñana exemplifica, para nós, a estratexia latina da resposta gobernamental a un desastre ambiental.

Vexamos, pois, de vagar o caso do vertido tóxico no ambiente de Doñana para entender unha resposta gobernamental, que é a mesma que xa parece establecerse, tamén, para o caso do vertido orixinado polo naufraxio do petroleiro *Prestige*.

Antes do vertido, da rotura e do afundimento do petroleiro *Prestige* no mar de Galicia e da conseguinte contaminación de augas e costas, o maior desastre ecolóxico acontecido en España correspondía á inundación tóxica sucedida nos sevillanos ríos Agrio e Guadiamar, dous dos emisarios das marismas dos parques Natural e Nacional de Doñana; o propio río Guadalquivir, que delimita o bordo oriental de Doñana, foi afectado, aínda que máis moderadamente que os dous ríos citados.

Este suceso ocorreu no ano 1998, na noite do 25 de abril, cando se abriu unha gran fenda no paramento dunha presa construída para conter augas e lamas resultantes do lavado da pirita procesada pola empresa Boliden-Apirsa, de capital sueco-canadense, no termo municipal de Aználcollar (Sevilla). A consecuencia desa rotura foi o escape, incontrolado e en tromba, de 6 hm^3 de auga extremadamente ácida (pH 2) e con lamas mineiras que contiñan proporcións moi elevadas de metaloides tan tóxicos como o arsénico e de metais pesa-

developments in the case have proved us totally right: Doñana exemplifies, for us, the Latin strategy of governmental response to an environmental disaster.

So let us look with a certain degree of detail at the case of the toxic spill in the area of Doñana in order to try to understand a governmental response which is the same, as seems now well established, as that of the case of the oil slick caused by the sinking of the oil tanker *Prestige*.

Before the spill, the breaking up and sinking of the oil tanker *Prestige* off the coast of Galicia (November 19, 2002) and the subsequent pollution of waters and coastline, the most important ecological disaster to have occurred in Spain corresponded to the toxic flood of the Agrio y Guadiamar Rivers in Seville, two watercourses coming out of the wetlands of the Doñana Natural Reserve and National Park; the River Guadalquivir itself, which forms the eastern border of Doñana, was also affected, though more moderately than the two rivers cited.

This event occurred in the year 1998, in the middle of the night of 25 April, when a large hole opened up in the face of a dam built to hold back the water and sludge resulting from the washing of pyrite processed by the Boliden-Apirsa company, owned by Swedish-Canadian capital, in the municipal area of Aznalcóllar, Seville. The consequence of that break was the uncontrolled, torrential escape of 6 cubic hectometres of extremely acid (pH 2) waters and mining sludge containing high levels of toxic metalloids

dos tan nocivos e persistentes como zinc, chumbo, cobre, cobalto, talio, bismuto, antimonio e manganeso. Ese volume de auga asolagou o tramo final do río Agrio e 62 quilómetros de leito e ribeira do río Guadiamar, afectando a unha superficie total de 4.634 hectáreas, 98 das cales pertencen ó propio Parque Nacional de Doñana; nas súas portas, no lugar chamado Entremuros, púidose finalmente deter o fluxo principal do vertido por medio de diques de terra levantados apresuradamente.

Soamente dous días despois, os peixes mortos recollidos sumaron algo máis de 29,5 toneladas. Á parte das aves mortas nos días seguintes, o Consejo Superior de Investigaciones Científicas (CSIC) determinou que, case un ano despois da inundación, un total de 19.900 aves de 18 especies estaban aínda contaminadas con doses elevadas de metais pesados. Así mesmo, case un ano máis tarde, en 1999, despois dunha custosísima limpeza mecánica, o 60 % do chan afectado presentaba, segundo o informe do Grupo de Expertos do CSIC, niveis elevados de zinc e arsénico, que no 20% dos casos estaban moi por riba dos límites legais. O acuífero 27 (segundo a clasificación do Instituto Tecnológico Geominero de España, ITGME), que tamén fornece de auga as marismas de Doñana (a de mellor calidade), experimentou unha contaminación moderada. No referente á poboación afectada directamente, os seus efectivos calculáronse en 50.000 persoas.

Concluíndo, dende as primeiras horas o asunto presentábase moi feo. Como declararía

such as arsenic and of harmful and persistent heavy metals such as zinc, lead, copper, cobalt, thallium, bismuth, antimony and manganese. This mass of water devastated the last stretch of the Agrio River and 62 kilometres of the channel and banks of Guadiamar River, affecting a total area of 4,634 hectares, 98 of which belonged to the Doñana National Park itself, and at its gates, in the spot called *Entremuros*, it was possible to halt most of the flow by means of hurriedly thrown up earthwork dikes. Only two days later the dead fish collected had come to more than 29.5 metric tons. Apart from the birds that died in the following days the *Consejo Superior de Investigaciones Científicas* (Higher Council of Scientific Research - CSIC) determined that, almost a year after the flood, a total of 19,900 birds of 18 species were still contaminated with high levels of heavy metals. In the same way, almost a year later, in 1999, after an extremely costly mechanical clean-up, 60% of the affected soil showed, according to a report of the CSIC Group of Experts, high levels of zinc and arsenic that in 20% of cases were way over legal limits. Aquifer 27 (according to the classification of the *Instituto Tecnológico Geominero de España*, [*Geo-mining Technological Institute of Spain*] ITGME), that also carries water into the wetlands of Doñana (the water of the best quality) suffered moderate pollution. With regard to directly affected population, the number of persons is calculated at 50,000.

In conclusion, from the very first hours the situation looked really ugly.

un ano despois da rotura do dique o director do Parque Nacional de Doñana (Alberto Ruíz de Larramendi): "Cuando vi el vertido desde el aire pensé que nada de lo que hiciéramos podría salvar al Parque"[1].

Máis de dous meses e medio despois do desastre, o 7 de xullo, comezan a declarar as vinteúnha persoas inculpadas na causa aberta no Xulgado n.º 2 de Sanlúcar la Mayor (Sevilla) e na que tamén participaba o fiscal de medio natural da Audiencia de Sevilla (Arcadio Martínez). Visto no momento, unha multitude de persoas inxenuas pensou que este proceso era un bo sinal para que aboiasen os responsables penais; entre os candidatos tamén estaban (como no caso do *Prestige* deberían estar) as administracións públicas (a autonomía andaluza, en mans do Partido Socialista Obrero Español, PSOE, e o Goberno central, en mans do Partido Popular, PP, que ofreceron a España un impresentable cruzamento de descualificacións mutuas e vergonzosos escamoteos).

Sen embargo, agora xa sabemos que ese camiño do penal non levou a outro destino que ó frustrante sobresemento do caso tres anos despois pola xuíza ordinaria, Celia Belhadj-Ben Gómez. Realmente, calquera persoa cun pouco de experiencia nestes sucesos podería prognosticar ese desenlace, ou outro semellante, dende o momento en que non se

1. *Diario16*, especial *Doñana, año uno*; domingo 25 de abril de 1999, p. 5.

As the director the Doñana National Parque (Alberto Ruiz de Larramendi) said a year after the dam burst: "When I saw the spill from the air I thought that nothing we could do would be able to save the Park"[1].

More than two and a half months after the disaster, on July 7, 21 people began to give evidence as defendants in the case opened in courtroom n. 2 of Sanlúcar la Mayor (Seville), in which the prosecutor for environmental affairs of the High Court of Seville (Arcadio Martínez) also took part. At the time a number of ingenuous people thought that this action was a good sign that penal responsibility might come to light, and among the accused were also (as should be in the case of the *Prestige*) the public administrations involved (the autonomous government of Andalusia, in the hands of the Spanish Socialist Party, PSOE, and the central government, in the hands of the Partido Popular, PP, who offered Spain an unedifying crossfire of mutual disqualifications and shameful concealment). However, we now know that the path of penal action did not get any further than the frustrating dismissal of the case three years later by the civil judge, Celia Belhadj-Ben Gómez. In fact any person with a little bit of experience in this sort of cases could have predicted this outcome, or something similar, from the moment in which (as also occurred in the case of the *Prestige*) a special prosecutor was

1. *Diario16*, special *Doñana, año uno*; Sunday, 25 April, 1999, p. 5.

nomeou (como tamén sucede no caso do *Prestige*) un fiscal especial, como a catástrofe requiría. ¿É que en ambos os dous casos non se suscitou unha inaudita alarma social? En Doñana, coma no vertido do *Prestige*, nin sequera interveu de oficio o fiscal xeral do Estado, Jesús Cardenal, como solicitaron, no caso de Doñana, Greenpeace e WWF/ADENA. Malia este despropósito, que afondou no seu momento o coñecido descrédito da administración española de xustiza, a apertura e as primeiras dilixencias do sumario fixéronse con moito barullo mediático e gobernamental, como é preceptivo na estratexia latina, onde a aparencia das cousas é moito máis importante cá cousa en si mesma. En tal sentido débese interpretar a primeira reacción da ministra de Medio Ambiente, Isabel Tocino, cando, impresionada polo que viu o mesmo día 25 de abril desde un helicóptero, anunciou que a Garda Civil empezara a traballar as dilixencias "para presentar una denuncia por delicto ecológico y empezar a depurar responsabilidades de todo tipo"[2]. A demanda administrativa empezou, si, ó día seguinte da rotura do encoro, pero parouse tres anos longos, que foron os que se demoraron a instrucción e o proceso da infructuosa vía penal; proceso que aínda non concluíu hoxe (marzo de 2003) e que leva mal camiño para os intereses públicos polas sentencias que ata o momento se determinaron, como de seguida se verá.

2. *El País*, domingo 26 de abril de 1998, p. 28.

not appointed, as the catastrophe called for. Didn't both cases cause an exceptional alarm among the population?. In Doñana, as in the *Prestige* oil spill, the Solicitor General, Jesús Cardenal, did not even join in the action ex officio, as requested, in the case of Doñana, by Greenpeace and WWF/ADENA. In spite of this blunder, which at the time served to aggravate the well known discredit of the Spanish administration of justice, the opening and preliminary proceedings in the case were carried on with a great deal of governmental and media commotion, an essential part of the Latin strategy, in which the appearance of things is much more important than the things in themselves. It is in this sense that the first reaction of the Minister for the Environment, Isabel Tocino, should be interpreted, when, shocked by what she saw on that same 25 April from a helicopter, she announced that the Guardia Civil had begun to work on proceedings "to present charges of ecological crime and begin to carry out an exhaustive enquiry"[2]. Administrative action did begin the day after the dam broke, but came to a stop for three long years, which delayed the pre-trial hearings and the process of the unsuccessful criminal prosecution, and, it has not yet concluded today (March, 2003) though it has not gone well for public interest in view of the sentences that have been passed up to now, as will be seen below.

2. *El País*, Sunday, 26 April, 1998, p. 28.

Convén agora referirse ás denuncias antecedentes á rotura final para documentar un feito sintomático da estratexia latina: o sistema administrativo e xurídico non funciona e iso, na práctica, significa a protección efectiva dos intereses industriais e financeiros por riba doutros valores sociais; por riba diso tan etéreo pero, ó tempo, tan identificable sempre como o *ben común.*

PRIMEIRA DENUNCIA ANTECEDENTE

Data de 1994, catro anos antes do vertido neglixente. O obxecto da denuncia é que a balsa-represa atinxida era receptora de vertidos alleos á empresa explotadora autorizada, Minas de Aznalcóllar, S.A. A acción de verter residuos alleos á concesión da presa está tipificada como delicto, pola Ley Básica de Residuos Tóxicos y Peligrosos (Lei 20/1986).

As empresas mineiras alleas que vertían eran clientes de Boliden-Apirsa e están situadas no Polo Químico de Huelva: Río Tinto Minera, FESA, FORET e Minas de Almagrera; todas estas vertían na balsa de Aznalcóllar residuos do tratamento concentrado de piritas.

Deste vertido, en realidade, xa se tiña constancia documental oficial dous anos antes, en 1992, pois a Consejería de Medio Ambiente da Junta de Andalucía coñecía que a empresa vertía cinzas procedentes do *tostado de piritas* cun alto contido de metais e metaloides como o arsénico.

It is worth referring now to the complaints made previous to the final break to document something that is symptomatic of the Latin strategy: the administrative and legal system does not work, and that, in practice, effectively means protection for industrial and financial interests over and above other social values; over and above something so ethereal and, at the same time so identifiable, always, as *the common good.*

FIRST PRIOR COMPLAINT

Dated 1994, four years before the negligent spill. The object of the complaint was that the reservoir-dam concerned was receiving refuse from outside the authorised operating firm, Minas de Aznalcóllar, S.A. Dumping outside refuse into the area of the concession of the dam is defined as a crime by the Basic Law for Toxic and Dangerous Residues (Law 20/1986).

The outside mining firms that were dumping were customers of Boliden-Apirsa and are located in the Huelva's "Chemical Centre": Río Tinto Minera; FESA; FORET and Minas de Almagrera; all of them were dumping residues from concentrate pyrite treatment into the Aznalcóllar reservoir.

In fact there were already official documentary records of this dumping from two years before, in 1992, since the Ministry of Environment of the Autonomous Government (*Junta*) of Andalusia knew the company was dumping ashes coming from pyrite roasting with a high content of metals and metalloids such as arsenic.

A denuncia de 1994 foi presentada diante do fiscal xefe da Audiencia de Huelva por José Manuel Mena e Manuel Canto Romero, empregados da Agencia de Medio Ambiente da Junta de Andalucía. A denuncia foi arquivada.

A mesma denuncia foi presentada o 27 de maio do mesmo ano 1994 diante da Fiscalía da Audiencia Provincial de Sevilla. Ía dirixida contra o conselleiro de Medio Ambiente y Cultura da Junta de Andalucía e o seu delegado en Sevilla, así como contra o presidente da Agencia de Medio Ambiente e o seu director xeral en Sevilla. O contido da denuncia anterior engadiuse agora que a balsa-vertedoiro onde se depositaban os residuos en cuestión non tiña o vaso impermeabilizado e que aqueles se vertían sen ningún tratamento.

Este feito xa fora detectado o ano anterior, 1993, mediante un estudio realizado pola Empresa de Gestión Medio Ambiental, S.A. (EGMASA, unha empresa pública da Junta de Andalucía) e foi mantido como *confidencial* ata que foi filtrado a varias organizacións de defensa ambiental.

A denuncia foi obxecto de dilixencias previas (a n.º 1394/94) por parte do Xulgado n.º 1 de Sanlúcar la Mayor, Sevilla, pero non transcendeu moito máis aló.

SEGUNDA DENUNCIA ANTECEDENTE

Data de 1995, novembro. Foi presentada por un particular, o enxeñeiro Manuel Aguilar

The 1994 complaint was presented to the head prosecutor of the High Court of Huelva by José Manuel Mena and Manuel Canto Romero, employees of the Environmental Agency of the Junta of Andalusia. The complaint was shelved.

The same complaint was presented on 27 May of the same year, 1994, to the Prosecutor's Office of the Provincial High Court of Seville. It was presented against the Minister of Environment and Culture of the Junta of Andalusia and its delegate in Seville and against the president of the Environmental Agency and its general director in Seville. To the contents of the prior complaint was now added the information that the basin of the reservoir-sink where the residues in question were deposited had not been impermeabilised and that the residues were dumped without any treatment whatsoever.

This had been detected the year before, 1993, in a study done by the *Empresa de Gestión Medio Ambiental, S.A* (EGMASA, Environmental Management Company, Ltd., a public company belonging to the Junta of Andalusia), and the information was classified as *confidential* until it was leaked to different environmental action organisations.

This complaint was the object of a preliminary investigation (nº 1394/94) by Court nº 1 of Sanlúcar la Mayor, Seville, but went no further than that.

SECOND PRIOR COMPLAINT

Dated November, 1995. It was lodged by a private citizen, engineer

Campos, ex-directivo despedido de Minas Aznalcóllar, S.A., onde foi xefe de carga e transporte. No seu informe, o Sr. Aguilar Campos revelaba:

1. O alarmante estado de conservación da represa de residuos de Aznalcóllar.
2. A degradación do río Guadiamar, cos seus nocivos efectos sobre as marismas do Parque Nacional de Doñana debido ás emisións descargadas dende a citada balsa-presa.
3. A escasa capacidade da planta depuradora da mina de Aznalcóllar: a penas alcanzaba a tratar o 25% das augas residuais da actividade mineira.
4. O empeoramento que suporía, sobre este panorama, a apertura dun novo depósito programado por Boliden (o *dos Frailes*), pois utilizarían as mesmas instalacións cás que estaban en servicio para a corta en explotación.

Así mesmo, o informe contiña unha avaliación sobre o estado dos paramentos de dique das balsas, o seu grao de permeabilidade, o estado dos filtros e da drenaxe e a calidade do tramo aumentado, alertando sobre as filtracións detectadas no río Agrio e, a través del, no Guadiamar. Menciónanse vertidos que contiñan cobre, chumbo, zinc, arsénico, mercurio e floculantes, entre outros, como o amilsantato potásico.

O denunciante remataba facendo referencia a unha analítica hídrica sobre o río Agrio

Manuel Aguilar Campos, a former executive of Minas Aznalcóllar, S.A., where he was head of cargo and transport, who had been discharged. In his report Mr. Aguilar Campos revealed:

1. The alarming state of conservation of the Aznalcóllar tailings dam;
2. The degradation of the Guadiamar River, with its harmful effects on the wetlands of the Doñana National Park due to emissions coming from the reservoir-dam cited above;
3. The limited capacity of the water treatment plant of the Aznalcóllar mine: it could barely treat 25% of the black water from mining activity;
4. The further deterioration of this grim panorama represented by the proposed opening up of a new cut-off programmed by Boliden (*los Frailes*), since it would use the same installations that were already in service for the cutoff in operation.

The report also contained an evaluation of the condition of the faces of the breakwaters of the dams, their degree of seepage, condition of the filters and drainage, and quality of the expanded stretch, warning of seepage detected going into the Agrio River and, by way of it, into the Guadiamar. Discharges are mentioned containing copper, lead, zinc, arsenic, mercury and flocculants such as, among others, potassium amyl xanthate.

The complainant closed by referring to a hydric analysis on the Agrio River from the year 1977 in which

do ano 1977, onde xa se detectaban niveis de ferro, cobre, manganeso, chumbo e zinc totalmente fóra de normas, sobre todo no comprensible caso do ferro, con 300 mg/l, cando o tolerado, naquela data, era de 0,1 mg/l.

Tratábase dunha denuncia administrativa, non penal, e o Sr. Aguilar Campos presentouna diante da Agencia de Medio Ambiente da Junta de Andalucía; diante da Consejería de Industria, Comercio y Turismo da mesma Junta; diante do Patronato do Parque Nacional de Doñana; diante da Coordinadora Ecologista Pacifista de Andalucía (CEPA), e diante da D. G. de Obras Hidraúlicas do Ministerio de Obras Públicas, Transporte y Medio Ambiente.

De todos os destinatarios, a única organización que presentou unha denuncia penal foi a CEPA, en xaneiro do ano seguinte, 1996; fíxoo diante do fiscal xefe da Audiencia de Sevilla. Cinco meses despois, en xuño, o xuíz arquivaría as dilixencias previas (n.º 154/96-1) abertas polo Xulgado de Instrucción n.º 2 de Sanlúcar la Mayor, o mesmo que seis anos despois sobresería o sumario aberto polo gran vertido tóxico de Minas de Aznalcóllar, S.A.

Esta mesma denuncia da CEPA fora enviada como denuncia administrativa diante do Comisario de Medio Ambiente da Unión Europea no propio mes de xaneiro de 1996, o que evidenciaba a potencial gravidade dun eventual vertido catastrófico sobre Doñana, o maior Parque Nacional dun país membro da Unión Europea e declarado pola

levels of iron, copper, manganese, lead and zinc were detected that were way over regulation limits, particularly in the understandable case of iron, with 300 mg/l when the level tolerated at the time was 0.1 mg/l.

This was an administrative, not a criminal complaint, and Mr. Aguilar Campos filed it with the Environmental Agency of the Junta of Andalusia; with the Ministry of Industry, Commerce and Tourism of the Junta; with the Board of the Doñana National Park, with the Ecologists' and Pacifists' Coordinating Committee of Andalusia (CEPA), and before the D. G. of Hydraulic Works of the Ministry of Public Works, Transport and Environment.

Of all these, the only organisation that presented a criminal complaint was the CEPA, the following year, 1996, on January 26; it was filed with the Head Prosecutor of the High Court of Seville. Five months later, on June 4, the judge closed the preliminary investigation (nº 154/96-1) opened by Magistrates' Court nº 2 of Sanlúcar la Mayor, the same judge who six years later would dismiss the case of the great toxic dumping of Minas de Aznalcóllar, S.A.

The same complaint presented by the CEPA was forwarded as an administrative complaint to the Commissar for Environment of the European Union in the following month of January, 1996, pointing out the potential seriousness of the effects of possible catastrophic dumping on Doñana, the largest National Park of any member country in the European Union and declared a *Biosphere Reserve* by

UNESCO, no 1980, como *Reserva da Biosfera*. Tal denuncia europea fora rexistrada co n.º 196/4177-SG(96)A/2680 e proposta á Comisión Europea para o seu arquivo en agosto de 1997, ó estimar, *rutineiramente* e ata quizais con dó, que a resposta dada polo Goberno español (na data, do Partido Popular) era satisfactoria xa que, segundo este, "el río Guadiamar no entra en Doñana; [que] la acidificación de las aguas del río Agrio responde a la constitución geológica de la cuenca; [que] la comisaría de aguas de la Confederación Hidrográfica del Guadalquivir controla suficientemente al Guadiamar y al Agrio desde 1974 sin que se haya apreciado en la calidad de sus aguas cambios significativos antes y después de la explotación minera, salvo en manganeso y zinc; y [que] las medidas preservativas para evitar la filtración de las balsas se están realizando y son suficientes". A realidade, sen embargo, seguía unha xeira ben distinta e todo este montón de mentiras oficiais foi empurrado pola gran fenda e a conseguinte enchente tóxica de auga e lama que tivo lugar na noite do 25 de abril de 1998[3].

O recordatorio destes antecedentes e os seus desenlaces importa ó cabo moito porque fundamenta un feito social de crucial interese:

UNESCO in 1980. This European level complaint was registered as nº 196/4177-SG(96)A/2680 and a proposal was made to the European Commission for it to be shelved in August of 1997, considering, *routinely*, and even, perhaps, under false pretences, that the response provided by the Spanish government (at that date in the hands of the Partido Popular) was satisfactory since, according to it "The Guadiamar River does not enter Doñana; [that] the acidification of the waters of the Agrio River are the result of the geological makeup of the basin; [that] the commission for waters of the Hydrographic Confederation of the Guadalquivir has maintained adequate observation of the Guadiamar and Agrio Rivers since 1974 without having seen significant changes in the quality of their waters before and after the beginning of the operation of the mine except in manganese and zinc; and [that] conservation measures to avoid seepage from the reservoirs are being taken and they are sufficient" Reality, however, continued to follow a very different course, and all this mass of official lies was swept away by the break and resulting toxic flood of water and sludge that occurred on the night of 25 April, 1998[3].

Recalling these precedents and their results is of considerable importance because it testifies to a social reality of

3. Sobre as denuncias previas á riada tóxica de Aznalcóllar-contorno de Doñana e sobre unha detallada cronoloxía desta ata o domingo 10 de maio de 1998, pode consultarse con moito proveito o informe AGADEN, 1998.

3. On complaints prior to the toxic flood at Aznalcóllar - area of Doñana and for a detailed chronology from Sunday, 10th May 1998, of interest is the report AGADEN, 1998.

se se atendesen correctamente as denuncias evitaríase unha catástrofe cun custo económico e ambiental aínda hoxe descoñecido; de aí a lóxica desafección cívica derivada desta constatación; a desmobilización moral dos mellores elementos da comunidade, a descohesión desta. Ese vai ser o grave resultado dun sistema xudicial, administrativo e político que non atendera cun mínimo rigor profesional as demandas fundamentadas e contrastadas de particulares e organizacións cívicas. Temos neste factor outro elemento de contraste entre as estratexias de resposta anglosaxona e latina: na primeira, delinquir, se un é descuberto e probado, ten consecuencias máis ou menos proporcionadas; a lei conta; ten un poder incontestable; na segunda, delinquir adoita ser barato e, sobre todo, impóñense os distingos: depende de quen, de como e de canto; este último distingo ten importancia pois a pena vai ser inversamente proporcional ó canto, porque o que rouba moito adoita ser alguén, xa que é sabido, popularmente, que o que rouba pouco é un ninguén.

Xa que estamos neste asunto dos antecedentes denunciados, previos a unha catástrofe ambiental e económica da que sempre derivan graves anomalías sociais, e dada a realidade que agora nos reúne, no caso do petroleiro *Prestige*, seméllame oportuno referirme ó mundo do transporte marítimo e, en concreto, ó das substancias perigosas, un asunto no que Galicia, o seu mar, as súas costas, as súas rías e portos, teñen a nefasta

crucial interest: if the complaints had been handled correctly a catastrophe whose economic and environmental costs are unknown even today would have been avoided, hence the logical civic disaffection that is the result of this fact; the moral demobilisation of the best elements of the community and the break-up of its. That is the serious result of a legal, administrative and political system that does not handle with a minimum of due professional severity, well-founded and substantiated complaints presented by private citizens and civic organisations. Here we have another element of contrast between Anglo-Saxon and Latin strategies of response: in the former, committing an offence, if you are discovered and the offence is proved, has more or less proportionate consequences; the Law counts; it has unquestionable power; in the latter committing an offence tends to be cheap and, most of all, certain distinctive factors come into play; it depends on who, how and how much; this last factor is important since the sentence tends to be inversely proportionate to *how much* because someone who steals a lot tends to be *somebody* since it is a well known and popular idea that those who steal small amounts are *nobodies*.

Since we are on this subject of precedents that were denounced in their time, previous to an environmental and economic catastrophe from which serious social anomalies arise, and given the matter that brings us together here, the case of the tanker *Prestige*, I think it might be appropriate to refer to the world of maritime transport and, specifically, transport of dangerous substances, a question in which Galicia, its

notoriedade mundial de adoitar ser escenario de naufraxios ambientalmente catastróficos: só dende 1976 contabilízanse cinco grandes vertidos e incendios mariños tóxicos que, por riba, segaron un total de 53 vidas humanas (1976, maio, *Monte Urquiola;* 1979, xaneiro, *Andros Patria;* 1987, decembro, *Cason;* 1992, decembro, *Aegean Sea;* 2002, novembro, *Prestige*).

Voulles ler un texto alleo de denuncia xeral para salientar a persistencia e o predominio deses intereses industriais e financeiros ós que aludín antes e para amosar como, cando reina a inxustiza, o coñecemento dos problemas, polo menos no ámbito europeo, non é garantía de nada. Atención. Di así:

> Detrás de cada tragedia producida en la mar hay una explicación real y tangible sobre la que, invariablemente, se ceba el silencio y la confusión. No es la mar, elemento que el Hombre domina hoy con suficiencia, la razón abstracta de tanto accidente marítimo inexplicable. Son, por el contrario, esos barcos viejos y rotos –auténticos ataúdes flotantes– que siguen navegando contra viento y marea porque todavía son rentables para los ansiosos bolsillos del armador de turno; [...] son esos oficiales sin título alguno, [...] es ese continuo y criminal olvido de las empresas cuando tienen que reponer el material de salvamento de sus buques; son esos capitanes más preocupados por el orden y la disciplina [...] que el de las condiciones de navegabilidad del buque a su mando...

sea, its coasts, its rias and ports possesses the unfortunate world-wide fame for having frequently been the scene of environmentally catastrophic shipwrecks; just since 1976 there have been five major spills and toxic fires at sea which also took a total of 53 human lives (May, 1976, *Monte Urquiola*; January, 1979, *Andros Patria*; December, 1987, *Cason*; December, 1992, *Aegean Sea*; November, 2002, *Prestige*).

I am going to read you an outside text, which is a denunciation of general character, and will identify it at the end, to emphasise the persistence and predominance of those industrial and financial interests which I referred to before and to show how, when injustice reigns, an awareness of the problems, at least in Europe, is no guarantee of anything. Attention. It says:

> Behind every tragedy that occurs at sea there is a real, tangible explanation that is invariably shrouded in silence and confusion. It is not the sea, over which mankind today has sufficient control, the abstract reason for so many unexplainable accidents at sea. It is, on the contrary, those old broken down boats – genuine floating coffins – that continue to sail against hell or high water because they are still profitable for the greedy pockets of the whatever shipowner; [...] it is those ship's officers without qualifications; [...] it is the continual, criminal forgetfulness of companies when they have to replace the lifesaving equipment on their vessels; it is those ship's captains more concerned about order and discipline [...] than about the navigability of the vessel under their command...

Realmente este texto podería terse escrito agora mesmo; sen embargo data de 1976, cando foi redactado e difundido polo español Sindicato Libre de la Marina Mercante no seu dossier *La verdad de una catástrofe*. Neste caso a catástrofe de referencia foi a do petroleiro *Monte Urquiola*, naufragado na boca da ría da Coruña o 12 de maio de 1976. O petroleiro estoupou e unha espesa marea negra invadiu a ría. A tripulación e o práctico conseguiron salvarse aínda que non así o capitán, quen permaneceu a bordo ata o final.

Nesa mesma publicación denunciábase así mesmo algo que tamén sairía á luz moitos anos despois co gallo do vertido tóxico de Aznalcóllar e das mareas negras do *Prestige*; algo que é característico da resposta latina. Afirma este sindicato que "si por algo se caracterizó la lucha contra la contaminación desarrollada por las autoridades de Marina fue la forma secreta y totalitaria en que se llevó a cabo..."[4]. ¿Sóalles de algo todo isto? Ese xeito *secreto e totalitario* de actuar por parte das autoridades (os seus beneficiarios, ó cabo, son entidades industriais e financeiras) tamén se practicou antes do actual Estado democrático e agora con el, verbo doutras grandes obras públicas de gran repercusión ambiental e social como o transvasamento de

4. *ÍIbidem* (Sindicato, 1976:56). Un breve pero proveitoso recordatorio das mareas negras recentes que afectaron a España (sobre todo a Galicia) pode consultarse en Fernández (1999); de alí tomou as referencias o Sindicato Libre de la MarinaMariñna Mercante.

This text in fact could have been written today; however it dates from 1976 when it was written and published by the Spanish *Sindicato Libre da Marina Mercante* (Free Merchant Marine Union) in their dossier, *La verdad de una catástrofe* (*The Truth about a Catastrophe*) In this case the catastrophe referred to was the tanker *Monte Urquiola*, sunk at the mouth of the ria of Coruña on 12 May, 1976. The tanker exploded and a thick oil slick entered the ria. The crew and the pilot managed to save themselves, not so the captain, who remained aboard to the end.

In this same publication that I have cited above, something else is denounced which would come to the surface again years later with the toxic dumping at Aznalcóllar and the *Prestige* oil slicks and that is characteristic of the Latin response. The Union affirms that "If there is anything that typifies the fight against pollution as carried on by Marine authorities it was the secret and totalitarian way they went about it...."[4]. Does any of this sound familiar? That "secret and totalitarian way" of taking action on the part of the authorities, the beneficiaries of which are, in the end, industrial and financial interests, was also in practice before the present democratic form of government, and now with it, with respect to other important public

4. *Ibídem* (Sindicato, 1976:56). For a short but worthwhile record of recent *oil slicks* that have affected Spain (particularly Galicia) consult Joaquín Fernández (1999); the Sindicato Libre de la Marina Mercante took references from it.

auga entre a cunca do Texo e a do Segura (obras entre 1968 e 1978) proxectado en tempos do dictador Franco (1938-1975), ou o transvasamento, actualmente en obras, entre a cunca do Ebro e outras cuncas de Cataluña, Levante e Andalucía.

En España, as autoridades, mesmo no actual réxime *formalmente democrático*, sempre preferiron a propaganda ó debate e a arenga ó consenso, se non a simple represión. É un feito constatado que a resposta pautada das autoridades españolas á disidencia ambiental colectiva, aínda que esta fose pacífica, foi unha significativa represión policial:

> De acuerdo con la muestra de eventos de protesta recogidos en las páginas de nacional de *El País*, entre 1988 y 1999 [408], en el trascurso de un 11% de las protestas […] no violentas se produjeron incidentes que implicaron el uso de la fuerza. En un 7% hubo heridos, en su gran mayoría de carácter leve […]. Finalmente, en un 11,4% de las movilizaciones se practicaron detenciones [...]. Estos porcentajes sitúan el nivel de represión de movilizaciones no violentas en España entre los más altos de la Unión Europea [...]. En ningún otro lugar las movilizaciones se saldan con heridos con tanta frecuencia como en España. ¿Qué explica este alto nivel de represión policial en las movilizaciones a favor del medio ambiente?[5].

5. Jiménez (2002: 234-235).

works with great environmental and social impact, such as the diversion of water from the basin of the Tajo and the Segura (work between 1968 and 1978), planned in the time of the Franco dictatorship (1938-1975), and the diversion, with work underway now, between the basin of the Ebro and other rivers of Catalonia, Levante and Andalusia. In Spain, the authorities, even in the present *formally democratic* regime, always prefer propaganda to debate, harangue to consensus, or if not, simple repression. It is a documented fact that the standard response of Spanish authorities to collective environmental protest, even when it is peaceful, was significant police repression:

> According to a sample of protest events taken from the national affairs pages of the newspaper *El País* between 1988 and 1999 [408], during 11% of non-violent protests [...] incidents occurred that involved the use of force. In 7% there were people injured, most of them with slight injuries [...] Finally, in 11.4% of the mobilizations arrests were made [...]. These percentages put the level of repression of non-violent mobilisations in Spain among the highest in the European Union [...]. In no other place do protests result in as many persons injured as in Spain. What is the explanation for this high level of police repression of demonstrations in defence of the environment?[5].

5. Jiménez (2002: 234-235).

Semella probado que no enfoque latino hai un medo, cultural e histórico, ó conflicto, á disidencia, en todos os termos, pero sobre todo na súa vertente social. Pagaría a pena facer unha aproximación antropolóxica a este asunto, mais iso traspasaría o tempo e o obxecto desta exposición. Quede apuntado como unha suxestiva dimensión explicativa.

Volvamos as rendas á pedagóxica enchente tóxica de Aznalcóllar-contorno de Doñana. Cando o presidente de Boliden Limited, o sueco Anders Bülow, acudiu a España para avaliar *in situ* o suceso (o 28 de abril de 1998, catro días máis tarde da riada), o que traía na súa cabeza era a doutrina ambiental e xurídica anglosaxona, aínda que non tiña unha idea ben formada do alcance real do vertido. Aparentemente, España non era como Chile, país onde tamén pillaran a Boliden en graves delictos ambientais; España era membro da poderosa Unión Europea e a décima potencia industrial do mundo, segundo pregoaba a retórica oficial. As primeiras declaracións do Sr. Bülow, ademais dunha certa desolación, transmitían unha boa disposición a colaborar coas autoridades, mais esa actitude cambiaría radicalmente pouco tempo despois cando, no camiño de Boliden, se cruzou co famoso bufete madrileño de Garrigues-Andersen, que o puxo no recto entendemento da doutrina latina: négao todo; non pagues, *motu propio*, un céntimo e ¡que chova! Porque, como din os *castas marisme-*

It seems to me that it has been proved that in Latin culture there is a cultural and historical fear of conflict and of dissidence, in all areas but particularly in their social aspect. It would be worth the time to take an anthropological approach to this subject but that would go beyond the time limits and subject of this presentation. So let us leave it here as an indication of an interesting explanatory dimension of the problem at hand.

Let us go back then to the highly instructive toxic flood at Aznalcóllar and the area around Doñana. When the president of Boliden Limited, the Swede Anders Bülow, arrived in Spain to evaluate the event *in situ* (28 April, 1998, four days after the flood), what he had in mind was the Anglo-Saxon environmental and legal doctrine, though he did not have a definite idea of the real extent of the spill. Evidently Spain was not Chile, a country that would also see Boliden implicated in serious environmental offences; Spain was a member of the powerful European Union and in tenth place in the industrial world according to official rhetoric. The initial public statements of Mr. Bülow, aside from a certain feeling of distress, expressed a willingness to cooperate with the authorities, but this attitude radically changed shortly afterward when met with the famous Madrid law firm of Garrigues-Andersen which put him in a position to correctly understand the classic Latin doctrine: deny everything; don't pay, *motu propio*, a cent and let the sun rise where it will! Because, as they say, in Spain, justice, in January is strict, but

ños, en España, "la justicia, en enero es rigurosa, pero en febrero ¡ya es otra cosa!"[6].

Esa primeira desolación anglosaxona e a súa contrición esperando un exemplar golpe da xustiza e (ou) do Estado español tiveron un primeirísimo reflexo na cotización bolsista (bolsa de Toronto) do consorcio industrial Trelleborg; o seu valor caeu 1,43 dólares por acción (un 9,57%), e estas quedaron a 13,51 dólares, segundo informaba a prensa o 28 de abril[7]. Así mesmo, as auditoras obrigaron a Boliden a abastecer un fondo equivalente a unha suma algo superior a 36 millóns de euros (6 mil millóns de pesetas) para facer fronte a eventuais indemnizacións que ata o presente non tiveron lugar, como convén agora lembrar.

Tamén convén lembrar neste punto que, malia os graves problemas ambientais derivados do inadecuado procesamento dos materiais mineiros por Boliden-Apirsa e das súas insuficientes e insatisfactorias instalacións, as autoridades autonómicas andaluzas (PSOE), sempre baixo a chantaxe de conseguir emprego a calquera prezo, estaban desexando reabrir a mina de Aznalcóllar. Esa impaciencia in February, it's something else again![6].

That initial Anglo-Saxon distress and contrition, expecting an exemplary blow from Spanish justice and/or the Spanish state were first reflected in stock market prices (Toronto market) for the Trelleborg industrial consortium, when prices fell $1.43 per stock (9.5%), closing at $13.51 as the press reported on 28 April[7] At the same time auditors obliged Boliden to create a fund equivalent to a sum of a little over 36 million euros (6 thousand million pesetas) to meet possible compensations that up to now have not happened, as is appropriate to recall here.

It is also appropriate to recall at this point that, in spite of the serious environmental problems arising from inadequate processing of mining materials by Boliden-Apirsa and from their insufficient and unsatisfactory installations, the authorities of the autonomous government of Andalusia (PSOE), blackmailed by the desire to create employment at any price, wanted to reopen the Aznalcóllar mine. In fact this impatience was consistent, as since 1993 Boliden-Apirsa had been the recipient

6. Inicialmente, Boliden-Apirsa mostrou por escrito a súa disposición a colaborar na limpeza e no pagamento das colleitas perdidas (*El País*, 30 de abril de 1998, p. 27; 2 de maio, p. 22; 7 de maio, p. 29). Sen embargo, despois de quince días de traballo Boliden retirou as súas máquinas e os obreiros aducindo que non afrontaría os traballos de limpeza nin o pagamento das colleitas mentres non mediase unha resolución xudicial firme (*La Vanguardia*, 18 de maio de 1998, p. 28).

7. *El País*, 28 de abril de 1998, p. 30.

6. Initially, Boliden-Apirsa stated in writing their willingness to cooperate in cleaning and in payment for harvests lost (*El País*, April 30, 1998, p. 27; May 2, p. 22; May 7, p. 29). However, after 15 days of work Boliden withdrew their machines and workers arguing that they would not be responsible for cleaning work or payment for harvests lost until there a definitive court decision had been made (*La Vanguardia*, May 18, 1998, p. 28).

7. *El País*, April 28, 1998, p. 30.

resultaba coherente pois, ó cabo, dende 1993 Boliden-Apirsa fora obxecto de subvencións oficiais autonómicas e tamén do Goberno central (PSOE, na data) por un valor conxunto equivalente a algo máis de 42 millóns de euros (7 mil millóns de pesetas), dos que un 54% estaban xa entregados na data do vertido[8].

Visto dende a perspectiva actual, cando sabemos que Boliden-Apirsa se declarou en quebra en outubro de 2001 e cesou na explotación de Aznalcóllar, esa preferencia da Junta de Andalucía pola continuidade de Boliden e o feble comportamento do propio Goberno da nación despois do vertido semellan patéticos e só podo percibilos como un escarnio. Teño que lembrar, aquí e agora, que hai outras políticas económicas, outra caste de empregos, xusto os vinculados cun aproveitamento sustentable de recursos naturais no ambiente de Doñana que ata o de agora non recibiron unha atención axeitada por parte das autoridades chamadas a ser competentes no necesario regulamento do seu uso.

Co que chegou o intre da gran pregunta: ¿canto custou a inundación tóxica dos ríos, das ribeiras e das leiras adxacentes ó Agrio, ó Guadiamar e, en parte, ó Guadalquivir? A resposta inmediata e verdadeira é que, aínda hoxe, ese dato é descoñecido e ademais atrévome a asegurar que non se coñecerá nunca, porque hai medicións na parte da biosfera

8. *El País*, 17 de maio de 1998, p. 2 do suplemento dominical.

of official subsidies from both the autonomous government and from the central government (both in the hands of the PSOE at the time) coming to a total of more than 42 million euros (7 thousand million pesetas), of which 54% had been paid at the date of the flood[8].

Looked at from a perspective of today, when we know that Boliden-Apirsa declared bankruptcy in October, 2001, and closed down operations at Aznalcóllar, the Junta of Andalusia's preference for Boliden's continuing and the lax behaviour of the government of the nation following the flood seem totally pathetic to me, and I can only perceive them as a mockery. It should be recalled, here and now, that there are other kinds of economic policies and other kinds of employment, precisely the kinds of employment connected with a sustainable exploitation of the natural resources of the area around Doñana, which up to the moment have not received adequate attention from the authorities responsible for the necessary regulation of their use.

Now comes the turn of the great question: how much did the toxic flood of the rivers, river banks and properties in the vicinity of the Agrio, Guadiamar and, in part, the Guadalquivir cost? The immediate and true response is that, as of today, that information is unknown and in addition I would go so far as to affirm that

8. *El País*, May 17, 1998, p. 2 of the Sunday magazine.

afectada que, se non se fixeron no momento, xa non significan, ou non valen, o mesmo.

Os únicos datos publicados proceden das administracións públicas atinxidas, a Junta de Andalucía e o Goberno central, e ambos refírense a unha parte do custo en que deberon incorrer os presupostos públicos para realizar a limpeza de ríos, ribeiras e leiras anegadas pola riada; e outros gastos, entre os que podo enumerar os seguintes:

- Subvencións por rendas de traballo e por explotación ós xornaleiros, ós agricultores e ós pescadores afectados.
- Subvencións por rendas de traballo ós mineiros de Aznalcóllar.
- Financiamento de programas de calidade ambiental.
- Recuperación de leitos fluviais.
- Creación dun *corredor verde* arborado ó longo do leito do Guadiamar.
- Plano de información pública.
- Seguimento da calidade sanitaria dos traballadores da limpeza e da poboación afectada.
- Investigación científica do grupo de expertos do CSIC.
- Gastos de atención ó voluntariado.

Hai que subliñar que a Junta de Andalucía renunciou, loxicamente, a resarcirse do investimento realizado na compra dos terreos privados afectados polo vertido (unhas 2.430 hectáreas), que supuxo un desembolso equivalente a 21.492.192 euros (3.576

it will never be known because there are measurements in the part of the affected biosphere that, if not taken at the right moment, do not have the same meaning or significance.

The only published data come from the public administrations involved, the Junta of Andalusia and the central government, and refer to a part of the cost incurred by the public budgets to carry out the cleaning of rivers, riverbanks and rural property flooded during the accident and other expenses, of which I can enumerate the following:

- Subsidies for work and exploitation incomes for day labourers, farmers and fishermen affected.
- Subsides for work income for the Aznalcóllar miners.
- Financing of environmental quality programmes.
- Recovery of river beds.
- Creation of a forested *green corridor* along the Gaudiamar.
- A plan for public information.
- Follow-up on health care quality for cleaning workers and the affected population.
- Scientific research by the group of CSIC experts.
- Expenses on attention to volunteers.

It should be observed that the Junta of Andalusia logically relinquished compensation for the investment involved in the purchase of private lands affected by the flooding (2,430 hectares) which meant an outlay equivalent to 21,492,192 euros (3,576 million pesetas)[9]. Neither the

millóns de pesetas)[9]. Nin o Goberno central nin a Junta de Andalucía publicaron conxuntamente, como debían, os valores finais detallados de todos estes custos.

A sanción administrativa imposta polo Consello de Ministros, no ano 2002, agosto 2, ascendeu a 45.077.510 euros (7.500.266.578 pesetas) e desagregouse nestes tres epígrafes:

- Valor da multa por infracción da Lei de Augas (29/1985): 601.000 euros.
- Valor da reparación: 2.870.181 euros.
- Valor dos traballos de recuperación da parte do leito do Guadiamar asignado ó Estado: 41.606.316 euros.

Boliden non fixo efectiva esta sanción e o desenlace continúa pendente. Por parte da Junta de Andalucía reclamouse por vía civil a Boliden un valor de 150 millóns de euros, segundo anunciou o seu presidente, Manuel Chaves, en xullo do ano 2002. O 5 de xaneiro do ano 2003 fíxose público que o Xulgado de Primeira Instancia n.º 11 de Sevilla rexeitara a citada demanda, aínda que nesta ocasión o valor reclamado era só de 89,8 millóns de euros[10].

central government nor the Junta of Andalusia published together, as they should have, a detailed, final account of the total costs.

The administrative sanction imposed by the Cabinet, meeting on August 2, 2002, amounted to 45,077,510 euros (7,500,266,578 pesetas) and is itemized under these three concepts:

- Value of the fine for violation of the Law on Waters (29/1985): 601,000 euros.
- Value of repairs: 2,870,181 euros.
- Value of the repair work on the part of the Guadiamar river bed assigned to the State: 41,606,316 euros.

This sanction was not paid by Boliden and the outcome remains pending. The Junta of Andalusia sued Boliden in the civil courts for 150 million euros, as its president, Manuel Chaves, announced in July of 2002. On 5 January, 2003, it was reported that the Court of First Instance nº 11 of Seville *would reject* this claim though on this occasion the amount in question was 89.8 million euros[10].

9. O gasto da Consejería de Agricultura da Junta de Andalucía está en *El País*, domingo 25 de abril de 1999, p. 31. Crónica asinada en Sevilla por Alejandro Bolaños. A renuncia da Junta de Andalucía a ese valor está en *La Vanguardia Digital*. Crónica asinada por José Bejarano en 2002, agosto 3 (www.lavanguardia.es/web/20020803/3089865.html).

10. A sanción gobernativa do Goberno central e a reclamación da Junta de Andalucía está en *La*

9. Cost to the Agricultural Ministry of the Junta of Andalusia, in *El País*, Sunday, April 25, 1999, p. 31. Report signed in Seville by Alejandro Bolaños. Relinquishment of rights to this amount by the Junta of Andalusia in *La Vanguardia Digital*. Report by José Bejarano, August 3, 2002 (www.lavanguardia.es/web/20020803/3089865.html).

10. Sanction imposed by the central government and claim by the Junta of Andalusia, in *La*

Resumindo, o custo confesado (é dicir, descontando o valor da multa por infracción da Lei de Augas) sería, polo menos, de 194.476.497 euros (32.350 millóns de pesetas). Iso supón, só polo concepto de limpeza cos fondos públicos, un custo por hectárea afectada de 41.967 euros (equivalente a 6.982.721 das antigas pesetas). E polo dito ata aquí semella clara a gran dificultade que teñen as dúas administracións españolas para percibiren de Boliden Limited esa suma.

Denantes afirmei que este valor de custo incorrido é só unha parte do valor do dano producido: ¿que quedou fóra da avaliación oficial? As perdas inmediatas e futuras da fauna salvaxe e as perdas inmediatas e futuras da productividade primaria; e a contaminación eventualmente incorporada ós chans e ás augas soterradas e ós leitos dos ríos, dos caneiros das marismas, é dicir, o eventual menoscabo do patrimonio natural. Por outra parte tamén podería ocorrer que, a longo prazo, algunha das actuacións executadas como remedio do vertido puidese resultar beneficiosa para a fauna salvaxe, como é o caso do *corredor verde* forestal creado ó longo do río Guadiamar. Habería que medir e cuantificar ese efecto en valor económico, polo que, ó cabo, a valoración económica total do

To sum up, the recognised cost (in other words, discounting the value of the fine for violation of the Law for Waters) would be, at least, 194,476,497 euros (32,350 million pesetas). That means, solely for the concept of cleaning with public funds, a cost per affected hectare of 41,967 euros (equivalent to 6,982,721 of the old pesetas). And for what we have seen up to this point the considerable difficulty that the two administrations, in short, the Spanish people, are having to get this sum out of Boliden Limited is clear.

I previously affirmed that this amount of cost incurred is only a part of the value of the damage produced: what was left out of the official valuation? The immediate and future losses of wild fauna and the immediate and future losses of primary productivity; and the pollution that may have penetrated the soil and ground water and river beds, cane and ponds of the wetlands, in other words, the possible diminishment of the natural heritage. On the other hand it may also happen that, in the long term, some of the actions taken to remedy the results of the flood may turn about to be beneficial for wild fauna, as is the case of the forested *green corridor* created along the Guadiamar River. That effect should be measured and quantified in economic terms, so that, in the end, the total economic valuation of the

Vanguardia Digital. Crónica asinada por José Bejarano en 2002, agosto 3 (*vid.* nota anterior). O rexeitamento da demanda da Junta de Andalucía por valor de 89,8 millóns de euros está en *El Mundo*, 5 de xaneiro de 2003, p. 17.

Vanguardia Digital. Report by José Bejarano on August 3, 2002 (See previous footnote). Rejection of the suit brought by the Junta of Andalusia for 89.8 million euros, in *El Mundo*, 5 January, 2003, p. 17.

vertido tería que saír dun saldo bastante complexo de calcular pois hai outras facetas igualmente difíciles de avaliar como os sanitarios (onde, por certo, habería que incluír a morte de catro persoas en accidentes de tránsito directamente relacionados cos numerosos camións e coas máquinas empregadas na limpeza dos chans).

Esta grave ausencia da non-valoración económica dos bens ambientais comprometidos no vertido tóxico de Aznalcóllar puido evitarse se o Goberno de España (do PP) incluíse científicos desa especialidade no *grupo de expertos* creado para realizar un seguimento dos efectos químicos e biolóxicos da catástrofe que fora presidido polo Dr. César Nombela, daquela tamén presidente do Consejo Superior de Investigaciones Científicas (CSIC). Realmente desperdiciouse unha ocasión histórica que suporía un pulo moi significativo para o avance en España da economía ambiental e tamén para as necesarias interrelacións entre as ciencias naturais e experimentais coa economía. Hoxe estariamos mellor armados teórica e practicamente para enfrontármonos á complicada tarefa de cuantificar, co maior rigor científico posible, as perdas económicas e ambientais comprometidas nas mareas negras do petroleiro *Prestige*, en lugar de perder o tempo en confusas e interminables reunións tratando de conseguir alambicados compromisos dos que, ó cabo, non derivará acción lúcida ningunha.

Debo falar ben dese grupo de expertos creado polo Goberno para seguir a evolución

flood would have to come out of a balance that is quite complex to calculate, since there are other aspects that are equally difficult to evaluate, such as health care (in which, by the way, should be included the deaths of four persons in traffic accidents directly related with the numerous lorries and machines employed in the cleaning of the soil).

This serious absence of economic valuation of environmental goods affected by the toxic flood of Aznalcóllar could have been avoided if the Spanish government had included scientists with this speciality in the *Group of Experts* formed to do a follow-up of the chemical and biological effects of the catastrophe and chaired by Dr. César Nombela, president of the Higher Council for Scientific Research (CSIC). In reality an historic opportunity was missed which would have meant a highly significant step forward for Spain in environmental economy and also for the necessary interrelationships between natural and experimental sciences and economics. We would be better armed today, theoretically and practically, to meet the complicated task of quantifying, with the greatest possible scientific precision, the economic and environmental losses involved in the oil slicks from the tanker *Prestige*, instead of wasting time in confusing and interminable meetings attempting to obtain convoluted commitments which in the end will not result in any clear-sighted action whatever.

I must say a word on behalf of this *Group of Experts* created by the government to monitor developments

do vertido no contorno de Doñana. A súa creación foi oportuna, rápida, e o seu labor fructífero, conseguido mediante unha independencia científica, se non perfecta, si suficiente. Aí están, para probalo, os trece informes elaborados entre 1998 e 2001 (xaneiro, 26) e dispoñibles a través de internet[11]. Malia estas bondades, decepcióname que aínda hoxe non se realizase unha publicación convencional facendo unha síntese unitaria e completa de todas as variables químicas e biolóxicas analizadas nos informes. Pero, como é lóxico, aínda me decepcionou máis, no seu momento, o feito de que o coordinador especialmente acreditado para a formación do grupo de expertos do CSIC e doutros organismos públicos de investigación, o Dr. Enrique MacPherson, non movese un dedo para incluír os economistas do CSIC con experiencia probada en Doñana que, aceptando unha invitación xeral para o efecto por parte do presidente do CSIC, se ofreceron por escrito para formar parte do citado grupo de expertos. Só tres meses despois dese ofrecemento, o Sr. MacPherson respondeu cun sinxelo aviso de recibo a este e ¡ata hoxe!

Para pechar as referencias críticas á estratexia latina aplicada ó vertido do contorno de Doñana seméllame oportuno citar agora cal foi o desenlace dun caso mineiro estadounidense comparable (agás na parte da riada tóxica) ó caso de Boliden-Apirsa en Aznalcóllar. Como

11. www.csic.es/hispano/coto.

with regard to the flood in the area of Doñana. Its creation was timely and quick and its work was fruitful, performed with a scientific independence that, if not perfect, was sufficient. There, to prove it, are the 13 reports prepared between 1998 and 2001 (January 26) and available on the Internet[11]. In spite of these virtues, it is disappointing to me that a conventional publication has still not been prepared, making a unitary, complete valuation of all the chemical and biological variables analysed in the reports. But, as is logical, I was even more disappointed at the time by the fact that the particularly reputable coordinator for the formation of the *Group of Experts* from the CSIC and other public research organs, Dr. Enrique MacPherson, did not life a finger to include CSIC economists with proven experience in Doñana, who, accepting a general invitation to this effect, from the president of the CSIC, offered in writing to form a part of the *Group of Experts*. It was only three months after this offer was made that Mr. MacPherson answered with a brief note acknowledging its receipt and so it remains to this day!

To close my critical references to the Latin strategy as applied to the dumping in the Doñana area, I think it might be appropriate to cite here the outcome of a case in U.S. mining comparable (except as regards the toxic flood) to the case of Boliden-Apirsa in Aznalcóllar. By contrast, I think that it is a healthy comparison with the

11. www.csic.es/hispano/coto.

contraste, coido que é unha comparación saudable coa estratexia anglosaxona practicada pola Administración Federal dos Estados Unidos de América e polos gobernos dos dous Estados afectados. Falo do caso de ASARCO, unha das maiores empresas de minerais non férricos do mundo. En 1998, xaneiro, ASARCO subscribiu un pacto coa Environmental Protection Agency (EPA), unha axencia federal do Goberno dos Estados Unidos de América, mediante o cal a firma pagaría, ó longo de 6 anos, unha suma equivalente a 50.821.583 euros (obsérvese a curiosa aproximación coa demanda administrativa do Goberno español a Boliden, 45 millóns de euros) para limpar os seus propios vertidos a cambio de que a EPA non iniciase una demanda contra ASARCO.

Esta actuación gobernamental partiu das inspeccións practicadas pola EPA tres anos antes nas explotacións mineiras de ASARCO en Arizona (Kearny) e Montana (Eats Helena), onde a empresa levaba case un século vertendo residuos da súa actividade en balsas semellantes ás de Aznalcóllar. Os dous Estados afectados iniciaron procedementos xudiciais contra ASARCO por delicto ambiental, pero a empresa acabou pactando un acordo coa EPA para evitar que os seus directivos ingresasen no cárcere, aínda que co acordo non puido evitar unha multa por un valor equivalente a 5.787.746 euros (963 millóns de pesetas). Velaí o poder da lei na estratexia anglosaxona.

Durante o exercicio de 1997, a EPA conseguiu que a administración de xustiza esta-

Anglo-Saxon strategy practiced by the Federal Government of the United State of America and the governments of the states affected. I am talking about the case of ASARCO, one of the most important companies for non-ferric minerals in the world. In January, 1998, ASARCO signed an agreement with the *Environmental Protection Agency* (EPA), a federal agency of the government of the United States of America by which the firm would pay, over a period of 6 years a sum equivalent to 50,821,583 euros, (please observe the curious proximity with the amount claimed in the administrative action of the Spanish government against Boliden, 45 million euros) to clean up its own dumping; in exchange for which the EPA would not initiate action against ASARCO. This governmental action was the result of inspections done by the EPA three years before on ASARCO's mines in Arizona (Kearny) and Montana (East Helena) where the company had spent almost a century dumping residue from its activities into reservoirs similar to those of Aznalcóllar. The two states affected initiated legal proceedings against ASARCO for ecological crime, but the company ended up coming to an agreement with the EPA to avoid its chief executives going to prison, though the agreement could not prevent a fine for the equivalent of 5,787,746 euros (963 million pesetas). Here we have the power of the Law in the Anglo-Saxon strategy.

During the financial year 1997, the EPA managed to bring to trial some 322 people for ecological crimes; sen-

dounidense incriminase a 322 persoas por delictos ambientais; as penas sentenciadas sumaron 196 anos de cárcere e un valor equivalente a 150,2 millóns de euros (25.500 millóns de pesetas). O contraste do caso ASARCO coa estratexia latina practicada en España no caso Boliden-Apirsa é nidio; aquí produciuse un dano cun valor mínimo cuantificado en 194,5 millóns de euros e non é que non fose ninguén ó cárcere, nin que non se recuperase o custo, senón que nin sequera se puido facer efectiva a multa máis modesta nin, por suposto, houbo dimisión ningunha, nin de rango administrativo nin político. E todo se intentou remediar cun plan financeiro alleo ó que debería ser unha economía de catástrofe ambiental[12].

Ata hoxe, e en perfecta continuidade cos tempos do dictador Franco (1938-1975), a clase dirixente española, fose cal fose a súa cor política, deu probas ata o aburrimento da súa íntima incomprensión e do seu desinterese polo reto ecolóxico dunha sociedade industrial; só lle preocupan os problemas ambientais se supoñen unha fonte de desorde pública. Van a remolque da sociedade. Ramón Margalef (1980: 16) propón unha explicación desta actitude cando escribe que "[...] las ideologías más militantes se

tences added up to a total of 196 years in prison and fines equivalent to 150,253,026 euros (25,500 million pesetas). The contrast of the ASARCO case with the Latin strategy employed in Spain in the Boliden-Apirsa is evident; here damage occurred with a minimum value put at 194,500 million euros, and no one went to prison, nor was even the smallest cost recovered, not even the most modest fine was collected, nor, of course, were there any resignations, administrative or political. And an attempt was made to remedy everything with a financial approach totally alien to what should be the economics of environmental *catastrophe*[12].

To this date, in perfect continuity with the times of the dictator Franco (1938-1975), the Spanish governing class, whatever its political colours, has demonstrated time and time again its intrinsic lack of understanding and total disinterest in the ecological challenge in an industrial society. They are only concerned with environmental problems insofar as they may be a source of public disorder. They are reluctantly dragged along by the society. Ramón Margalef proposes an explanation for this attitude when he writes that: "[...] the most militant ideologies place themselves on the margin of ecological considerations

12. A información sobre o caso ASARCO débese a Michael S. Alushin, quen a expuxo na VI Conferencia Internacional sobre Industria y Medio Ambiente, organizada por Planer en Madrid durante a semana do 25 ó 28 de maio de 1998 (*El País*, 25 de maio de 1998, p. 34; crónica asinada por Inmaculada G. Mardones).

12. Information on the ASARCO case is thanks to Michael S. Alushin, who presented it at the 6th International Conference on Industry and Environment, organised by *Planer* in Madrid, May 25 to 28, 1998 (*El País*, 25 May, 1998, .34; report by Inmaculada G. Mardones).

sitúan un poco al margen de la consideración ecológica porque tienden a ver al Hombre como algo muy aparte de la Naturaleza, con el destino de ser su dueño o su verdugo".

Volvamos agora a nosa atención, brevemente, ó *Prestige*, para caracterizar algunhas das condicións da estratexia latina que xa están asentadas neste caso, como era de esperar. Evidentemente, espero que aprecien o meu bo gusto para non enumerar unha tediosa e redundante relación de referencias e non facer alusión ningunha á notoria axitación política local e nacional á que deron lugar as variadas vicisitudes do caso. Limitareime a enunciar algúns dos feitos probados e que son semellantes ó caso do vertido no ambiente de Doñana:

1 Inmediata infravaloración da catástrofe por parte das autoridades

Miguel Arias Cañete, ministro de Agricultura, en declaracións radiofónicas en novembro, 15: "No hay riesgo de contaminación"[13]. Esta é a máis esperpéntica pois na mañá do día 16 máis de 200 km de costa recibiron a primeira marea negra.

because they tend to see mankind as something quite separate from nature, destined to be its lord or its executioner".

Let us briefly shift our attention to the *Prestige* to describe some of the characteristics of the Latin strategy that are evidenced in this case, as was to be expected. Evidently I am in the hopes that you will appreciate my good taste in not enumerating a tedious and redundant list of references or making any reference whatsoever to the considerable local and national political turmoil that the various events in the case have occasioned. I will limit myself to mentioning some of the proven facts in the matter that are similar to the case of the area around Doñana:

1 Inmediate underestimation of the extent of the catastrophe by the authorities

Miguel Arias Cañete, Minister of Agriculture: statement on radio on November 15: "There is no risk of pollution"[13]. This is the most outrageous example, since on the morning of the 16th more than 200 km of coastline were hit by the first oil slick.

13. *El Mundo*, 24 de novembro de 2002, p. 22.

13. *El Mundo*, November 24, 2002, p. 22.

2 Escurantismo inicial por parte das autoridades, sobre todo no que atinxe ás manobras do barco dende o día 13 de novembro (17.00 horas) ata o seu afundimento o día 19 (11.45 h)

Fragmento da crónica enviada a *El Mundo* por Gustavo Catalán Deus, Premio Nacional de Xornalismo Ambiental 2002:

> Rajoy se hace cargo de la crisis. Pero tras visitar la zona, el silencio oficial se abre paso. Ni un dato llega a los cientos de periodistas destacados en Galicia. Todo son inquietudes. ¿Dónde están las manchas? ¿Cuándo llegarán? ¿Son correctas las estimaciones de la cantidad vertida ante los daños causados? ¿Cómo actuar? ¿Cuándo limpiar y cómo? La descoordinación comienza a adueñarse de la situación en tierra[14].

Texto do mesmo xornalista publicado o 4 de decembro e titulado expresivamente: "Sello de silencio para el Nautile":

> Cuando el Gobierno español contrató los servicios del submarino Nautile pidió una cláusula de confidencialidad. Así lo declaró ayer a El Mundo Guy Herruin, coordinador de las tareas del submarino, desde la sede de la empresa pública propietaria del batiscafo, en Toulon-La Sayne. El Nautile se ha sumergido

2 Initial obscurantism on the part of the authorities, particularly with regard to the vessel's manoeuvres from 13 November (5 p.m.) to its sinking on the 19th (11.45 a.m.)

Extract from the dispatch sent to *El Mundo* by Gustavo Catalán Deus, winner of the 2002 National Award for Environmental Journalism:

> Rajoy takes charge of the crisis. But after visiting the zone, official silence moves in. Not one bit of information reaches the hundreds of journalists sent to Galicia. It's all anxiety. Where are the slicks? When are they going to get here? Are the estimates of the amount of oil spilled correct in terms of the damage sustained? What action is going to be taken? When and how is cleaning going to be done? Disorganisation begins to take possession of the situation on land[14].

Text from the same journalist published December 4 and expressly titled: "Seal of silence for the Nautile":

> When the Spanish government contracted the services of the submarine Nautile they asked for a confidentiality clause. This is what El Mundo was told by Guy Herruin, coordinator of the submarine's tasks from the headquarters the public company it belongs to, in Toulon-La Sayne. The Nautile has submerged in the zone of the

14. *El Mundo*, 24 de novembro de 2002, p. 22.

14. *El Mundo*, November 24, 2002, p. 22.

en la zona del naufragio del *Prestige* para averiguar si pierde más fuel de sus tanques, donde se supone que quedan 60.000 toneladas. En el contrato de 700.000 euros, el Gobierno se reserva el derecho a facilitar la información de la investigación. Hasta ahora, la Vicepresidencia del Gobierno ha informado que en su primera inmersión "no se ha detectado fuel procedente de los tanques". Ayer, El Mundo pudo observar desde el aire manchas nuevas de fuel, en no más de 24 horas, de 500 hectáreas. Mucha cantidad para proceder sólo del combustible del *Prestige*. En cualquier caso, serían afloramientos de combustible que han tenido lugar 11 días después del naufragio. International Owners Pollution Federation, contratada por el Gobierno, tiene información precisa de estas manchas y vertidos, aunque tampoco está disponible para la opinión pública[15].

O día seguinte, 5 de decembro, o xornalista Carlos Elías asina, en *El Mundo*, un texto titulado "Silencio en el CSIC sobre el *Prestige*":

La prensa estaba expectante: "El Consejo Superior de Investigaciones Científicas (CSIC) convoca la conferencia de prensa sobre la presentación del plan científico de evaluación sobre el impacto del vertido del *Prestige*". La fecha para facilitar esa importante información

wreck of the *Prestige* to determine if it is losing more fuel from its tanks, believed to still hold 60,000 tons. In the contract, for 700,000 euros, the government reserves the right to facilitate information on the investigation. Up to now the office of the Vice-president of the Government has announced that in its first immersion, 'no fuel coming from the tanks was detected'. Yesterday, El Mundo was able to observe new fuel oil slicks from the air, after no more than 24 hours, over an area of 500 hectares. A large amount to have come only from the fuel from the *Prestige*'s engines. In any case they would represent engine fuel coming to the surface 11 days after the wreck. The International Owners Pollution Federation, contracted by the government, has precise information on these slicks and spills, but it is not available to the public either[15].

The following day, on the 5th of December, journalist Carlos Elías signed, also in *El Mundo*, a text with the headline: "Silence on the *Prestige* in the CSIC":

The press was expectant: 'The Higher Council for Scientific Research (CSIC) calls a press conference to present the scientific plan for evaluation of the impact of the *Prestige* spill'. The date for providing that important information was yesterday. However, first thing in the morning, a peculiar note called off the press conference

15. *El Mundo*, 4 de decembro de 2002, p. 12.

15. *El Mundo*, December 4, 2002, p. 12.

era ayer. Sin embargo, a primera hora de la mañana, una extraña nota desconvocaba la rueda de prensa "por razones técnicas". En el encuentro con los medios de comunicación estaba prevista la presencia del presidente del CSIC, Rolf Tarrach, además de otros investigadores que integran el equipo al que el Gobierno ha encargado un estudio científico sobre los efectos de la marea negra. La nota del CSIC recordaba que la Comisión Interministerial para el seguimiento de los daños, presidida por el vicepresidente Mariano Rajoy, "encargó al CSIC y al Instituto Español de Oceanografía el estudio sobre las consecuencias ambientales del vertido del petrolero". La convocatoria del CSIC había despertado el interés de los medios porque añadía que Ciencia y Tecnología también había encargado al organismo que elaboraran "las propuestas de actuación para caracterización, seguimiento y análisis de las consecuencias del vertido en la zona del hundimiento y su litoral"[16].

É certo que, ó cabo, nesta ocasión tamén se creou un Comité Científico Asesor, pero houbo un retroceso verbo do vertido de Aznalcóllar, onde se fixera de xeito inmediato. No caso do *Prestige* houbo un atraso de 26 días dende a primeira fenda do buque, polo que se perdeu un tempo precioso para realizar, de xeito coherente e centralizado, todo o

'for technical reasons'. The president of the CSIC, Rolf Tarrach, was expected to be present at the meeting with the press, as well as other researchers who make up the team the government has appointed to prove a scientific study of the effects of the oil slick. The CSIC's note reiterated the fact that the Inter-ministerial Commission for follow-up on the damage, chaired by Vice-president Mariano Rajoy, 'entrusted the CSIC and the Spanish Institute of Oceanography with the task of doing a study on the environmental consequences of the spillage from the oil tanker'. The CSIC's announcement had aroused interest in the media because it added that Science and Technology had also asked the organisation to prepare "proposals for action for the definition, follow-up and analysis of the consequences of the spill in the area where the vessel sank and its coastline"[16].

It is true that, finally, on this occasion an *Advisory Scientific Committee* was also created, but there it was a step backward in comparison to the Aznalcóllar dumping, where this was done immediately. In the case of the *Prestige* there was a delay of 26 days from the first breakage of the vessel, with a loss of precious time in which to carry out, in a coherent and centralised fashion, all the necessary analytical work, beginning

16. *El Mundo*, 5 de decembro de 2002, p. 12.

16. *El Mundo*, December 5, 2002, p. 12.

necesario labor analítico, comezando polo propio combustible. Así as cousas, os primeiros datos publicados débense ó centro científico francés LE CEDRE (Centre de Documentation, de Recherche et d´Experimentations sur les Pollutions Accidentelles des Eaux)[17].

O obxecto fundacional do propio Comité Científico Asesor foi, así mesmo, limitado ós problemas derivados dos restos do *Prestige*. Tiveron que pasar dous meses para que o Goberno se cuestionase, superficialmente, encarar unha valoración ambiental das mareas negras do *Prestige* e admitir que certos economistas especializados en valoracións ambientais traballasen para o Comité Científico Asesor de expertos. Así e todo, estas eventuais investigacións económicas (é só o meu prognóstico) poden non contemplar os danos ó patrimonio natural e non esgrimir razóns diante dun tribunal competente para reclamar lexítimas indemnizacións, posto que

17. O fuel vertido polo *Prestige* corresponde ó M-100 segundo a clasificación rusa, e ó fuel óleo n.º 6 segundo a terminoloxía inglesa. Conten un 2,58% de xofre. En Francia está incluído na categoría de fuel óleo n.º 2 (normas AFNOR NF M 15-010 ata NFM 15-013). A mostra analizada por LE CEDRE foi captada polo buque francés anticontaminación *Ailette* o día 18 de novembro de 2002, un día antes do afundimento do petroleiro *Prestige*. As mostras chegaron a CEDRE na mañá do 22 de novembro. Os datos analíticos poden consultarse en internet: www.le-cedre.fr/fr/prestige/z_produit.ntm. Na súa actualización da información correspondente ó día 7 de decembro de 2002, LE CEDRE anunciaba que "se están llevando a cabo intercambios y comprobaciones de los datos con el CEDID, en Vigo, y el CID/CSIC, en Barcelona" (p. 7).

with the fuel itself. The first published data was thanks to the French scientific centre LE CEDRE (*Centre de Documentation, de Recherche et d´Experimentations sur les pollutions accidentelles des Eaux*)[17].

The object of the *Advisory Scientific Committee* when it was created, was also limited to problems deriving from the wreckage of the *Prestige*. Two months had to pass before the government considered, even superficially, confronting an environmental valuation of the *Prestige* oil slicks, allowing certain economists specialising in environmental valuations to work for the *Advisory Scientific Committee* of experts. However, these possible economic investigations *seem* – this is only a prediction on my part – that they will not consider damage to the natural heritage nor will their work be used before the corresponding courts to claim legitimate compensations,

17. The fuel oil spilled by the *Prestige* corresponds to M-100, according to Russian classification and to *fuel oil nº 6*, in English terminology. It contains 2.58% sulphur. In France it is included in the category of fuel oil nº 2 (AFNOR regulations NF M 15-010 to NFM 15-013). The sample analysed by LE CEDRE was taken by the French anti-pollution ship *Ailette* on 18 November, 2002, a day before the sinking of the oil tanker *Prestige*. The samples reached CEDRE on the morning of 22 November. Data from the analysis can be consulted on the Internet: www.le-cedre.fr/fr/prestige/z_produit.ntm. In its update of the information corresponding to 7 December, 2002, LE CEDRE announced that "exchange of information is being carried on with the CEDID, in Vigo, and the CID/CSIC, in Barcelona" (p. 7).

os riscos cubertos polos seguros vixentes na Unión Europea limítanse a un valor máximo de 180 millóns de euros e, polo declarado ata a data, o Goberno español tampouco forzará demasiado a vía política. É máis: hoxe en día, o Goberno aínda non autorizou a presencia efectiva de especialistas independentes en economía ambiental dentro do programa oficial (por agora, tapado) de avaliación dos danos ecolóxicos e económicos provocados polas mareas negras do *Prestige*. Ou sexa: repítese a estratexia seguida en Doñana que tan bos dividendos políticos lle proporcionou ó gobernamental Partido Popular.

3 Negativa ó nomeamento dun fiscal especial

Nin sequera intervén o fiscal xeral do Estado, Jesús Cardenal, igual que se inhibiu no caso de Boliden-Apirsa. Como en Doñana, o caso circunscríbese a unha modesta xurisdicción como é a do Xulgado n.º 1 de Corcubión (A Coruña). O sumario n.º 960/2002, aberto polo xuíz Francisco Javier Collazo Lugo, axiña quedará sepultado por unha indixerible morea de papel levantada pola querela (admitida) presentada pola plataforma cívica Nunca Máis e polos demandantes das indemnizacións oficiais outorgadas polo Fondo Internacional de Indemnización de Danos Debidos á Contaminación por Hidrocarburos (FIDAC) e polo London Steam-Ship Owners Mutual Insurance Association Limited; o valor máximo é de só

since the risks covered by insurance in force in the European Union are limited to a maximum value of 180 million euros, and judging from statements made up to now, the Spanish government is not going to strongly force political channels. Further than that, at this date, the government has still not authorised the effective presence of independent specialists in environmental economy in the official programme (at present *undercover*) for evaluation of ecological and economic damage caused by the *Prestige* oil slicks. In other words, a repeat of the strategy followed in Doñana that brought such *good* political dividends to the *Partido Popular* in government.

3 Refusal to appoint a special prosecutor.

Not even the Solicitor General, Jesús Cardenal, took part in the case, just as he had abstained in the Boliden-Apirsa case. Just as with Doñana, the case was assigned to a modest jurisdiction, here Court nº 1 of Corcubión (A Coruña) in case nº 960/2002, with proceedings opened by judge Francisco Javier Collazo Lugo, who immediately found himself buried under an indigestible mountain of paper erected by the complaint (admitted) presented by the civil organisation *Nunca Máis* and by claimants for official compensation offered by the *International Fund for Compensation for Oil Pollution Damage* (IOPC Fund) and by the *London Steam-Ship Owners Mutual Insurance Association Limited*. The maximum amount is only 180 million

180 millóns de euros (1.081.821.787 pesetas): ¡un escándalo![18].

4 A pechada negativa do propietario do buque (Mare Shipping), do armador (Universe Maritime) e, máis aínda, do fretador (Crown Resource, filial de Alpha Group) non xa a pagar a máis mínima indemnización senón a colaborar, tan sequera, coas autoridades españolas

Neste punto non podo deixar pasar a oportunidade de criticar a clara conivencia das autoridades da Unión Europea co actual sistema de transporte marítimo de substancias perigosas; unha das súas claves está na existencia dos paraísos fiscais (incluíndo Suíza) e do abandeiramento de conveniencia.

Falo de conivencia intencionadamente, pois aquí hai que volver criticar esa condición da estratexia latina que é o desleixo de non reaccionar con eficacia política, administrativa e xurídica para, aprendendo das catástrofes do pasado, evitar que ocorran no futuro. Nos Estados Unidos, despois da marea negra do *Exxon Valdez* en Alasca (1989, marzo), promulgouse unha nova lei como prevención e resposta ós vertidos de petróleo e outros hidrocarburos (Oil Pollution Act, de 1990),

euros (1,081,821,787 pesetas): a scandal![18].

4 The firm refusal of the vessel's owner (Mare Shipping), of the operator (Universe Maritime) and, even more, of the charterer (Crown Resource, subsidiary of Alpha Group) not just to pay the most minimal compensation but even to cooperate, in any way, with Spanish authorities

And on this point I cannot let the opportunity go by to criticise the clear collusion of European Union authorities with the current system of maritime transport of dangerous substances: the key lies in the existence of tax havens (including Switzerland) and *flags of convenience*.

I speak of collusion quite deliberately, since here we must again criticise the nature of the Latin strategy, which is the relinquishment of the possibility of reacting with political, administrative and legal effectiveness in order, by learning from the catastrophes of the past, to avoid their occurring in the future. The United States, following the *Exxon Valdez* oil slick in Alaska (March, 1989), enacted a new law as a prevention and response to petroleum and other hydrocarbon spills (*Oil Pollution Act, of 1990*), which pre-

18. Así foi publicitado polos propios FIDAC e The London Club en anuncios inseridos na prensa nos que informaban sobre a apertura dunha oficina de reclamacións na Coruña (*El Mundo*, 8 de xaneiro de 2003).

18. This was publicised by the IOPC and The London Club in advertisements in the press in which they announced the opening of an office to receive claims in A Coruña (*El Mundo*, January 8, 2003).

que prescribe unha serie de garantías ou cautelas, entre as que quero destacar as seguintes:

- Só operarán en mares e portos de Estados Unidos os buques petroleiros de dobre casco.
- A empresa propietaria do buque, o seu armador ou o fretador deberán depositar unha fianza (que no caso dos superpetroleiros pode alcanzar hoxe un valor de ata 1.000 millóns de dólares) diante da Administración estadounidense para poder navegar ou operar en augas e portos da súa xurisdicción. Entre as consecuencias da non disposición de documentos que acrediten esa fianza por parte de calquera petroleiro que navegue ou estea fondeado nesas augas, este pode ser apresado e confiscado polo Goberno dos Estados Unidos de América (Sección 2716 da OPA'90).
- A empresa propietaria do buque, o seu armador e o seu fretador deberán acreditar a unha persoa ou entidade, residente nos Estados Unidos, como o seu representante permanente ante a Administración Federal[19].

scribes a series of guarantees and precautions of which I would like to point to the following:

- Only petroleum tankers with a double hull will operate in United States waters and ports.
- The company that is owner of the boat, its operator or charterer, will have to deposit a guarantee (which in the case of super tankers may today reach an amount of up to 1,000 million dollars) with the U.S. administration in order to be able to navigate or operate in waters and ports under its jurisdiction. Among the consequences for not making available documents that attest to this deposit for any oil tanker that navigates or is anchored in those waters, the vessel can be seized and confiscated by the Government of the United States of America (section 2716 of the OPA '90).
- The company that is owner of the boat, its operator or charterer, will be required to authorise a person or legal entity, resident in the United States, as its permanent resident before the Federal Administration[19].

19. A *Oil Pollution Act* de 1990 identifícase como 33 USCA sec. 2701-2761 no código estadounidense. Ademais desta lei, os vertidos de petróleo e derivados contémplanse na Lei de Auga Limpa (*Clean Water Act*) e no Plan Nacional de Continxencias por Petróleo e Substancias Perigosas (*National Oil and Hazardous Substances Contingency Plan*). Por suposto, ademais das cautelas e garantías esixidas como prevención dos vertidos, na eventualidade de que

19. The *Oil Pollution Act of 1990* is identified as 33 USCA sec. 2701-2761 in the U.S. code. In addition to this law, spills of oil and its by-products are covered by the *Clean Water Act* and by the *National Oil and Hazardous Substances Contingency Plan*. Of course, in addition to the precautions and guarantees required as prevention of spills, in the event that they occur, the owner of an oil

Eu pregunto: ¿fíxose algo semellante na Unión Europea despois do recente caso do *Erika* (1999) nas costas bretonas? ¿Fíxose algo para a actividade mineira metálica en Europa, ou en España, despois do desastre de Boliden-Apirsa en Aznalcóllar? ¡Non! Pero, ¿farase o mesmo despois do caso *Prestige* nos mares de Galicia, Asturias, Cantabria, País Vasco e, moito máis levemente, Francia? Agora mesmo, só Francia, España, Portugal e Italia, dende o 1 de xaneiro do ano 2003, impídenlles operar nos seus portos (non nas súas augas) ós petroleiros monocasco. Pero en España o grao de cumprimento desta apresurada norma (Real Decreto Lei 9/2002) é unha cuestión, como mínimo, controvertida: só 41 días despois da súa pretendida entrada en vigor recalaran e operaran en portos españois 131 buques monocasco de máis de 15 anos de servicio, con presuntas deficiencias regulamentarias e substancias perigosas, segundo unha comprobación feita polo Centro de Estudios del Medio Ambiente da Fundación Hogar del Empleado *(CEMA-FUHEM).*

O día 13 de febreiro de 2003, a prensa difundía este relatorio sobre os portos de

I ask, was something similar done in Europe after the recent *Erika* case (1999) off the coast of Brittany? Was anything done about mining activity in Europe, or in Spain, after the Boliden-Apirsa disaster in Aznalcóllar? No!; further: will something similar be done after the effects of the *Prestige* case in the waters of Galicia, Asturias, Cantabria, the Basque Country and, much more slightly, France? Right now, only France, Spain, Portugal and Italy, as of January 1, 2003, impede the operation in their ports (though not in their waters) of single hull oil tankers. But in Spain the degree of compliance with this hurriedly passed regulation (Royal Decree-Law 9/2002) is a question that is at least *controversial*: only 41 days after its supposed coming into force 131 single hull ships with more than 15 years of service, with alleged deficiencies in regard to compliance with regulations and carrying dangerous substances, had entered and operated in Spanish ports, according to a check done by the *Centre for Environmental Studies* of the *Fundación Hogar del Empleado* (*CEMA-FUHEM*).

On 13 February, 2003, the press published these results, referring to the ports of entry and the cargo of some of the oldest ships: the *Aramo*, 26 years

estes ocorresen, o propietario dun buque petroleiro, o seu armador (na parte que lle corresponda) é contemplado como responsable do pago de certos custos de rehabilitación natural e de danos e prexuízos específicos. Estes custos de rehabilitación inclúen os gastos en que incorran as autoridades federais, estatais ou do condado, de acordo coas disposicións sobre vertidos de petróleo e derivados establecidas polas leis que as regulan e polos plans de continxencia en vigor.

tanker, or its operator (for the corresponding part) is considered responsible for payment of certain natural rehabilitation costs and for specific damages. Rehabilitation costs include expenses incurred by federal, state or county authorities, in accordance with the provisions with regard to spills of oil and its by-products established by the laws covering them and contingency plans in force.

entrada e os cargamentos dalgúns dos buques máis vellos: o *Aramo*, de 26 anos, con alcatrán, en Avilés; o *Bitjord*, de 32 anos, tamén con alcatrán, en Avilés; o *Imant Sudmalis*, de 33 anos, con productos petrolíferos, en Tenerife; o *Cinderella*, de 28 anos, con gas natural en Cartaxena e Huelva; e o *Seawind II*, de 25 anos, con cru de petróleo, en Cartaxena. As cargas dos 131 buques sinalados eran: productos petrolíferos (petróleo cru e refinados, gasolina, gasóleo, fuel, queroseno, benceno, alcatrán, asfalto e aceites); productos químicos (ácido sulfúrico, ácido fosfórico, metanol, etanol, tetrahidrofurano e urea); e gases e derivados (gas natural, propano, butano, butadeno, propileno e amoníaco)[20].

O día seguinte, 14 de febreiro, o Ministerio de Fomento desmentía esta información no sentido de afirmar que o citado Real Decreto Lei "se está aplicando, desde su entrada en vigor, con toda seriedad y rigor" e sinalando que "ninguno de los buques citados en el informe del CEMA-FUHEM entra en el ámbito de aplicación del citado Real Decreto-Ley"[21]. Entre os 131 buques citados, 40 son petroleiros monocasco (¿ou non?), unha condición de inoperatividade expresamente recollida no Real Decreto Lei 9/2002. E se, aínda así, o Goberno di que todo está en regra, é evidente que a regra debe ser cambiada cara a maiores estándares de seguridade.

old, with tar, in Avilés; the *Bitjord*, 32 years old, also with tar in Avilés; the *Imant Sudmalis*, 33 years old, with petroleum products, in Tenerife; the *Cinderella*, 28 years old, with natural gas in Cartagena in Huelva; and the *Seawind II*, 25 years old, with crude oil in Cartagena.

The cargos of the 131 vessels cited were: petroleum products (crude oil and refined petroleum, gasoline, gas oil, fuel oil, kerosene, benzene, tar, asphalt and oils); chemical products (sulphuric acid, phosphoric acid, methanol, ethanol, tetra-hydrofurane and urea); and gases and their by-products (natural gas, propane, butane, butadiene, propylene and ammonia)[20].

The following day, 14 February, the Ministry of Development denied this information, affirming that the Royal Decree-Law in question "has been applied, since its entry into force, strictly and seriously" and pointing out that "none of the vessels cited in the CEMA-FUHEM report enter into the scope of the application of this Royal Decree-Law"[21].

Of the 131 vessels cited, 40 are single hull oil tankers (or aren't they?) a condition for their inoperability that expressly figures in Royal Decree-Law 9/2002. And if, in spite of that, the government claims that everything is correct according to the rules, it is evident that the rules should be changed to enforce better safety standards.

20. *El Mundo*, 13 de febreiro de 2003, p. 22; crónica asinada por Juan Fornieles.

21. *El Mundo*, 14 de febreiro de 2003, p. 25.

20. *El Mundo*, February 13, 2003, p. 22; report by Juan Fornieles.

21. *El Mundo*, February 14, 2003, p. 25.

De calquera xeito, aínda que España tomase en serio as súas propias leis, o caso de Xibraltar, un paraíso fiscal, é un desafío impúdico e permanente a calquera resolución conservacionista. Diga o que diga a retórica europeísta, a crúa realidade é que a Unión Europea, por desleixo, prefire amparar os intereses industriais e financeiros de grupos ben caracterizados presentes no Reino Unido, Holanda e Grecia, dentro da Unión, e de Suíza, feliz na súa gaiola dourada, e mesmo da hoxe tenebrosa Rusia, que dotarse de medios xurídicos máis apropiados e de medios de control naval militar da navegación comercial irregular. É un feito que hoxe a Unión Europea ofrece un marco institucional suficiente para que prosperen as operacións comerciais máis variadas e potencialmente perigosas e opacas á acción dun Estado de Dereito Democrático.

5 *Chuvia desmedida e efectista de diñeiro público*

Xa adiantei ó comezo que esta reacción é a principal das condicións que caracterizan a resposta latina a unha catástrofe ambiental.

O Consello de Ministros, celebrado de forma extraordinaria na Coruña o venres 22 de xaneiro de 2003, adoptou unha serie de decisións económicas para Galicia que encaixan perfectamente no prognóstico dunha actuación típica de estratexia latina. A decisión nova é que o Goberno de España habilitaría un valor extraordinario de 5.207 millóns de euros

In any case, even if Spain were to take her own laws seriously, the case of Gibraltar, a tax haven, is a shameless, permanent challenge to any conservationist resolution. Whatever European rhetoric may say, the raw truth is that the European Union, by inaction, prefers to protect the industrial and financial interests of clearly distinguishable groups present in the United Kingdom, Holland and Greece, within the Union, and in Switzerland, happy in its golden cage, and even in today's sinister Russia, than to provide appropriate legal means and systems of naval military control for irregular commercial navigation. It is a fact that today the European Union offers an institutional framework that allows for the prosperity of commercial operations of the most diverse and potentially dangerous nature, shielded from the action of democratic rule of law.

5 *Disproportionate and theatrical shower of public money*

I mentioned at the beginning that this reaction is one of the main characteristics of the Latin response to environmental catastrophe.

The Cabinet, in an extraordinary meeting held in A Coruña Friday, 22 of January, 2003, adopted a series of economic decisions for Galicia that fit perfectly with what can be expected of an action typical of the Latin strategy. The novel decision is that the Spanish government authorised an extraordinary allocation of 5,207 million euros (866,371,902,000 pesetas) as a consolation in relation to the *Prestige* inci-

(866.371.902.000 pesetas) como investimento de consolación ligado ó suceso do *Prestige*, é dicir, que non habería tal investimento de non suceder o vertido catastrófico. Hai que sinalar que nese valor extra, o que estrictamente atinxe á chamada oficialmente "recuperación ambiental do litoral" son 925 millóns de euros (153.907.050.000 pesetas), un 17,76%; o resto irá a investimentos noutros sectores alleos ó pesqueiro; tan alleos que comarcas moi afectadas polas mareas negras (como Bergantiños, Soneira e Fisterra) quedarán fóra da gran lotería das obras de enxeñería.

Demagoxicamente, este notable valor foi publicitado, por parte do Goberno, xunto con outros investimentos públicos extraordinarios, e, en parte, xa en execución bastante tempo antes do caso *Prestige*. Así, o valor confusamente proclamado ó público ascende á impresionante cifra de 12.459 millóns de euros (máis de 2 billóns de pesetas). Convén, pois, puntualizar que este valor total abarca, polo menos, o período 1997-2008 e, ademais dos fondos habilitados como consecuencia do caso *Prestige*, abrangue os habilitados para a nova infraestructura do transporte terrestre (autovías interiores galegas, trens de alta velocidade); para as actuacións en Galicia do Plan Hidrolóxico Nacional e para as actuacións galegas do Plan Forestal Nacional[22].

dent; in other words, this investment would not have been made if the catastrophic spill had not occurred. It should be pointed out that what strictly corresponds to what is officially called the environmental recovery of the coast is the sum of 925 million euros (153,907,050,000 pesetas), 17,76%; the rest will go to investments in other sectors appart from fishing, so removed that regions seriously affected by the oil slicks, such as Bergantiños, Soneira and Fisterra end up being left out of the great lottery of engineering works.

In a demagogic fashion, this considerable amount of money was publicised by the government, along with other extraordinary public investments, some of which were already in operation some time before the *Prestige* case. Thus the amount confusingly proclaimed to the public rose to the impressive figure of 12,459 million euros (more than 2 billion pesetas). It would be wise, thus, to point out that this total amount covers, at least, the period 1997-2008 and in addition to funds authorised as a consequence of the *Prestige* case, includes allocations for new ground transport infrastructure (dual carriageways for the interior of Galicia; high speed trains) and for actions in Galicia connected with the National Hydrological Plan and with the National Forest Plan[22].

22. *La Voz de Galicia*, 25 de xaneiro de 2003, pp. 3-6; *El País*, 25 de xaneiro de 2003, p. 15; *El Mundo*, 25 de xaneiro de 2003, p. 10.

22. *La Voz de Galicia*, January 25, 2003, p. 3-6; *El País*, January 25, 2003, p. 15; *El Mundo*, January 25, 2003, p. 10.

Deteñámonos un intre no valor extra dos 5.207 millóns de euros habilitados como consecuencia do caso *Prestige* ou, mesmo, no valor de 925 millóns de euros para a chamada Recuperación Ambiental: ¿é moito ou é pouco? A todo o mundo, ambos os valores seméllanlle non moito senón moitísimo, e iso tivo o efecto balsámico de acalar moitas voces críticas, xusto o efecto buscado polo Goberno, que desexa, inmoralmente, facer que se lle perdoen (nun ano electoral para Galicia) os notorios erros cometidos noutras instancias. Pero eu digo que tan inxusta é unha indemnización que non chega a cubrir todo o danado ou o perdido como a que desborda amplamente o valor desa perda ou dese dano. É lexítimo que unha persoa, un pobo, clame e reclame contra unha inxustiza, pero é moralmente inaceptable calar e aledarse intimamente cando unha inxustiza lle é favorable. Porque, imos ver, ¿de onde coida a xente que sairá o, presuntamente, abondoso diñeiro do caso *Prestige*?

Non será un maná, unha beatífica e milagreira chuvia cósmica. Ese diñeiro sairá de toda España e tamén da Unión Europea. Evidentemente non se trata de se Galicia merece ou non eses cartos públicos. Trátase de que o que vaia a Galicia de máis se detraerá doutras rexións españolas e europeas que o poden necesitar igual ou con máis motivos, pois en canto a merecementos outras comunidades tamén poden exhibir taras históricas. Agora ben, ¿como saber se o diñeiro público anunciado se pasa ou non abonda para reme-

Let us pause for a moment to consider the extra sum of 5,207 million euros authorised as a consequence of the *Prestige* case or, even the sum of 925 million euros for the so-called Environmental Recovery. Is it a lot or is it too little? To everyone both amounts sound like not just a lot, but an enormous amount of money, and that had the calming effect of quieting many critical voices, precisely the effect the government was looking for, longing, immorally to gain a pardon, in an election year for Galicia, for notorious errors committed in other circumstances. But I say that a compensation that does not cover all damages and losses is as unjust as one that goes far over the value of that loss or damage. It is legitimate that a person, or a people clamour and make their claims against injustice, but it is morally unacceptable to fall silent and feel inwardly pleased, when an injustice is in one's favour. Because, let's see, where do people think the presumably overabundant money for the *Prestige* case is going to come from?

It will not be a kind of manna in the desert, a beatific and miraculous cosmic rain. That money will come out of all of Spain and also from the European Union. It is evidently not a question of whether Galicia *deserves* this public money or not. The question is that what goes to Galicia *in excess* will be taken away from other regions of Spain or Europe that may need it just as much or with even more justification, since as far as deserving goes other communities can also show historic signs of suffering. So, how do we

diar o dano do caso *Prestige*? Pois, sinxelamente, tratando de medir o dano causado.

A principal das condicións que definen a ciencia é a súa capacidade de cuantificar os fenómenos, e a ciencia económica quere, decididamente, cumprir esa condición. ¿Por que na estratexia latina de resposta ás catástrofes ecolóxicas se prescinde sempre dos economistas ambientais?

Remato e afirmo que a estratexia latina debe ser borrada en todos os países da Unión Europea e substituída polas mellores condicións presentes na estratexia anglosaxona. Mais, polo dito ata agora, non crean que son un admirador incondicional do mundo anglosaxón. Cinguíndonos ó eido onde se fan a cotío actividades económicas en calquera lugar do planeta, tipicamente poden catalogarse, polo menos, dúas grandes castes de comportamento económico colectivo:

- Por unha banda, a dos que, dalgún xeito, están, máis ou menos, *iluminados* pola ciencia económica.
- Na outra banda, a de quen confunde a economía co *mundo dos negocios;* cos milleiros de xeitos de *facer diñeiro* á custa, case, do que sexa.

En ambas as castes, algúns dos paradigmas que rexen hoxe uns e outros comportamentos deben ser desbotados como propios dunha xeira que cómpre superar por parte da humanidade pois son, de feito, paradigmas dun comportamento *paleoeconómico.*

know if the public money announced is *too much* or *not enough* to remedy the effects of the *Prestige* case? Very simply, by trying to measure the damage incurred.

The principle condition that defines science is its capacity to quantify phenomena, and the science of economics tireless aspires to fulfil this condition. Why does the Latin strategy for response to ecological catastrophes always dispense with the services of environmental economists?

The Latin strategy should be erased from each and every one of the countries of the European Union and replaced by the better conditions offered by the Anglo-Saxon strategy.

Do not come to the conclusion, due to what I have said up to now, that I am an unconditional admirer of the Anglo-Saxon world. Let's stick to the pragmatic field where economic activity takes place on a day to day basis anywhere on the planet. Typically, we can identify, at least, two great classes of collective economic behaviour:

- On the one hand those who, in some way, are more or less *enlightened* by economic science.
- on the other those who confuse economics with the *business world*; with the varieties of ways of *making money* at almost any cost.

In both cases, some of the models that rule one behaviour or another should be thrown out as belonging to a period to be left behind by Humanity today since they are, strictly speaking, models of *palaeoeconomic* behaviour.

Permítanme, para rematar, á fin, que faga unha alegación dalgún dos novos paradigmas que deberían nuclear unha ciencia e unha práctica económicas novas; permítanme que faga unha alegación da economía sustentable. Unha parte da economía, a parte medular, a que atinxe o concepto de producción, debería ser analizada e comprendida formando corpo coa ciencia física. Non facelo así supón un erro crucial e a sociedade ou a civilización que caia nel deberá pagalo dolorosamente dalgunha maneira, nalgún lugar e nalgún tempo. Non se pode construír unha economía sustentable ignorando as limitacións que as ciencias naturais, en xeral, e a ciencia física, en particular, tiraron das súas análises sobre a realidade coñecida do noso Universo. Esta conclusión non pode ser considerada como unha banalidade ou como un adorno *intelectualoide.* As bombas termonucleares proban que a física vai en serio. A situación de penuria constante na que vive o 70% da poboación mundial, coa súa cohorte de violencia e inxustiza, proba que a economía que se usa vai en serio. A existencia de *paraísos fiscais* e do abandeiramento de conveniencia, coa súa ácida mestura de negociantes criminais, terroristas de toda natureza e ladróns, proba que o capitalismo sen contrapesos vai en serio. Do mesmo xeito que a morte dun dos nosos, pegándonos no estómago, revela que a vida vai en serio.

Allow me, on concluding, finally, to enter a plea for some of the new models that should form new economic science and practice: allow me to make a plea for a sustainable economics.

One part of economics, the fundamental part, which affects the concept of production, should be analysed and understood as forming a body with physical science. Not to do so supposes a crucial error and the society or civilisation that commits it will have to pay, painfully, in some way, at some place and some time. A sustainable economy cannot be built by ignoring the limitations that the natural sciences, in general, and physical science, in particular, drew from their analyses of the known reality of our Universe. This conclusion cannot be taken as a banality or an intellectual adornment. Thermonuclear bombs prove that physics means business. The situation of constant poverty in which 70% of the world's population lives in, with its companions of violence and injustice, prove that the economics now in vogue mean business. The existence of *tax havens* and flags of convenience with their acid mixture of criminal businessmen, terrorists of all sorts, and thieves proves that capitalism without counterweights means business. Just as the death of someone dear, hitting us in the stomach, reveals to us that life means business.

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AS PERDAS ASOCIADAS Á DETERIORACIÓN DO PATRIMONIO NATURAL
LOSSES ASSOCIATED WITH THE DETERIORATION OF THE NATURAL HERITAGE

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INTRODUCCIÓN

No concepto de custo social dunha marea negra queremos agregar nunha mesma factura unha avaliación económica global dos danos, que sexa útil[1] non só –nin principalmente– para o logro de indemnizacións efectivas senón, sobre todo, para fundamentar a necesidade dun cambio no marco institucional de responsabilidade e prevención. É dicir, para que se leven a cabo modificacións xa inaprazables sobre o ámbito, as contías e os procedementos de responsabilidade ambiental no caso de accidentes con vertidos de hidrocarburos nas augas da Unión Europea.

Unha avaliación global e de todos os danos debería engadir os beneficios perdidos tanto de mercado como sen mercado, os gastos de limpeza, os programas de restauración e todos os custos de oportunidade relevantes[2]. Estas categorías de danos preséntanse na figura 1, diferenciando entre aqueles de natureza privada, que atinxen a un número limitado de individuos nos sec-

1. Hay e Thebaud 2002:3.
2. Grigalunas *et al.* 1986:257.

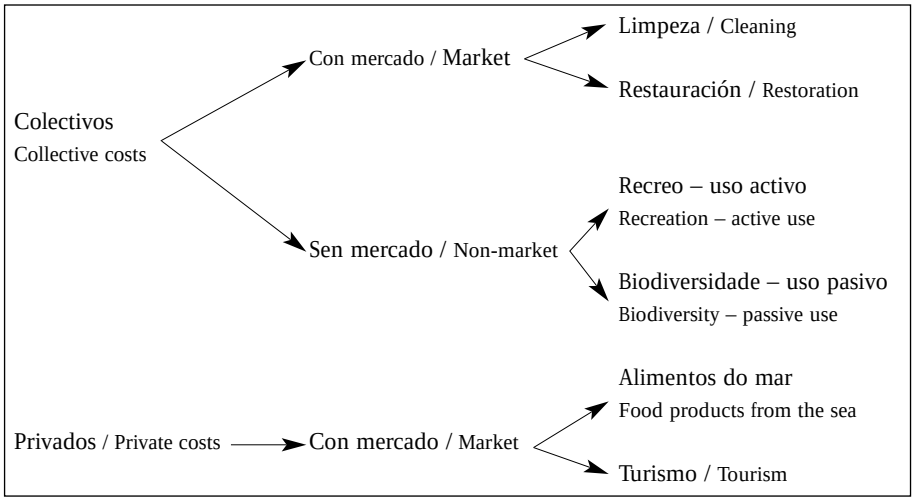
INTRODUCTION

Within the concept of the *social cost of an oil slick* we wish to include an overall economic valuation of the damages in one single *summary of costs*, a summary that will be useful[1] not only – or even chiefly – for purposes of cash compensations, but rather, most of all, to justify the need for a change in the institutional framework of liability and prevention. In other words, so that changes which can no longer be put off can be brought about with regards to the scope, amounts and proceedings for environmental liability in the case of oil spill accidents occurring in the waters of the European Union.

An overall valuation of all the damages should include both market and non-market benefits lost, cleaning costs, restoration programmes and all relevant opportunity costs[2]. These different categories of damage are presented in Figure 1, distinguishing between those of a private nature which affect a limited number of individuals in sectors connected with tourism and food products from

1. Hay and Thebaud 2002:3.
2. Grigalunas et al. 1986:257.

Figura / Figure 1
Custos dunha marea negra
Costs of an oil slick



Elaboración propia / Our chart.

tores relacionados co turismo e os alimentos do mar, e os danos de natureza colectiva, que afectan a todos os cidadáns, independentemente de que amosen unha relación directa co recurso.

En xeral, os danos a empresas e particulares dispoñen de mercados para a súa avaliación e asócianse a actividades económicas (pesca, marisqueo, hostalería, restauración, etc.) a través do impacto directo ocasionado ó recurso natural danado polo vertido: o mar (como recurso alimentario e como recurso para atraer visitantes). Non adoitan presentarse aquí problemas insuperables para a súa

the sea and those of a collective nature, which affect everyone, regardless of whether or not they have a direct relationship with the resource.

In general, damages of a private nature have markets for their valuation and are associated with economic activities (fishing, shellfish harvesting, hotel and restaurant businesses) through the direct impact on the natural resource damaged by the spill: the sea (both as a food producing resource and as one that attracted visitors). Insurmountable problems do not tend to appear here for their inclusion within the IOPC-IMO

inclusión no marco[3] de responsabilidade FIDAC-OMI aplicable na UE, aínda que si para a súa concreta cuantificación e total pago (o que explicará as fortes diverxencias entre estimacións e pagos efectivos finais).

Polo contrario, os danos colectivos non poden ser avaliados con indicadores de mercado e engloban os prexuízos producidos en recursos naturais e ambientais. Estes danos teñen un marcado carácter social e/ou público.

Xa nun acordo xudicial de referencia nos EE.UU. con motivo da marea negra do *Exxon Valdez* recoñecíanse estes danos directos ós recursos naturais nesta enumeración textual[4]: "... perdas en valores de uso, de non-uso, opción, recreo, herdanza, existencia, excedente do consumidor, rendas económicas, e outras semellantes...". Na mesma liña e máis recentemente[5] a Comisión Europea planea avaliar os danos para coñecer o valor dos recursos naturais e dos servicios perdidos incluíndo: "... recursos vivos e non vivos como a terra, os hábitats, a fauna, o medio natural, o medio biótico, o aire, as augas subterráneas e superficiais, e os ecosistemas". Consecuentemente a proposta de Directiva (COD 2002/0021) de Responsabilidade Ambiental na UE (art. 2.1.19) especifica que o valor total do dano debe engadir:

framework[3] of liability applicable in the EU, but they do appear in regard to their specific quantification and total payment (which explains the strong differences between estimations and actual payments finally made).

On the other hand, collective damages can be evaluated through market indicators and include the damages that occur to natural and environmental resources. These damages have a definite social and/or public nature.

In a benchmark judicial decision in the US on the *Exxon Valdez* case direct damages to natural resources were textually listed as[4]: "...losses in use and non-use values, option values, recreation, heritage, existence, consumer surplus, income and other similar values…" Along the same line and more recently[5] the European Commission proposed evaluating damages in order to establish the value of natural resources and services lost by including: "... living and non-living resources, such as the land, habitats, fauna, the natural environment, the biotic environment, the air, subterranean and surface waters and ecosystems"; consequently, the proposal for the EU Directive (COD 2002/0021) on Environmental Liability (Art. 2.1.19) specifies that the total value of the damage should include:

3. Serían as perdas reclamables de beneficios FIDAC 2002:7.

4. USDC 1991:5-6.

5. Comisión 2000:51-52.

3. These would be claimable losses of profits IOPC 2002:7.

4. USDC 1991:5-6.

5. Commission 2000:51-52.

i) "... o valor que as persoas obteñan como consecuencia da utilización directa do recurso natural";
ii) "... o valor que as persoas atribúan ós hábitats e ás especies con independencia da súa utilización directa".

Pero, malia o avance que a enumeración destes conceptos supón para a responsabilidade ambiental, o grave problema vai ser que tanto o tráfico marítimo de hidrocarburos, como a responsabilidade ambiental derivada dos seus vertidos, exclúense explicitamente de seren afectados pola dita directiva (art. 3.3.).

Así as cousas, no caso dos danos directos ós recursos naturais e ambientais por unha marea negra, a situación actual da responsabilidade na UE é dunha clara primacía do enfoque de mercado, que exclúe a avaliación e reparación dos danos sociais que poidan exceder os custos dos programas de limpeza e restauración[6]. Na situación do marco institucional vixente, deixando a un lado as perdas para o sector extractivo e os desembolsos na retirada, limpeza e xestión do hidrocarburo vertido en mar e terra (que adoitan ser aceptados polo FIDAC-OMI e nos que o único que se discute é a súa adecuación, contía e custos de oportunidade), as perdas en usos recreativos non se aceptan como indemnizables e as ecolóxicas só na contía dos "razoables" custos de restauración (Hay e Thebaud 2002:23).

6. Só medidas *razoables* de restauración (FIDAC 2002:7).

i) "... the value that people obtain as a consequence of the direct use of the natural resource";
ii) "... the value that people attribute to habitats and species regardless of their direct use".

However, in spite of the advance that inclusion of these concepts signifies in terms of environmental responsibility, the serious problem is going to be that maritime hydrocarbon traffic and the environmental liability deriving from its spillage is explicitly excluded from the directive cited (Art. 3.3.).

As things stand, in the instance of direct damage to natural and environmental resources caused by an oil slick, in the current situation of liability in the EU, priority is clearly given to a market approach that excludes assessment and repair of social damage that might exceed the costs of cleaning and restoration programmes[6]. The situation of the institutional framework in force, leaving aside losses for the extraction sector and expenditures for the removal, cleaning and handling of the hydrocarbon from sea and land (which tend to be accepted by IOPC-IMO and in which the only question under discussion is their adaptation, amount and opportunity costs) losses in recreational uses are not accepted for compensation and ecological losses are only considered as "reasonable" restoration costs (Hay and Thebaud 2002:23).

6. Only reasonable restoration measures (IOPC 2002:7).

Estes danos sen mercado (de uso / recreo ou de non uso / ecosistemas), debido ó seu carácter público, só poderían ser reclamados polo Goberno –logo da superación das dificultades técnicas para avalialos– se o marco legal o permitise. A razón radica no carácter colectivo destas perdas, pois a Administración debe funcionar, neste caso, como administrador e garante do patrimonio común. Sen embargo, cando –como sucede na UE– o marco legal os exclúe explicitamente, a énfase diríxese a atender os meros custos de limpeza e restauración (Grigalunas *et al.* 1998b:63).

Tal marco de responsabilidade descansa nunha dobre e moi dubidosa suposición:

i) que as medidas de restauración –que si se sufragan– poden "situar o lugar danado no mesmo estado ecolóxico" e que "un vertido importante de hidrocarburos non causará danos permanentes ó medio mariño" (FIDAC 2002:29);
ii) que en relación a eventuais cuantificacións en termos monetarios "O Fondo non terá en conta reclamacións por danos ó medio natural tomando como base unha cuantificación abstracta calculada de acordo con modelos teóricos" (FIDAC 2002:30).

Ambos os dous supostos son dubidosos pois, en primeiro lugar, algúns danos prolónganse moi a longo prazo no tempo e a recuperación ambiental en moi raras ocasións será total e, en segundo lugar, existen xa ferramentas contrastadas para avaliar as perdas

These damages without market costs (use/recreation; non-use/ecosystems), given their public nature, can only be claimed by the Government – once surmounted the technical difficulties involved in evaluating them – when the legal framework so permits. The reason is the collective nature of these losses which we have already indicated, since the administration must act in this case as administrator and guarantor of the common heritage. However, when - as occurs in the EU – the legal framework explicitly excludes them, the emphasis is placed on attempting to deal with the basic costs of cleaning and restoration (Grigalunas et al. 1998b:63).

This liability framework rests upon a double, quite doubtful supposition:

i) that restoration measures – which are defrayed – can "restore the damaged area to the same ecological condition" and that "a significant spill of hydrocarbons will not do permanent damage to the marine environment" (IOPC 2002:29);
ii) that with regard to incidental quantifications in financial terms of the damages to the environment, "The Fund will not take into account claims for damages to the environment taking as a basis an abstract quantification calculated according to theoretical models" (IOPC 2002:30).

Both suppositions are doubtful since, on one hand, some damage is prolonged over a considerable space of time and environmental recovery will

sociais de benestar –transitorias ou non– que se están producindo a longo prazo[7].

Se non temos en conta todos os danos e simplificamos os custos sociais identificándoos cos gastos en programas de restauración[8], implicitamente estaremos aceptando como real un virtual regreso ó día antes do vertido, por riba de renunciar a que se indemnicen os valores non comerciais danados e, finalmente, eximindo ó causante do dano do pago total deste. Se os valores non cuantificados polo mercado son cuantiosos, o que ocorre non só podería cualificarse de estafa social senón –quizais máis importante aínda– que pode considerarse como un estímulo perverso para que seguir contaminando sexa "barato".

O noso diagnóstico non é novo, pois vaise abrindo un amplo consenso na UE nos últimos tempos sobre a necesaria ampliación da actual definición de danos causados pola contaminación (Comisión 2000b:37), admitindo que o dano ecolóxico debe ser recoñecido e precisado (CESF 2000:111) e que os métodos de avaliación continxente permiten medilos (Ministère 2000).

Por iso o obxectivo do presente texto é contribuír con suxestións fundamentadas á realización dunha análise rigorosa no caso do *Prestige*

on rare occasions be total, and in second place because today we have reliable techniques to evaluate losses in social welfare – transitory or not – that occur over long-term periods[7].

If we do not take into account all damages and simplify social costs by identifying them with costs of restoration programmes[8], we will be implicitly accepting as real a virtual return to the day before the spill, in addition to renouncing the possible indemnification for damaged non-commercial values, and, finally, exempting the agent causing the damage from total payment. If non-market costs are significant, what occurs can not only be qualified as a social fraud but also – perhaps more importantly – can be seen as a perverse stimulus that makes it "cheap" to continue to pollute.

Our diagnosis is not new; a broad consensus is lately taking shape within the EU about the need to expand the current definition of damage caused by pollution (Commission 2000b:37), admitting that ecological damage should be recognised and specified (CESF 2000:111) and that methods of contingent valuation make it possible to measure them (Ministère 2000).

The objective of the present text is to make a contribution of suggestions based on carrying out a rigorous analy-

7. Fronte ás demandas baseadas nos custos razoables da recuperación as demandas baseadas "na utilización de técnicas de avaliación como os custos de transporte ou avaliación continxente... non son aceptadas" (Thébaud 2002).

8. Ambos son independentes (MacAlister 2001:47).

7. In contrast with claims based on reasonable restoration costs, claims based "on the use of valuation techniques such as costs of transport or contingent valuation... are not accepted" (Thébaud 2002).

8. The two are independent of one another (MacAlister 2001:47).

que, recoñecendo a estructura e limitacións do actual marco de responsabilidade ambiental, permita fundamentar a súa necesaria modificación e actualización sobre todo no que atinxe ós danos colectivos das mareas negras.

A. OS CUSTOS DE LIMPEZA-MITIGACIÓN E DE RESTAURACIÓN DO MEDIO NATURAL

Os prezos e os custos das medidas de mitigación dos danos son as vías de mercado para aproximármonos á contía dos impactos da marea negra sobre o patrimonio natural colectivo. Neste apartado presentaremos algunhas cifras relacionadas con custos "históricos" de limpeza e restauración noutras mareas negras, cos cales comparar e contextualizar as previsións gobernamentais sobre os gastos en mitigación no caso do *Prestige*. Estas previsións de custos asociados coa mitigación habitualmente incorporan as seguintes partidas de gastos:

a) recollida, xestión e tratamento final de residuos,
b) recuperación do fondo mariño,
c) programas de restauración de ecosistemas e hábitats,
d) control e seguimento da calidade ambiental,
e) recuperación da imaxe en productos, servicios e mercados.

Sobre os casos presentados cronoloxicamente no cadro 1 é oportuno facer algunhas precisións e comentarios.

sis of the *Prestige* case which, recognising the structure and limitations of the current framework for environmental liability, would make it possible to propose the necessary modifications and updating of it as regards the collective damages caused by oil slicks.

A. COSTS OF CLEANING-MITIGATION AND RESTORATION OF THE NATURAL ENVIRONMENT

The prices and costs of measures for the mitigation of damages are market mechanisms with which to approximate the oil slick's impact on the collective natural heritage. In this section we will present some figures related to "historic" costs of cleaning and restoration with which we can compare and put into context governmental estimates of mitigation costs in the case of the *Prestige*. The estimates of costs associated with mitigation normally include the following cost headings:

a) collection, management and final treatment of waste,
b) restoration of the sea floor,
c) restoration programmes for ecosystems and habitats,
d) control and monitoring of environmental quality,
e) image rehabilitation in products, services and markets.

It would be advisable here to make a few observations and comments on the cases presented in chronological order in Table 1*.

*Numbers in tables are written in latin style, that is, 29,92 in english and 287.000 would be

O *Amoco Cadiz* é un excelente referente pola amplitude da literatura económica xerada (Bonnieux e Rainelli 1991). Na faceta que aquí nos ocupa, e a título de exemplo, acometeuse mesmo a avaliación[9] de traballos de voluntarios e de soldados. Ademais o custo de mitigación unitario obtido por estes autores, ó redor de 650 $ por t (de 1978), pódese confrontar con outras investigacións[10]. Nesta marea negra o 85% dos pagos ó cabo realizados polos fondos de seguros estaban vencellados cos gastos en limpeza, malia que inicialmente estes non acadaban ni o 40% dos danos totais avaliados.

O caso do *Exxon Valdez* é outro referente salientable por varios motivos. O fundamental é a asunción directa pola empresa petroleira dos custos de mitigación (2.100 millóns de $) así como o acordo extraxudicial para fornecer un fondo de restauración do medio natural (por outros 1.000 millóns de $). O interese por manterse nunha baía de carga no remate dun oleoducto, os importantes ingresos fiscais do estado de Alasca sobre as exportacións de petróleo e a demanda de novas prospeccións petrolíferas nese estado e no Ártico poden ser argumen-

The *Amoco Cadiz* case is an excellent point of reference given the extent of economic literature produced on the subject (Bonnieux and Rainelli 1991). In the aspect that concerns us here, and by way of example, even the valuation[9] of the work of soldiers and volunteers is dealt with. In addition, the unit cost of mitigation arrived at by these authors, around $650 per metric tonne (M.T.) (in 1978) can be contrasted with other research[10]. In this oil slick 85% of the payments finally made by insurance funds were connected with cleaning costs, although initially these were under 40% of the total evaluated damages.

The case of the *Exxon Valdez* is for various reasons a singular one. Most important is that the oil company directly assumed responsibility for mitigation costs (2,100 million dollars), coupled with the extra-judicial agreement to provide restoration for the natural environment ($1,000 million). Interest in being able to remain in a bay suitable for loading ships at the end of an oil pipeline, the large amount of tax revenues the State of Alaska receives from the oil fields and the demand for new oil explorations in the State of Alaska and in the Artic could be reasons for this action and an agreement of this magnitude in contrast with European experiences. For

9. Para ver os criterios de contabilización de custos reclamables de limpeza e restauración (FIDAC 2002:20-23).

10. Grigalunas *et al.* 1986:244; Bonnieux e Rainelli 1991:44.

287,000 in english. The editors have maintained this criteria to simplify the tables

9. To see accounting criteria for claimable cleaning and restoration costs (IOPC 2002:20-23).

10. Grigalunas et al 1986:244; Bonnieux and Rainelli 1991:44.

Cadro / Table 1
Custos de mitigación dos danos en mareas negras
Costs of mitigation of damages in oil slicks

Marea Slick	Tipo type	Miles t 1000 M.T.	Costa km km. coast	Total custo total cost	Custo / cost t	I	II
A. Cadiz (1978)(1)	cru crude	200	350	134 M$	650 $	50%	37%
E. Valdez (1989)(2)	cru crude	38,8	700	3.100 M$	79.896 $	100%	35%
Erika (1999)(3)	fuel fuel oil	20	400	124 M€	6.200 €	¿	15%
Prestige (2002)(4)	fuel fuel oil	37	700	1.230 M€	33.200 €	15%	¿

Elaboración propia / Our chart.

Notas / Notes

I. Porcentaxe do indemnizado finalmente sobre os gastos de mitigación realizados.

I. Percentage of final compensation over costs of mitigation.

II. Porcentaxe sobre os danos totais estimados dos custos de mitigación.

II. Percentage of the costs of mitigation over total estimated damages.

(1) Unidades monetarias de 1978; as porcentaxes en Hay e Thebaud 2002:7; serían 230 M euros de 2003 (Bonnieux e Rainelli 2003:9) e un 46% en II segundo os mesmos autores.

Currency units of 1978; the percentages in Hay and Thebaud 2002:7; this would be 230 million euros in 2003 (Bonnieux and Rainelli 2003:9) and 46% in II according to the same authors.

(2) Unidades monetarias de 1991; en I caería a 35% sobre a estimación (1000 para restauración Fondo sobre 3000) de Carson *et al.*; en II derívase de 3100 sobre 8865 (Jorgensen 1995:41 e 509); segundo as referencias chégase a falar de 1500 km de costa (Bouza *et al.* 2003:40).

Currency units of 1991; in I this would fall to 35% of the estimate (1,000 for restoration Fund, over 3,000) of Carson et al.; in II it is derived from 3,100 over 8,865 (Jorgensen 1995:41 and 509); according to references as much as 1,500 km. of coastline was talked of (Bouza et al. 2003:40) so that it is fundamental to specify the level of impact.

(3) Unidades de 2000; o 15% de 124 sobre 841 M euros de custo social total (Thebaud 2002).

Units of 2000; the 15% of 124 over 841 million euros of total social cost (Thebaud 2002).

(4) Todos os datos provisionais e/ou estimacións oficiais (Presidencia do Goberno, 2003, e Xunta de Galicia, 2003). En I é o máximo de 180 sobre os 1230; nótese sobre o interrogante que se estes custos estivesen entre o 35% do *E. Valdez* e o 15% do *Erika* situaríanos nun custo social total de 6.000 M euros (cifra da que sería o 20% os 1200 de mitigación). Neste caso é importante distinguir mitigación de programas especificamente de restauración que só acadarían aprox. 200 millóns. Cando se corrixen as probas deste libro (abril, 2004) a cifra tiña caído á metade (600 M euros) e o vertido de fuel estimábase no dobre (60.000 t), o custo/t sería de 10.000 euros en lugar de 33.200.

All provisional data and/or official estimates (Office of the President of the Government, 2003, and the Xunta of Galicia, 2003). In I it is the maximum of 180 over 1,230; please note with regard to the question mark that if these costs were between 35% of the *E. Valdez* and the 15% of the *Erika*, they would give us a social cost of 6,000 million euros (a figure of which the 1,200 for mitigation would be 20%).

In this case it is important to distinguish mitigation from programmes that are specifically for restoration, which only reach about 200 million. When the first proofs of this book are corrected (April, 2004), this figure has decreased to half the former one (600 M euros) and the fuel spilt was estimated as double (60,000 t), the cost/t would be of 10,000 euros instead of 33,200.

tos para tan singular acordo verbo das experiencias europeas. A causa disto, o custo resultante sitúase moi por riba[11] do de calquera outra marea negra.

No caso do *Erika* a cifra unitaria por t de fuel (6200 €), sendo moi superior ó obtido para o *A. Cadiz*, atoparía a súa xustificación no maior impacto ambiental do fuel verbo do cru ou dos seus primeiros refinados[12]. Neste senso, semella probado que cada t de fuel vertida convértese aproximadamente en 10 de residuos recollidos[13] (CESRPL 2000:6 e 9). Esta cifra unitaria encaixa, ademais, co anotado noutras mareas negras[14].

Ademais, entre os vertidos do *Erika* e do *Prestige* danse algunhas simetrías que convén anotar. Entre elas e, en primeiro lugar, a sobranceira achega de traballo de voluntarios non retribuídos; aínda que en Francia foron 100.000 xornadas (CESRPL 2000:24) e, no caso de Galicia, xa só en dous concellos afectados totalízanse 75.000[15]. Tamén hai semethis reason the resulting cost is situated far above[11] that of any other oil slick.

In the case of the *Erika* the unit figure for M.T. of fuel oil (€6,200), much higher than the figure for the *A. Cadiz*, is due to the greater environmental impact of fuel oil in comparison with crude oil or its first refining[12]. In this sense, it appears to be a proven fact that each M.T. of fuel oil spilled is converted into approximately 10 of collected waste[13] (CESRPL 2000:6 and 9). This unit figure corresponds, in addition, with what has been observed in other oil slicks[14].

In addition, there are certain similarities between the *Erika* and *Prestige* oil slicks which would be advisable to take note of. Among them, in the first place, the important contribution of the work of unpaid volunteers; although in France this amounted to 100,000 work-days (CESRPL 2000:24) and in the case of Galicia, in only two of the Galician municipalities affected there was a total of 75,000[15]. There is also similarity in the difficulty and increase in cost in applying correct final

11. Nesta liña argumentan Bonnieux *et al.* 1993:10; cfr. tamén Russell *et al.* 2001, Exxon Mobil 2002 e USDC 1991:3.

12. Grigalunas *et al.* 1988 indican que o fuel n.º 2 alomenos duplicaría os do cru lixeiro; en vinte veces (10.000 de fuel = 200.000 de cru bruto) amplíase o impacto en Ministère 2000.

13. Co que cabería esperar retirar do *Prestige* 370.000 t de residuos (na data de hoxe non se levaría recollido nin a terceira parte).

14. Bonnieux e Rainelli 1991:44 con 7.800 $/t en Suecia por exemplo.

15. Carnota con 50.000 e Muxía con 25.000. O custo imputado en Francia de 76 euros/xornada. Cando isto se redacta –febreiro, 2003– contabilízanse xa 200.000 xornadas en toda Galicia.

11. In this line of argument, Bonnieux et al 1993:10; see also Russell et al. 2001, Exxon Mobil 2002 and USDC 1991:3.

12. Grigalunas et al. 1988 indicate that fuel oil nº 2 would at least duplicate that of light crude oil; in Ministère 2000, impact went to twenty times (10,000 of fuel oil = 200,000 of crude oil).

13 So that it can be expected to remove 370,000 M.T. of waste from the *Prestige* (as of today not even a third part has been collected).

14. Bonnieux and Rainelli 1991:44 with $7,800 /M.T. in Sweden, for example.

15. Carnota with 50,000 and Muxía with 25.000. Cost attributed in France was 76 euros/day. When this was written – February, 2003 – 200,000 days of work had already been registered in all Galicia.

llanza na dificultade e encarecemento de aplicar un correcto tratamento final ós residuos recollidos na costa, nos que aparece o fuel mesturado con outro tipo de materiais. Así mesmo, en ambos os casos foi necesario recuperar o fuel do barco afundido; aínda que no *Erika* o pecio atopábase a 120 metros de profundidade (e supuxo un custo de 76 millóns de euros para 20.000 t de fuel) no caso do *Prestige* non sorprende que a máis de 3000 metros (para 37.000 t) se estime o custo arredor dos 230 millóns de euros.

Mais tamén existen notorias diferencias que, no caso do *Prestige* funcionan como agravantes[16]: a profundidade do barco afundido, a persistencia no tempo do impacto, a extensión de costa afectada,... que poderían situar o custo unitario de limpeza e restauración do *Prestige* moi por enriba do precedente francés, aínda que non tan elevado como o de Alasca.

Sen dúbida, a cifra total que o propio goberno español proporciona como estimación para os custos de limpeza e restauración (1230 millóns de euros) debe provocar unha reflexión* nos seguintes sentidos:

1º que só sería indemnizada polos seguros en a penas un 15% como máximo;
2º que a compoñente estricta de restauración (200 millóns) supera por si soa a garantía OMI-FIDAC;

16. MCeT 2002:9-10.
*Cfr. nota 4 do cadro 1.

treatment to the wastes collected on the coast, in which the fuel oil was mixed with other types of materials. Also, in both cases it was necessary to recover the fuel oil from the vessel, though in the case of the *Erika* the wreck was at a depth of 120 metres and had a cost of 76 million euros for 20,000 M.T. of fuel oil, and in the case of the *Prestige* it should come as no surprise that for 37,000 M.T. at more than 3,000 metres the cost is estimated at around 230 million euros.

But there are also significant differences that in the case of the *Prestige* act as aggravating circumstances[16]: in addition to the depth of the sunken ship, the persistence of the impact over a length of time, the extension of affected coastline… which could situate the unit cost of cleaning and restoration for the *Prestige* high above that of its French precedent though not as high as in the Alaskan case.

Without doubt, the total figure that the Spanish government itself provides as an estimate for costs of cleaning and restoration (1,230 million euros), should lead to the following considerations:

1º that no more than 15% could be compensated by the polluter's insurance;
2º that the restoration component alone (200 million) is over the IMO-IOPC guarantee;

16. MC&T 2002:9-10.
*Cfr. footnote 4 in table 1.

3º que aínda así esta compoñente supón unha infraavaliación dos danos ocasionados ós usos activos e pasivos do patrimonio natural.

É desta última cuestión da que cremos moi importante ocuparnos nos apartados seguintes da nosa exposición[17], pois consideramos moi relevante poder demostrar que unha estimación *ad hoc* dos danos e prexuízos ós usos activos e pasivos do patrimonio natural –singularmente ós colectivos sen un equivalente de mercado– poden superar eses 200 millóns de euros presupostados e vencellados á restauración. Implicitamente, se a estimación amosase que os danos ó patrimonio natural son moi superiores a esta cifra, estariamos fundamentando a incorrección do marco de responsabilidade vixente, que considera certo que os custos de restauración proporcionan unha axeitada aproximación ós danos ó patrimonio natural.

Como tal tarefa debe desenvolverse nos vindeiros anos con traballos de campo e datos directamente obtidos das propias áreas afectadas, limitarémonos, no que segue, a establecer as liñas argumentais e o contexto analítico deses traballos.

3º that even so, this component represents an underestimate of the damages caused to the active and passive uses of the natural heritage.

It is with this last question that we believe it is necessary to concern ourselves in the following sections of our presentation[17]. We consider that it is relevant to show that an ad hoc estimation of damages to the active and passive uses of the natural heritage – in particular, collective uses without a market equivalent – is over the 200 million euros allowed for restoration. If the estimation shows that damages to the natural heritage are much higher than this amount, we will be implicitly making clear the erroneous character of the framework for liability currently in force, which considers that restoration costs provide a correct approximation of damages to the natural heritage.

Since this work should be undertaken in coming years using field work and data obtained directly from the affected areas, we will limit ourselves in what follows to establish the lines of argument and analytical context of this work.

17. Sobre todo apartado C e B.4.

17. Specially, sections C and B.4

B. IMPACTO NOS USOS ACTIVOS (TURÍSTICO-RECREATIVOS) DO PATRIMONIO NATURAL DANADO: ESTIMACIÓN PRELIMINAR

Establécense aquí hipóteses sobre perdas de gozo por cesamento ou diminución das visitas de residentes e non residentes, mais tamén da menor satisfacción derivada das visitas que sigan tendo lugar. E, en ambos os dous casos, só para o primeiro ano do impacto.

B.1 Perdas por diminución de uso para recreo de visitas regradas

Sen contar os fluxos domésticos –dentro de Galicia– e sen contabilizar as visitas e durmidas non regradas, a marea negra vai reducir durante un tempo os fluxos de visitantes e durmidas que se producirían en ausencia de tal impacto.

Se ollamos unha representación cartográfica da intensidade desta demanda (durmidas) nas rexións atlánticas da UE cun maior risco de mareas negras, podemos observar que Galicia so é superada en España por Cantabria, e en Portugal só pola área de Lisboa (figura 2). Sen embargo, o seu nivel é inferior ó da Bretaña francesa, aínda que semellante á rexión de Loira.

Se consideramos un impacto hipotético[18] sobre a tendencia de durmidas do -25% para

18. Este e outros parámetros hipotéticos (en cursivas no texto) son os que habería que contrastar en traballo de campo.

B. IMPACT ON ACTIVE USES (TOURISM-RECREATION) OF THE DAMAGE TO THE NATURAL HERITAGE: PRELIMINARY ESTIMATE

Here hypotheses are presented with regard to use losses for suspension of or a decline in the number of visits by residents and non-residents, and also on the diminished satisfaction obtained on visits that continue to be made. In both cases only for the first year of impact.

B.1 Losses due to decline in recreational use in controlled visits

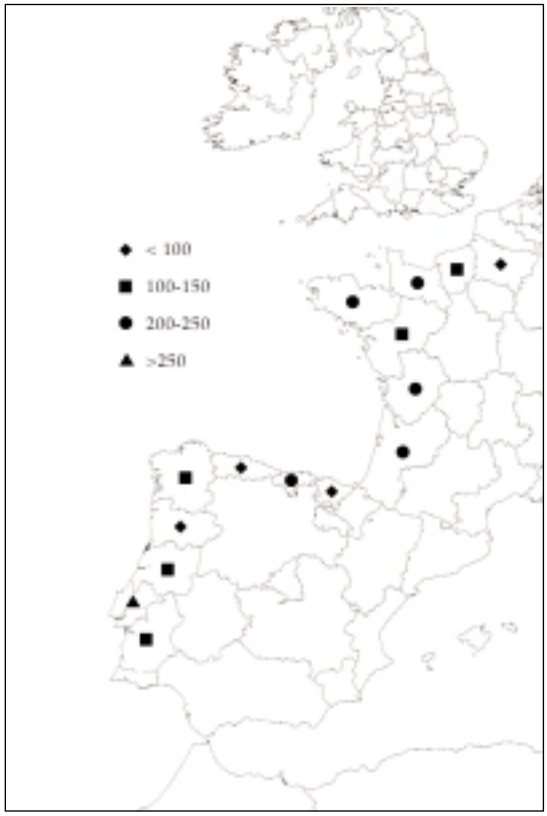
Without counting internal movements – inside Galicia – and without counting visits and overnight stays that are not controlled, the oil slick is going to reduce for some time the influx of visits and overnight stays in comparison with those that occurred in the absence of that sort of impact.

If we look at chart representing the intensity of this demand (guest-nights) in the Atlantic regions of the EU with higher risk of oil slicks, we can observe that Galicia is only surpassed in Spain by Cantabria and in Portugal by the area around Lisbon (Figure 2). However, the level is lower than that of Brittany, in France, though similar to the region of the Loire.

If we consider a hypothetical impact[18] on the trend in guest-nights

18. This and other hypothetical parameters (in italics in the text) to be checked against field work.

Figura / Figure 2
Durmidas turísticas (por 100 habitantes)
Tourism in guest-nights (per 100 inhabitants)



o 2003 teriamos unha caída de 1.750.000 durmidas. O dito nivel hipotético de impacto non semella a priori excesivo verbo do sucedido nas mareas negras do *A. Cadiz*[19] ou do

19. Visitantes -16% e anulación reservas -30% (Bonnieux e Rainelli 1991:47-89, 73, 131), (Bonnieux e Rainelli 1993:13).

of -25% for 2003 we would have a drop of 1,750,000 nights. This hypothetical level of impact does not seem excessive a priori in relation to what happened with the A. Cadiz[19] or

19. Visitors – 16% and cancelled reservations – 30% (Bonnieux and Rainelli 1991:47-89, 73, 131), (Bonnieux and Rainelli 1993:13).

Cadro / Table 2
Fluxos de visitas e durmidas turísticas regradas en Galicia 2001
Flow of controlled visits and guest-nights in tourism in Galicia 2001

	Persoas Persons	Durmidas Guest-nights	
Total Total	2.853.000	6.995.000	
Residentes[22] Residents[22]	2.072.000	5.863.000	86,8%
Non residentes Non-residents	457.000	889.000	13,2%

Fonte: Elaboración propia sobre Exceltur 2002:57 / Source: Own chart on Exceltur 2002:57.

Erika[20], sobre todo dada a importancia dos fluxos estacionais, do recreo vencellado ó uso do litoral[21] e a presencia na costa galega dos espacios da RN2000 máis valiosos[23] (figura 3).

Para avaliar economicamente esa reducción do uso recreativo no litoral danado pola marea negra dispomos de distintos datos de gasto diario. O *Instituto Galego de Estatística* (IGE) estima o gasto medio por individuo e noite en hotel en 131 euros, mentres que a renda da que prescinde un visitante ó Parque Natural das Illas Cíes sitúase arredor dos 50 euros (Prada, 2001). Esta cifra está mais preto

Erika[20] oil slicks, particularly given the importance of seasonal flows, of recreation connected with use of the coast[21] and the presence on the Galician coast of the most valuable N2000N (Natura 2000 Network) areas[23] (Figure 3).

To evaluate in economic terms this reduction in recreational use of the coast damaged by the oil slick we use different types of daily expenditure. The *Instituto Galego de Estatística* (IGE-Galician Statistics Institute) estimates average spending per individual and night in hotel at 131 euros while the amount spent by a visitor to the Islas Cíes Nature Reserve is around 50 euros

20. En Loira -25% durmidas (CESRPL 2000:51-73).
21. Bonnieux e Rainelli 1991:133.
22. Residentes e non residentes só en hoteis e hostais, no total non se inclúe visitas non regradas.
23. Sobre os que se sinala un especial ámbito de responsabilidade ambiental na UE (Comision 2000:9).

20. In Loire – 25% guest-nights (CESRPL 2000:51-73).
21. Bonnieux and Rainelli 1991:133.
22. Residents and non-residents only in hotels and hostals; total does not include non-controlled visits.
23. For which a special range of environmental liability is specified in the EU (Commission 2000:9).

Figura / Figure 3
Rede Natura 2000 no litoral de Galicia / Natura 2000 Network on the coast of Galicia

Mapa Map	Lugar de Interese Comunitario (LIC) Site of Community Interest (SCI)	Superficie (hectáreas) Area (hectares)
1	A Ramallosa	92
2	As Catedrais	304
3	As Gándaras de Budiño	834
4	Betanzos-Mandeo	865
5	Cabo Udra	623
6	Complexo húmido de Corrubedo	9.302
7	Complexo Ons-O Grove	7490
8	Costa Ártabra	7659
9	Costa da Morte	11.885
10	Costa da Vela	1385
11	Costa de Dexo	350
12	Enseada de San Simón	2252
13	Estaca de Bares	926
14	Esteiro do Tambre	1583
15	Illas Cíes	990
16	Illas Estelas	713
17	Monte e Lagoa de Louro	1161
18	Ortigueira-Mera	3795
19	Ría de Foz-Masma	575
	TOTAL (% RN2000)	52.784 (14,3%)

da utilizada para o *Erika*[24] en 1999 (45 euros) e, con ánimo conservador, é a que nós aplicamos ás durmidas perdidas. Así, o cálculo daríanos 87,5 M € en beneficios recreativos perdidos vencellados coas durmidas regradas de visitantes (non realizadas) en 2003.

Por un procedemento distinto, baseado na facturación do sector de actividades turísticas (Bouza *et al.*, 2003:38), e para un -15% de reducción de ingresos no 2003, as perdas serían de 58 M €, o que nos situaría nun impacto de 55 euros por día de visita perdido, moi semellante ó módulo diario utilizado na nosa estimación preliminar.

B.2 Perdas por diminución de fluxos turísticos non regrados para recreo

Neste caso, aplicamos unha ratio[25] que supón o triple de durmidas non regradas sobre as regradas, que consideramos que tamén se verían afectadas nun -25% do total. Á dita cifra (-5.250.000 durmidas) aplicamos un gasto[26] diario da metade do soportado polas durmidas regradas (25 €). Con isto, teriamos 131,2 M € perdidos en durmidas non regradas de visitantes en 2003.

24. CESRPL 2000:62; de 50 a 55 euros/día en Bonnieux e Rainelli 2002:17 e 21.

25. É a anotada en Loira (CESRPL 2000:57) (Bonnieux e Rainelli 1991:75); para Galicia e o conxunto español as estimacións son superiores: 4,2 veces e 3,2 veces respectivamente (*Fundación La Caixa 2000*: 431). O triple supón 21.000.000 durmidas no ano base.

26. CESRPL 2000:62.

(Prada, 2001). This figure is closer to that used for the *Erika*[24] in 1999 (45 euros) and, making a conservative estimate, is the one we will use for the guest-nights lost. Thus, the calculation will give us 87.5 million euros in recreational profits lost in terms of controlled guest-nights enjoyed by visitors (not occurring) in 2003.

For a different procedure, based on turnover in the tourism sector (Bouza et al., 2003:38), and for a -15% reduction in income for 2003, losses would be 58 M €, which puts us at an impact of 55 euros per day for visit lost, very close to the daily module used in our preliminary estimate.

B.2 Losses for decline in non-controlled tourism flow for recreation

In this case we apply a ratio[25] that estimates non-controlled guest-nights at three times the number of controlled guest-nights, which we suppose would also be affected in a -25% of the total. To this figure (-5,250,000 guest-nights) we assign an amount spent per day[26] that is half of that of the controlled stays (€25). Thus we arrive at €131,200,000 lost in non-controlled overnight stays of visitors in 2003.

24. CESRPL 2000:62; from 50 to 55 euros/day in Bonnieux and Rainelli 2002:17 and 21.

25. Noted in Loire (CESRPL 2000:57) (Bonnieux and Rainelli 1991:75); for Galicia and Spain as a whole estimates are higher: 4.2 and 3.2 times respectively (*Fundación La Caixa* 2000:431). The triple would mean 21,000,000 guest-nights in the base year.

26. CESRPL 2000:62.

Ambas as dúas partidas (durmidas perdidas regradas e non regradas) supoñen en conxunto unhas perdas de usos activos con mercado por 218,7 M de € para un impacto do -25%; se tal impacto fose inferior (p. ex. do -12%) a súa contía caería ós 109 millóns de €. Esta última cifra situaríase, con todo, entre os 75 e 150 M de €, cantidades que, para diminucións de entre o 10 e o 20% nos fluxos turísticos, se derivan dos propios cálculos do FIDAC[27].

B.3 Excedente do consumidor perdido por diminución de xornadas de visita de residentes ó litoral danado

Unha estimación prudente e non sobreavaliada do peso das xornadas-durmidas de residentes en Galicia sobre as orixinadas por visitantes non galegos podemos derivala da estructura que, noutras investigacións, observamos para os visitantes ó PN das Cíes[28]. En 1997, con 150.000 visitantes/ano, o perfil do visitante[29] para unha mostra de 600 enquisas era o que recolle o cadro 3.

Para esta mostra observamos que un 60% de visitantes eran de fóra de Galicia e un 40% dos usuarios eran residentes en Galicia.

Both figures (controlled and non-controlled guest-nights) together suppose losses of active with market use of €218,700,000 for an impact of -25%. If this impact were less (e.g.-12%) the amount would go down to €109 million. This last figure would be between the 75 and 150 million euros that, for reductions of between 10 and 20% in tourism flow, is the result of the estimates of the IOPC[27].

B.3 Consumers' surplus lost through reduction in days of residents' visits to the damaged coast

A conservative estimate of the weight of day visits-overnight stays of residents in Galicia as opposed to non-Galician visitors can be derived from the data we can see in other research on visitors to the Cíes Islands Nature Reserve[28]. In 1997, with 150,000 visitors/year the profile for visitors[29] from a sample of 600 interviews was the following:

In the sample we observe that 60% of the visitors were from outside Galicia and 40% were residents in Galicia. In the majority of cases these are visitors who spend an average of 15 days in Galicia (more than 50% in non-controlled circuits).

27. Considerando 7.12 da reunión da Comisión Executiva de 29.1.2003 (nota do director).

28. Prada 2001:70.

29. A praia de Rodas é o recurso ambiental máis utilizado (p. 71 *íbid*.) e o uso dos areais é o factor que máis motiva a visita futura (p. 107 *íbid*.).

27. Consideration 7.12 of the meeting of the Executive Commission, 29.1.2003 (Director's note).

28. Prada 2001:70.

29. The beach of Rodas is the most frequently used site (p. 71 íbid.) and the use of beaches is the factor that is the greatest motivation for future visits (p. 107 íbid.).

Cadro / Table 3
Residencia habitual e frecuencia da visita[30]
Usual residence and frecuency of visits[30]

	N.º visitantes nº visitors	A 1 vez A 1 time	B 2 ou máis B 2 or more	% A	% B
De Pontevedra from Pontevedra	161	76	85	47	53
Do resto Galicia from rest of Galicia	71	60	11	84	16
Do resto España from rest of Spain	321	307	14	96	4
Total Total	553	443	110	80	20

Fonte: Prada 2001 / Source: Prada 2001.

Trátase, na maioría dos casos, de visitantes que pasan en Galicia unha media de 15 días (máis do 50% en circuítos non regulares).

É esta unha ponderación prudente posto que outros espacios da RN2000 litoral que recentemente analizamos[31], para unha mostra da poboación galega, presentan unha maior frecuencia de visitas que a que os residentes fan das Illas Cíes. Neste caso, ós 600 cidadáns entrevistados en abril de 2001 preguntóuselles sobre a frecuencia e uso que realizaban dos espacios protexidos declarados na actualidade

This is a conservative weighting since other areas of the RN2000 coast that we have recently analysed[31], for a sampling of the Galician population, show greater frequency of visits than that of residents to the Islands Cíes. In this case, the 600 persons interviewed in April, 2001, were asked about frequency and type of use they made of the areas currently designated as protected in Nature Reserves in Galicia. As can be seen in Figure 4, islands and coastal areas (Corrubedo and Cíes) were most often visited, followed by wooded urban fringe areas

30. Nos últimos 6 anos.
31. Prada 2004 (en prensa).

30. Last 6 years.
31. Prada 2004 (in the press).

en Galicia Parques Naturais. Como se observa na figura 4, os espacios de litoral ou insulares (Corrubedo e Cíes) resultaron ser os máis visitados, seguidos dos espacios arborados de ámbito periurbano (Monte Aloia e Fragas do Eume) e, xa en último lugar, os espacios de montaña e interior (Baixa Limia e Serra do Invernadoiro). Este razoamento semella transferible ó conxunto de espacios de litoral propostos como Lugares de Interese Comunitario (LICs) para integrar a RN2000, e que se viron en boa medida afectados pola marea negra.

Así, teriamos que o número de visitas de residentes sería o 40% do total de durmidas regradas e non regradas (que ascenden a 47.000.000 de xornadas de visita), e situaríannos en 19.000.000 de residentes (dado que as de non residentes serían os 7 millóns das regradas e os 21 das non regradas, xa avaliados). De novo supoñemos un impacto do -25%, co que se perderían 4.750.000 de xornadas de recreo no litoral[32]. Aplicamos tamén a estas xornadas o importe monetario dunha de visitante non regrado[33] (25 €). Teriamos, en consecuencia, 118,7 M € perdidos en xornadas de visita non realizadas por residentes en 2003.

Facemos notar que esta estimación de xornadas perdidas daríanos 7 por familia e ano diminuídas no uso do litoral galego.

(Monte Aloia and Fragas do Eume) and, in last place, mountains and areas of the interior (Baixa Limia and Serra do Invernadoiro). This pattern would seem to be transferable to the coastal areas proposed as Sites of Community Interest (SCIs) for inclusion in the N2000N, and which have been to a great extent affected by the oil slick.

Thus we would take the number of visits by residents to be 40% of the total controlled and non-controlled guest-nights (which comes to 47,000,000 visiting days), and would give us 19,000,000 from residents (given that the non-residents would account for the 7 million controlled and 21 million non-controlled days already evaluated) Again we assume an impact of -25% which would mean the loss of 4,750,000 days of recreational visits to the coast[32]. We also apply to these days the monetary value of a non-controlled visiting day[33] (€25). We get, as a result, €118,700,000 in losses for visits by residents in 2003.

We should note that this estimate of days lost gives us a decrease of 7 per family and year in the use of the Galician coast.

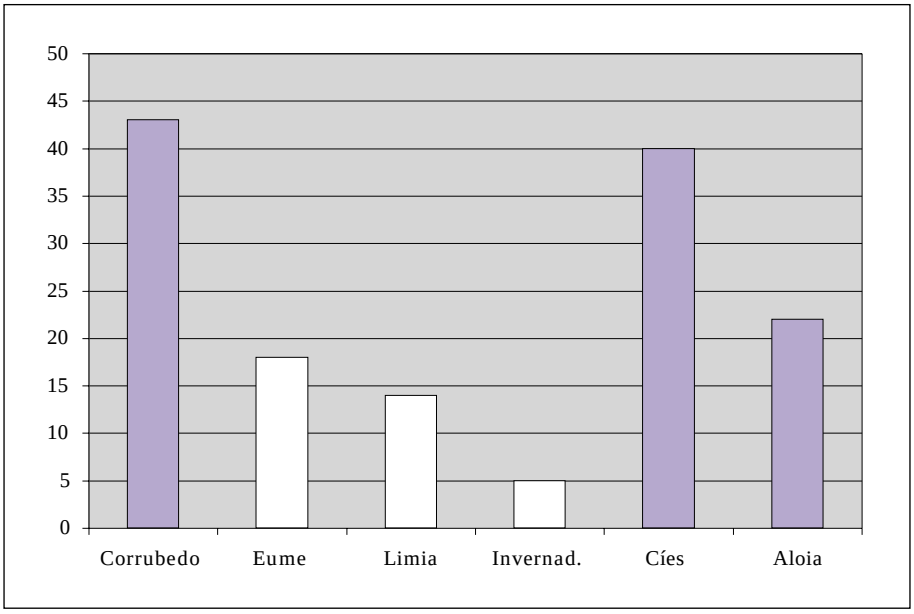
32. Para o caso do *Erika* e só en xornadas de pesca recreativa perdidas estímanse -1.910.000 (Bonnieux e Rainelli 2002:14 e 21).

33. Criterio aplicado no *A. Cadiz* (Bonnieux e Rainelli 1991:134).

32. For the *Erika* case, solely in loss of days of recreational fishing, the estimate was – 1,910,000 (Bonnieux and Rainelli 2002:14 and 21).

33. Criterion applied in *A. Cadiz* (Bonnieux and Rainelli 1991:134).

Figura / Figure 4
Visitas a parques naturais galegos (en porcentaxe de entrevistados)
Visits to Galician Nature Reserves (in percentage of persons interviewed)



Fonte: Prada 2004 / Source: Prada 2004.

B.4 Excedente do consumidor afectado pola diminución de utilidade das visitas que sigan facéndose ó litoral danado

Dos tres apartados anteriores derívase que o 75% dos usos do ano base (2002) seguirían producíndose (cadro 4).

Para este prudente escenario do uso activo turístico-recreativo que persistiría despois da marea negra, faise aínda necesario estimar o indubidable impacto negativo vencellado cos efectos da marea na satisfacción/utilidade

B.4 Consumer surplus affected by decrease in use in visits that continue to be made to the damaged coast

From the three previous sections it is concluded that 75% of the uses of the base year (2002) would continue to be made, specifically:

For this cautious and conservative scenario of active tourism-recreational use which continues after the oil slick, it is still necessary to estimate the indubitable negative impact of the effects of the oil slick on the satisfaction/utility of

Cadro / Table 4
Escenario hipotético de usos recreativos para 2003
Hypothetical scenario of recreational uses for 2003

	Durmidas/xornadas nights/visits	Módulo € module €	Valor Millóns € value Millions €
Durmidas regradas con. guest-nights	5.250.000	50	262,5
Durmidas n/regradas n/con.- guest-nights	15.750.000	25	393,7
Visitas residentes visits residents	14.250.000	25	356,2
Total usos 2003 / Total use 2003			1.012,4

dos visitantes. É dicir, o obxectivo é pasar de cuantificar as perdas de visitas a estimar o valor económico da menor satisfacción obtida das visitas que continúan a facerse (Bonnieux e Rainelli 1991:121-122).

Convén lembrar aquí que o tempo de ocio de que se goza en Galicia asóciase –por estacionalidade e actividades– ó litoral e que este foi maioritariamente afectado con distintas intensidades polos vertidos de fuel. Ademais coñecemos por estudios previos[34] (figura 5) que a calidade da paisaxe, as praias, o baño, o sendeirismo e a fotografía son as actividades e atributos máis apreciados (xunto á gastronomía derivada do mar) polos visitantes.

these visitors. In other words, the objective is to go from quantifying loss of visits to economically estimating the loss of satisfaction obtained from visits that continue to be made (Bonnieux and Rainelli 1991:121-122).

It is a good idea to remember here that leisure time in Galicia is associated – in terms of season and activities – with the coast, and that it has been affected in a major way, with different degrees of intensity, by fuel oil spills. In addition, we know from previous studies[34] (Figure 5) that the quality of the landscape, the beaches, swimming, hiking and photography are the most highly valued activities and characteristics (along with the enjoyment of a cuisine based on seafood).

34. De 600 residentes en Galicia, os tres usos principais de 400 visitantes a ENPs (67% da poboación total) (Prada 2004).

34. Of 600 residents in Galicia, the three main uses of 400 visitors to ENPs (67% of total population) (Prada 2004).

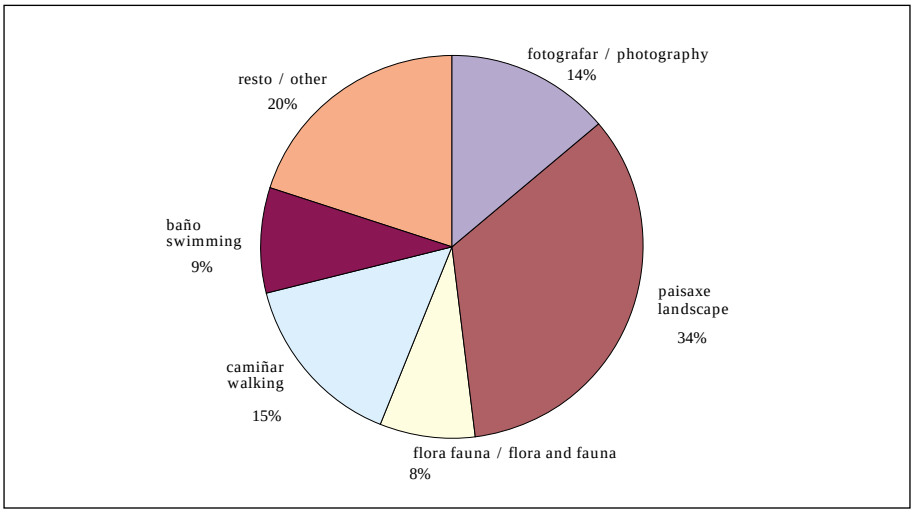
Por todo isto, e namentres non dispoñamos dun traballo de campo directo, suporemos unha reducción do -20% na utilidade. Cifra que, aplicada ó excedente agregado derivado das visitas que persistían, nos sitúa diante dunha nova partida de perdas de usos activos sen mercado que ascende a 202,4 M € en usos menos satisfactorios en 2003.

Dos catro apartados cuantificados ata este momento derívanse unhas perdas de usos activos con/sen mercado de 539,8 M € para o primeiro ano posterior á marea negra. Esta cifra foi estimada sobre os supostos prudentes e conservadores que se foron explicitando e a súa construcción (Bonnieux e Rainelli 1991:120-

For all those reasons, and while we do not have direct field work available, we will suppose a reduction of -20%. A figure which when applied to the aggregate surplus from the visits that continue to take place, would confront us with a new type of loss of non-market active use which comes to €202,400,000 lost in less satisfactory uses in 2003.

From the four sections that have been quantified up to this point there appear losses of market/ non-market active uses of €539,800,000 for the first year after the oil slick. This figure has been estimated on the basis of cautious, conservative assumptions that have been described and their construction (Bonnieux and Rainelli 1991:120-145

Figura / Figure 5
Actividades máis usuais nas visitas
Most usual activities on visits



145 e 131-133) non quere ser máis que indicativa do traballo *ad hoc* necesario que se vai realizar nos vindeiros meses.

Tampouco esta elaboración ten como desiderátum de cálculo a argumentación xudicial ou de reclamación de danos diante do FIDAC. Este asunto sería, xa que logo –no marco xurídico actual–, pouco eficiente xa que, por exemplo, no *A. Cadiz* os danos desta natureza estimados acadaban o 40% do total e non chegaron a ser a penas o 2% dos finalmente indemnizados (Hay e Thebaud 2002:7).

Pero, en troques, esta cifra sitúanos diante dunha importante conclusión: que os danos ós usos activos do patrimonio natural na súa faceta turístico-recreativa xustificarían máis do dobre da actual limitación de responsabilidades ambientais[35] e que, só eles, xustificarían socialmente[36] unha cifra de perdas recreativas de máis do dobre dos gastos de restauración que se estiman necesarios para paliar os efectos da marea negra do *Prestige*. Polo tanto, esta estimación, aínda reducida á metade (é dicir, supoñendo un impacto do -12% en lugar dun -25%), igualaría por si soa a garantía total do FIDAC e tamén aqueles gastos de restauración previstos polas administracións públicas españolas.

35. Tamén para o *Erika* as perdas estimadas para o sector turístico acadaron os 400 M € (Bonnieux e Rainelli 2003:10).

36. Bonnieux e Rainelli 2002, e só avaliando os danos na pesca recreativa, chegan a unha cifra moi próxima ós custos totais de limpeza do *Erika*.

and 131-133) does not pretend to be any more than indicative of the ad hoc work that needs to be done.

Nor does this construction have as the purpose of the calculation the formation of an argument for legal purposes or for damage claims against the IOPC Fund. This would also be – within the present legal framework – of very little effectiveness since, in the *A. Cadiz* case, for example, estimated damages of this nature came to 40% of the total and did not reach more than 2% of the compensation finally paid (Hay and Thebaud 2002:7).

On the other hand, however, this figure does lead us to an important conclusion, that damages to active use of the natural heritage in its tourism-recreational aspect would justify more than double the current limit on environmental liabilities[35] and that they alone would socially justify[36] a figure for recreational losses of more than double the restoration costs (200 of the 1,230 million euros), estimated as necessary to alleviate the effects of the *Prestige* oil slick. Thus this estimation, reduced by half (in other word, supposing an impact of -12% instead of -25%), would in itself equal the IOPC limitation and those restoration costs.

35. For the *Erika* as well, estimated losses for the tourism sector reached €400 million (Bonnieux and Rainelli 2003:10).

36. Bonnieux and Rainelli 2002, and only evaluating damages to recreational fishing, reach a figure very close to the total *Erika* cleaning costs.

C. A AVALIACIÓN DAS PERDAS NOS USOS PASIVOS

C.1 Concepto e problemas de estimación

Os recursos naturais proporcionan diferentes tipos de beneficios sociais. Unha marea negra como a sufrida en Galicia polo vertido do buque *Prestige* diminúe ou elimina os beneficios que a poboación obtén dos seus recursos marítimo-costeiros. Sen embargo, o habitual é prestar só atención ás perdas individuais (pesca, marisqueo, turismo) e a aquelas sociais vencelladas co pago con fondos públicos das consecuencias do vertido, como os custos de limpeza e restauración. É dicir, en xeral son doadamente perceptibles e menos discutibles aquelas perdas que xeran un prexuízo monetario estimable con relativa facilidade.

Agora ben, tamén hai cuantiosas perdas colectivas de existencia indiscutible, aínda que sexan dificilmente estimables: son os valores de uso pasivo.

Estes valores abranguen aqueles de tipo cultural ou ecolóxico, non vencellados co uso actual das áreas naturais danadas senón co valor que teñen como patrimonio de todos, como ben público. O mantemento do litoral e da súa riqueza paisaxística e biolóxica é patrimonio de todos e, xa que logo, prodúcese un prexuízo xeral cando se ve ameazado.

As motivacións que aboian neste tipo de valores son múltiples e, xeralmente, englóbanse en tres grupos:

C. VALUATION OF PASSIVE USE LOSSES

C.1 Concept and problems of estimation

Natural resources provide different types of social benefits. An oil slick like the one suffered by Galicia as a result of the spill from the tanker *Prestige* reduces or eliminates all the benefits that the population obtains from its maritime-coastal resources. Nonetheless, attention is usually paid solely to individual losses (fishing, shellfish harvesting, tourism) and to social losses related with financing with public funds the consequences of the spill, such as cleaning and restoration costs. In general those losses that produce damage that can be estimated relatively easily in monetary terms are more easily perceptible and less questionable.

But substantial collective losses do unquestionably exist, though they may be more difficult to estimate: they are passive use values.

Passive use values include those of a cultural or ecological nature not related to the actual use of the damaged natural zones but rather with the value they have as a heritage belonging to all, as a public good. The maintenance of the coastline, its landscape and biological wealth is the heritage of all and as such, when it is threatened, general harm is done.

Thus there are a number of motivations underlying this type of values, and they are generally brought together in three groups:

1. *De opción ou uso futuro.* Malia que non visitasemos un lugar ou contemplasemos a súa paisaxe, coa flora e fauna, xeralmente amosamos unha inclinación ou preferencia positiva porque ese ecosistema sexa conservado, aínda que só sexa para manter sempre a opción de poder gozar del no futuro se algunha vez quixesemos. A perda dalgunhas destas opcións implica, polo tanto, unha perda de benestar e, como en xeral se trata de áreas e recursos públicos, esta perda de benestar é colectiva ou social.
2. *De herdanza ou legado* para descendentes propios e xeracións futuras. Este uso pasivo está vencellado co valor de herdanza que posúen as nosas áreas naturais e paisaxes, como patrimonio que recibimos dos nosos devanceiros e como posible legado que deixaremos ós nosos propios fillos e, en xeral, ás xeracións futuras. Sempre que se destrúe un recurso ou se dana un ecosistema diminúen as opcións de uso e lecer para os nosos descendentes. Eles non poden defender os seus dereitos, e na xeración presente temos nas mans elixir alternativas de producción e consumo que respecten, ou non, as súas opcións. Nós actuamos, xa que logo, de xestores dun patrimonio que recibimos dos nosos devanceiros e que debemos transmitir.
3. De *existencia ou non uso*. O valor de existencia non está vencellado co uso, ben sexa este actual ou futuro, senón co valor ou disposición que amosamos a conservar

1. *Optional or future use*. Though we have not visited a place or viewed a landscape with its flora and fauna, we generally show an inclination or positive preference for this ecosystem to be conserved, to keep open the option of being able to enjoy it in the future if we ever so desire. The loss of some of these options thus implies a loss of welfare and, as this is usually a matter of public areas and resources, this loss of welfare is collective or social.
2. *As inheritance or legacy* for one's own descendants and future generations. This passive use is connected with the value as inheritance that our natural zones and landscapes possess, as a heritage that we have received from our forebears and as a possible legacy that we will leave to our own children and, in general, to future generations. Whenever a resource is destroyed or an ecosystem is damaged the options for use and enjoyment on the part of our descendants is diminished. They cannot defend their rights, and it is up to the present generation to decide to choose alternative forms of production and consumption that will either respect their options or not. We act, as a result, as caretakers of a heritage that we have received and we must pass on.
3. *Existence or non-use*. This existence value is not related to use, either present or future, but rather with the value or the willingness to conserve a resource

un recurso independentemente de que o vaiamos utilizar, nós ou os nosos descendentes, hoxe ou no futuro. Na realidade, as veces estamos dispostos a facer algún sacrificio –monetario ou non– para que un lugar, unha paisaxe ou un ecosistema sexan conservados aínda que nunca vaiamos gozar deles directamente.

Estes bens, por ese carácter colectivo/público que os caracteriza, configuran unha tipoloxía de recursos naturais *con valor social pero sen prezo de mercado,* o que implica que as perdas destes non son xustificables contablemente como o serían recursos que se intercambian nos mercados.

Normalmente dise que para estes recursos o mercado falla. Pois o mercado funciona cando os prezos cumpren cunha dobre utilidade. En primeiro lugar, cando son indicadores de escaseza, é dicir, se ante a diminución nun recurso en cantidade ou en calidade o seu prezo aumenta (e diminúe se se fai máis abondoso). Ademais, este aumento de prezo xera un incentivo para consumilo ou utilizalo menos, para que a demanda troque cara a activos máis abundantes –e, polo tanto, máis baratos– evitando o uso excesivo do recurso escaso e a súa posible desaparición ou extinción.

Sen embargo, no caso das áreas naturais, ecosistemas e paisaxes que son públicos, nin se intercambian nos mercados, nin se pagan prezos polo seu uso e gozo, é dicir, a súa deterioración non ten traducción en ningunha variable de mercado. Isto implica que, se o sistema de

that we show regardless of whether we ourselves or our descendants are going to use it, today or in the future. In reality we are sometimes prepared to make a sacrifice – monetary or otherwise – so that a place, a landscape, or an ecosystem may be conserved, though we are never going to directly enjoy it.

These goods, due to the collective/public nature characteristic of them, form a type of resource *with social value but without market price,* which implies that the losses suffered by them are not justifiable as would be those to resources that are interchanged on the market.

Normally it is said that the market fails for these resources. The market works when prices perform a double function. In the first place, when they are indicators of scarcity; in other words, when due to the decrease of the quantity or quality of a resource its price increases (and decreases when it becomes more abundant). In addition, this price rise introduces an incentive to consume or use it less, so that the demand will change in the direction of more abundant – and thus cheaper – assets, avoiding the excessive use of a resource that is scarce and hence its possible disappearance or extinction.

However, natural zones, ecosystems and landscapes that are public are not interchanged on the market, nor are prices paid for their use and enjoyment; in other words their deterioration is not translated into any market variable. This implies that, if it

prezos é o que move e cambia conductas, ó non existir prezos, nada nos indica que se estean producindo perdas de valores de opción, legado e existencia, nin tampouco o mercado xera automaticamente incentivos para que se deixen de producir danos a estes. Así, en ausencia de intervención pública, o risco é que aqueles recursos que non producen bens de mercado, senón que "só" teñen funcións vencelladas co uso pasivo, rematen sendo danados de forma irreversible e, mesmo, desaparecendo.

Esta é a filosofía de fondo que fundamenta a protección dos beneficios públicos do patrimonio natural. Os gobernos rexionais e estatais dos países afectados por danos no seu patrimonio natural e as institucións europeas son as chamadas a operar como defensores e protectores destes bens colectivos. As institucións públicas deben entón actuar como responsables ou administradores –non propietarios- dun patrimonio que foi legado ás xeracións actuais e que debera selo, nas mellores condicións de conservación posibles, ás xeracións futuras.

Mais aínda, debido a que non temos un indicador vía prezos da dimensión das perdas de usos pasivos, faise preciso estimar o seu valor mediante outro tipo de metodoloxías (métodos directos ou de preferencias declaradas) que xurdiron na década dos 60 nos Estados Unidos, da man da realización de análises custo-beneficio de proxectos públicos e que, durante décadas, foron desenvolvidos e mellorados, ata acadar o seu recoñecemento, tanto académico como institucional.

is the price system that moves and changes behaviour, when there are no prices, there is nothing to indicate to us that losses are occurring to values of option, legacy and existence, nor does the market automatically generate incentives for ceasing to damage them. Thus, in the absence of public intervention, the risk is that those resources that do not produce market goods but "only" possess functions relating to passive use, will end up being irreversibly damaged and even disappearing.

This is the philosophy which is the basis of the protection of public benefits of the natural heritage. Regional and state governments of the countries affected by damage to their natural heritage, along with European institutions, are called upon to operate to defend and protect these collective goods. Public institutions should act as being responsible for and as administrators – not proprietors – of a heritage that was handed down to present generations and should be passed on, in the best possible conditions of conservation, to future generations.

In addition, due to the fact that we do not have an indicator by way of price of the extent of losses of passive use, it is necessary to estimate their value using another type of method, direct methods or methods of stated preferences, which appeared in the '60s in the United States associated with the performance of cost-benefit analysis of public projects and that have been developed and improved for decades to the point of gaining both academic and public recognition.

No caso dos efectos da marea negra en Galicia, as perdas de uso pasivo poden acadar niveis considerables. Aínda que, neste caso, o sector pesqueiro-marisqueiro-turístico ten unha senlleira importancia na economía galega, a riqueza ecolóxico-paisaxística da nosa costa é tamén moi relevante e sen dúbida comparable á danada no vertido do *Exxon Valdez* en Alasca. Mais sucede que o marco institucional actual na OMI e na UE non contempla indemnizacións ou responsabilidade ningunha baseada en perdas de valores de uso pasivo, tanto na situación actual como nas modificacións deste previstas para o futuro (borrador de Directiva sobre Responsabilidade Ambiental[37] e Paquetes Erika I e Erika II). De novo no caso do *Prestige*, e polas implicacións verbo da excesiva limitación do marco institucional vixente, é polo que esta partida de danos vencellados ó uso pasivo atinxe especial relevancia. Limitacións ancoradas no principio de *res nullius* segundo o cal[38] "... ninguén está xuridicamente cualificado para percibir unha compensación derivada da súa destrucción".

Neste contexto a avaliación de danos na marea negra do *Exxon Valdez*, realizada a principios dos anos 90 nos Estados Unidos[39], foi pioneira na incorporación das perdas de valores colectivos ás cifras de danos derivadas

In the case of the effects of the oil slick on Galicia, losses in passive use can reach considerable amounts. Though in this case the fishing-shellfish- harvesting-tourism sectors have a particular importance in the Galician economy, the ecological-landscape wealth of the Galician coast is also highly relevant and undoubtedly comparable to the damage in the *Exxon Valdez* spill in Alaska. Nonetheless the institutional framework does not cover any compensation or liability based on losses of passive use values, either in the current situation or in the modifications planned for the near future (draft of the Directive for Environmental Liability[37] and the Erika I and Erika II Packages). Again in the case of the *Prestige*, and due to the implications of the excessive limitation of the institutional framework in force, this heading of damages relating to passive use takes on particular relevance. Limitations that are based on the principle of *res nullius* according to which[38] "... no one is legally qualified to receive a compensation deriving from its destruction".

The valuation of damages deriving from the *Exxon Valdez* incident, done at the beginning of the '90s in the United States[39], was pioneer in incorporation of the loss of collective values in the figures for damages derived from the accident. Thus solely on the basis of this type of damages the Exxon oil

37. Comisión Europea 2002.
38. Hay e Thebaud 2002:16.
39. Carson *et al.* (1992).

37. European Commission 2002.
38. Hay and Thebaud 2002:16.
39. Carson et al. (1992).

do accidente. Así, só con base nesta tipoloxía de danos, a petroleira Exxon aceptou pagar 1000 millóns de dólares, que foron investidos no financiamento de estudios de avaliación e programas de restauración –tanto estatais como locais– destinados a volver os ecosistemas danados a unha situación o máis semellante posible á que amosaban antes do accidente. E isto foi preciso para un vertido de petróleo menos contaminante que o fuel pesado e de menos da metade de toneladas que o caso do *Prestige*.

Para avaliar as perdas de usos pasivos no caso do *Exxon*, utilizouse o método de *valoración continxente* (VC). En xeral, a falta de mercados para os bens que se vaian valorar, que nos proporcionen indicadores axeitados dos prexuízos no benestar derivados dos danos ecolóxicos, simúlase un mercado mediante un cuestionario. Neste, formúlaselles ós individuos un intercambio hipotético, no cal se lles ofrece a aplicación dunha determinada medida ou política que mellore a súa situación pero a cambio dun custo para el. Se o individuo decide que prefire a alternativa á situación de partida, implicitamente estanos revelando que a mellora no benestar que lle proporciona o cambio compénsalle o custo que este leva vencellado. Se isto non fose así, a súa decisión sería manterse na situación de partida. En consecuencia, a decisión do individuo diante do mercado simulado proporciónanos unha aproximación ós beneficios que obtén.

O método da valoración continxente conta xa con numerosas aplicacións e os desenvolve-

company agreed to pay 1,000 million dollars, which were invested in financing of valuation studies and restoration programmes – on both national and local levels – aimed at restoring the damaged ecosystems to conditions as close as possible to what they were before the accident. And this was necessary for a spill involving crude oil, which is less contaminant than heavy fuel oil, and less than half the tons than in the case of the *Prestige*.

To evaluate losses of passive use in the case of *Exxon*, the method of *contingent valuation* (CV) was used. In general, in the absence of markets for the goods to be evaluated, which provide us with adequate indicators of the harm to welfare brought about by ecological damage, a market is simulated using a questionnaire. In it individuals are presented with a hypothetical interchange, in which they are offered a specific measure or policy which would improve their situation, but at a cost to them. If the individual decides that he or she prefers the alternative to the initial situation, he is implicitly revealing to us that the improvement in welfare brought about by the change compensates for the cost associated with it. If this were not the case, the choice would be for the initial situation. Consequently, the individual's decision in a simulated market provides us with an approximation to the benefits obtained.

The contingent valuation method has a number of applications and the theoretical development it has undergone over the last decade has reinforced its validity, reliability and consistency of

mentos teóricos que experimentou na última década reforzaron a validez, fiabilidade e consistencia dos seus resultados[40]. En Estados Unidos a VC figura como un dos métodos de referencia[41] na Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), baixo as normas de aplicación do panel NOAA (1993). En Europa o método foi aceptado tamén pola Unión Europea (Comisión, 2000:21), que a admite como técnica para avaliar posibles danos á biodiversidade, en especial no caso da Rede Natura 2000. Agora ben, esta proposta non conseguiu trasladarse a outros contextos, como o dos danos derivados dos vertidos ó mar de hidrocarburos, nin o máis xenérico relacionado co borrador de Directiva sobre Responsabilidade Ambiental –que exclúe esta tipoloxía de danos. Nestes casos, nin se teñen por indemnizables as perdas de valores de non uso, nin, moito menos, se aceptan métodos de avaliación que non se baseen nos intercambios de mercado.

Implicitamente, o actual marco institucional europeo estaría así supoñendo ben que as perdas de valores de uso pasivo son nulas (é dicir, non recoñece que o dano ós ecosistemas afecta ó benestar da sociedade mediante valores non comerciais, baseados na cultura, o patrimonio colectivo e o legado a futuras xeracións) ou ben que os danos –lonxe de ser

40. Para unha revisión da teoría e práctica do método en Estados Unidos e Europa podemos recorrer ó libro de Bateman e Willis (1999).

41. Penn 2000:7.

results[40]. In the United States CV is one of the methods of reference[41] in the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), under the regulations of the NOAA panel (1993). In Europe the method has also been accepted by the European Union (Commission, 2000:21), as a technique for the valuation of possible damage to biodiversity, particularly within the scope of the Natura 2000 Network. Nonetheless, this decision has not managed to be passed on to other contexts, such as damages resulting from oil spills at sea, nor the more general context of the draft for the Directive for Environmental Responsibility – which excludes this type of damages. In these cases not even losses of non-use values are considered as eligible for compensation, nor, much less, are methods of non-market valuation accepted.

Implicitly, the current European institutional framework would suppose that either losses of passive use values are zero (in other words, it does not recognise that damage to ecosystems affects the welfare of society through non-commercial values, based on culture, collective heritage and the legacy left to future generations) or that the damage – rather than being permanent or long-lasting – will disappear in a brief period of time after the application of cleaning and mitigation measures.

40. For a review of the theory and practice of the method in the United States and Europe we can refer to the book by Bateman and Willis (1999).

41. Penn 2000:7.

permanentes ou duradeiros– esvaeceranse nun breve período de tempo tras da aplicación de medidas de limpeza e mitigación.

C.2 Perdas vencelladas co uso pasivo no caso do Prestige: impactos e escenarios preliminares

No caso de Galicia, o patrimonio natural costeiro afectado está a ser moi importante. Non debemos esquecer que boa parte do noso litoral está integrado por rías, ecosistemas ricos en biodiversidade, pero tamén moi sensibles, que dan lugar a marismas, areais e outras formacións de grande interese ecolóxico. Á altura de febreiro de 2003, ó redor de 1000 km da nosa costa foran xa afectados en maior ou menor medida.

Gran parte destes ecosistemas atópanse protexidos oficialmente baixo diferentes figuras. Así, temos cinco zonas húmidas como zonas RAMSAR; catro das cales son, por riba, zonas de especial protección para as aves (ZEPAs) e a quinta é un parque natural. Ademais, as Illas Sisargas son tamén ZEPA e a Costa do Dexo é Monumento Natural.

Tamén se atopa na costa o único Parque Nacional galego no conxunto español, o Parque Nacional das Illas Atlánticas, que abrangue as Illas Cíes, Ons (tamén ZEPAs) e Sálvora. Illas que recibiron de xeito especialmente intenso as sucesivas ondas de mareas negras e que actuaron como protectoras das nosas rías.

C.2 Losses related to passive use in the Prestige case: impacts and preliminary scenarios

In the case of Galicia, the natural heritage of the affected coast is very important. We must not forget that a good part of the coastline is made up of rias and ecosystems that are rich in biodiversity but extremely sensitive, home to wetlands, sandy areas and diverse formations of ecological interest. By February, 2003, approximately 1,000 km of Galician coast had already been affected to a greater or lesser extent.

A great part of these ecosystems are officially protected under different concepts. Thus there are five protected wetlands or RAMSAR zones; four of which are, in addition, Areas of Special Protection for Birds (ZEPAs) and the fifth is a nature reserve. In addition, the Illas Sisargas are also a ZEPA and the Costa do Dexo is a Natural Monument.

Also on the coast is the only Galician National Park, thirteenth in Spain, the Illas Atlánticas National Park, which includes the Islas Cíes, Ons (both also ZEPAs) and Sálvora. Islands that were hit with particular intensity by successive oil slicks and that acted as protectors for the respective Rias.

In the map shown for the coastal Natura Network (Figure 3) we can observe the 19 coastal areas proposed as Sites of Community Interest for their inclusion in the Network, with a total of almost 53.000 ha and which were – with greater or lesser intensity – affected by the oil slick.

Cadro / Table 5
Zonas RAMSAR en Galicia
RAMSAR zones in Galicia

	Concello (Provincia) Municipality (Province)	Superficie (h) Area (ha.)	Data de creación Date of creation	Outras proteccións Other protection
Dunas de Corrubedo e Lagoas do Carregal e Vixán	Ribeira (A CORUÑA)	550	05/12/89	PARQUE NATURAL NATURAL RESERVE
Ría de Ortigueira e Ladrido	Ortigueira (A CORUÑA)	2920	05/12/89	ZEPA
Lagoa e areal de Valdoviño	Valdoviño (A CORUÑA)	255	26/03/93	ZEPA
Complexo intermareal Umia-O Grove, A Lanzada, punta Carreirón e lagoa Bodeira	Vilagarcía, Cambados, Ribadumia, Meaño, Sanxenxo e O Grove (PONTEVEDRA)	2561	26/03/93	ZEPA
Ría do Eo	Ribadeo (LUGO)	1740	30/10/94	ZEPA

Fonte: Xunta de Galicia / *Source: Xunta of Galicia.*

No mapa xa antes presentado para a Rede Natura litoral (figura 3) podemos observar os 19 espacios costeiros propostos como de Interese Comunitario para a súa integración dentro da dita Rede cunha superficie total de case 53.000 h e que foron –con maior ou menor intensidade– afectados pola marea negra.

As nosas costas son, ademais de paisaxes, hábitats e espacios únicos, lugar de paso para paxaros e mamíferos mariños. Así, considéra-

In addition to being unique landscapes, habitats and areas of ecological interest, the Galician coasts are on the migratory routes of birds and marine mammals. Thus it is considered that approximately 38 protected species can be found on the Galician coast, some of which, such as the guillemot, are in serious threat of extinction.

Three months after the impact, provisional counts of birds collected

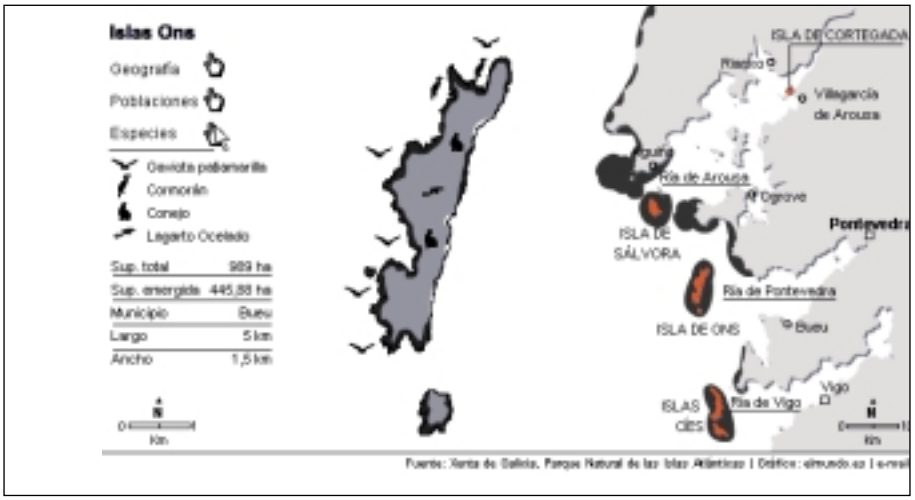
Figura / Figure 6
Parque Nacional Illas Atlánticas
Illas Atlánticas National Park

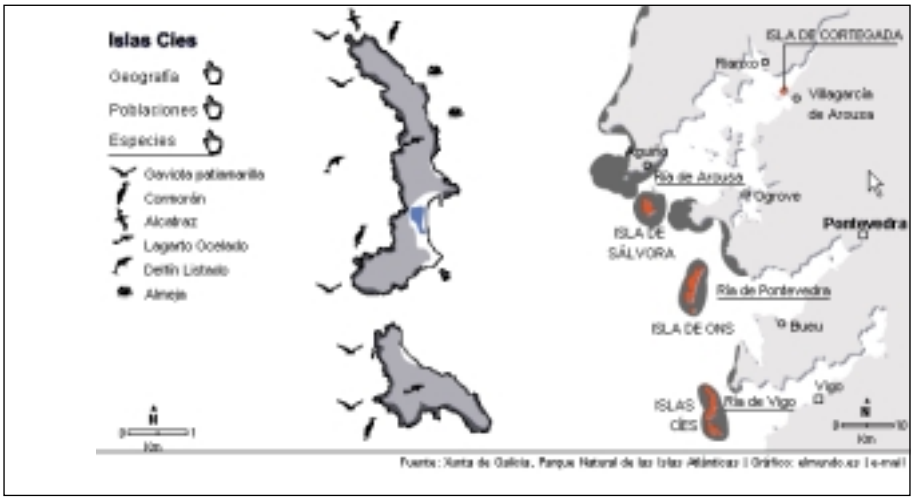
se que se poden atopar nas costas galegas ó redor de 38 especies protexidas, das que algunhas estarían en serio perigo de extinción (como o arao común).

Tres meses despois do impacto disponse de recontos provisorios sobre paxaros recollidos e/ou mortos (arao romeiro, papagaio mariño, arao, mascato, gaivota, corvo mariño, etc.) e de estimacións sobre poboacións atinxidas que poderían formar parte dun escenario de avaliación. É de salientar que 11.000 exemplares recollidos foron da especie arao común, ameazada de extinción, dos que 8.000 se atoparon xa mortos.

and/or dead (auk, puffin, guillemot, gannet, cormorant, etc.) and estimates on affected populations that could form a part of the valuation scenario are available. It should be noted that 11,000 of the specimens collected were guillemots, a species in danger of extinction, 8,000 of which were found already dead.

Figura / Figure 7
Parque Nacional Illas Atlánticas. Riqueza faunística
Illas Atlánticas National Park. Wildlife





Cadro / Table 6
Paxaros recollidos ata o 16.2.2003
Birds collected as of 16.2.2003

Barco Vessel	Ano Year	Lugar Place	Recollidos Birds collected	Estimación de mortaldade Estimated mortality
Torrey Canyon	1967	Cornualles Cornwall	7000	25.000
Amoco Cadiz	1978	Bretaña Brittany	5000	22.000
Braer	1993	Shetland Shetland	1500	5.000
Sea Empress	1996	Gales Wales	4600	10.000-15.000
Erika	1999	Bretaña Brittany	77.000	150.000-300.000
*Prestige**	2002	Galicia	21.538	100.000-200.000

*Datos ata o 16 de febreiro de 2003. Atopáronse aves petroleadas de 71 especies, 15.977 das cales estaban mortas.

*Data to 16 February, 2003. Oiled birds were found from 71 species, 15,977 of which were dead.

Fonte: World Birdwatch / SEO - BirdLife[42] / Source: World Birdwatch / SEO - BirdLife[42].

Tamén se empeza a dispor de avaliacións preliminares sobre mamíferos[43] (cetáceos, marsopa, arroaces, focas, tartarugas), aínda que convén non perder de vista que non só a macrofauna senón que tamén a biomasa mariña (microfauna da cadea) non directamente comercial debería ser avaliada en termos de danos[44].

Preliminary valuations are also beginning to be available on mammals[43] (cetaceans, porpoises, dolphins, seals, turtles) though it is advisable not to lose sight of the fact that not only macrofauna but also the marine biomass (microfauna of the food chain) which is not directly commercial should be evaluated as damage[44].

42. www.seo.org

43. En MCeT 2003:65 datos a finais de 2002.

44. Planctónicos, fitoplancto e fases larvarias (infauna, ciclo nutrientes, microfitobentos, macrófitos) (MCeT 2002:36).

42. www.seo.org

43. In MC&T 2003:65 data at the close of 2002.

44. To planktonics, phytoplankton and larval phases (infauna, nutrient cycle, microphytobentos, macrophytes) (MC&T 2002:36).

O noso referente para estimación de valores de uso pasivo vai ser a avaliación realizada en Alasca para o caso do *Exxon Valdez*. Así, se tomamos como aproximación os danos por fogar obtidos para ese vertido, 31 euros/dólares (1991), e os transferimos[45] ós efectos derivados do *Prestige*, obteriamos unha avaliación (disposición ó pago por evitar os danos nos

The point of reference for the estimation of passive use values is the valuation done in Alaska for the *Exxon Valdez* case. Thus, if we take as an approximation the damage per home obtained for that spill, *31 euros/dollars* (1991), and transfer it[45] to the effects arising from the *Prestige* incident, we would obtain a valuation (willingness to pay to avoid passive use losses) of

Cadro / Table 7
Especies que apareceron con restos de fuel
Species in the zone that have appeared with fuel oil

Especie Species	Recollidas Collected	Petroleadas Oiled	Mortas por fuel Dead due to fuel oil
Tartaruga boba Loggerhead sea turtle (caretta caretta)	63	54	12
Foca gris Grey seal (halichoerus grypus)	4	4	1
Lontra de río European otter (lutra lutra)	7	7	3
Cetáceos (arroaces-baleas) Cetaceans (Dolphins-Whales)	54	32	3

Fonte: Elaboración propia a partir de datos da Coordinadora para o Estudio dos Mamíferos Mariños e da Sociedade Española de Cetáceos sobre varamentos e avistamentos en Galicia entre o 13 de novembro de 2002 e o 13 de xaneiro de 2003.

Source: Own chart based on data from the *Coordinadora para o Estudio dos Mamíferos Mariños* (Coordinator for the Study of Marine Mammals) and the Spanish Cetacean Society on beachings and sightings in Galicia between 13 November, 2002 and 13 January, 2003.

45. Utilizando para a elevación as familias españolas; criterio ben asentado –cremos– na inigualable conducta solidaria do voluntariado con orixe en tódalas comunidades autónomas españolas.

45. Using Spanish households for the rise; a criterion we believe has a firm basis in the incomparable reaction of volunteers from the different Autonomous Communities in Spain.

beneficios de non uso activo) de preto de 372 M €. Nótese que malia ser esta unha aproximación moi conservadora (pois no noso caso trátase da mesma cantidade pero de fuel moito máis daniño), por si soa a estimación desta partida supera xa os límites de indemnización contemplados no Fondo Internacional de Indemnización de Danos debidos á Contaminación por Hidrocarburos (FIDAC).

Se, en cambio, partimos dos datos dunha investigación realizada recentemente para avaliar a ampliación e conservación dun grupo de espacios naturais de montaña en Galicia propostos para ser integrados na Rede Natura 2000, obtense que os individuos están dispostos a pagar preto de 120 euros/familia para ampliar a protección a 24 destes espacios, en lugar dos 3 actuais. Aínda que non dispoñemos, polo de agora, dunha aplicación específica sobre un conxunto de espacios litorais, cabe, diante desta marea negra, preguntarse: ¿sería o valor asociado á conservación dos 19 espacios costeiros afectados da dita Rede menor? Se non o fose, como semella intuírse da maior demanda de visitas ós espacios costeiros que ós espacios de interior (ver de novo figura 4), estariamos multiplicando por catro a disposición ó pago pola conservación no caso do *Exxon*[46] e acadando 1440 M €.

close to *372 million euros*. Observe that in spite of this being an extremely conservative approximation, since in our case we are dealing with the same quantity, but of fuel oil, which is much more damaging, the estimate for this concept alone goes over the compensation limits set by the International Fund for Compensation for Oil Pollution Damage (IOPC).

If, on the other hand, we start with the data from research done recently for the extension of a group of natural mountain areas in Galicia proposed for inclusion in the Natura 2000 Network, we find that persons interviewed are prepared to pay about 120 euros/household to extend the protection to 24 of these zones, as compared to the current 3. Though we do not have available at the moment a specific application to a set of coastal areas, we might ask: would the value associated with the conservation of the 19 coastal areas of this Network affected be less? If it were not, as would seem to follow, given the greater demand for visits to coastal areas than to the interior, we would be multiplying by four the willingness to pay for conservation estimated in the *Exxon* case[46] and reaching *1,440 million* euros.

46. Contamos tamén como referencia que, para o caso das Cíes (Prada, 2001), os individuos non visitantes están dispostos a pagar 6 euros/familia por motivos puramente de conservación, e isto por un só espacio.

46. We also take as a point of reference that in the case of Cíes (Prada, 2001), non-visitors are prepared to pay 6 euros/family for reasons purely of conservation, and that for one single area. If there

CONCLUSIÓN

Nunha imprescindible síntese final estimariamos, aínda que de forma moi preliminar, que fronte ós 200 M € de gastos previstos para a restauración (e algo menos do tope de responsabilidade ambiental global), unha cifra para o custo social –que tería en conta os custos de limpeza e restauración, os danos no turismo-recreación, as perdas relacionadas cos usos pasivos e as dos alimentos derivados do mar–. Este cálculo viría resumido no cadro 8.

Co que, tendo en conta os danos turístico--recreativos e as perdas de uso pasivo e mesmo tomando as estimacións máis conservadoras, situariámonos nuns danos superiores ós 800 M €, que implican máis do cuádruple dos gastos de restauración hoxe previstos e farían necesaria a dotación dun fondo de responsabilidade ambiental específico para o efecto por parte da Unión Europea. E isto á marxe[47] do que, en todo caso, debería facerse no marco do actual (FIDAC-OMI), que, segundo o propio Fondo, non pode nin sequera atender os

CONCLUSION

In an unavoidable final synthesis we have estimated, as opposed to the €200 million in costs envisaged for restoration (and a bit less in the maximum for overall environmental liability, though in a very preliminary fashion, a figure for the cost that would take into account costs of cleaning and restoration, damage to tourism-recreation and losses relating to passive uses. This estimation is summarised in Table 8.

Taking into account the tourism-recreational damages and passive use losses and even using the most conservative estimates, we arrive at non-market damages of over €800 million, which implies more than four times the restoration costs envisaged today and which would require the creation of a specific fund for environmental liability for this purpose on the part of the European Union. And that apart from[47] what in any case should be done within the framework of the current (IOPC-IMO) fund which, according to the IOPC itself cannot even meet the

Para 19 LICs costeiros, e mediante un cálculo simple, a disposición ó pago polo conxunto situaríase arredor dos 114 euros/familia, o que indicaría que a cifra de 120 euros/familia/ano pode ser unha aproximación non esaxerada. No caso do Nestucca en Washington (Grigalunas e Opaluch 1993) xa se estimaron 95 dólares/fogar.

47. A Comisión Europea (2003) semella formular (punto 2.2.3.4.) como alternativas ambas as vías: se a OMI na súa reunión prevista do 16.5.2003 non amplía a 1.000 M, debe facelo a Comisión antes do remate de 2003.

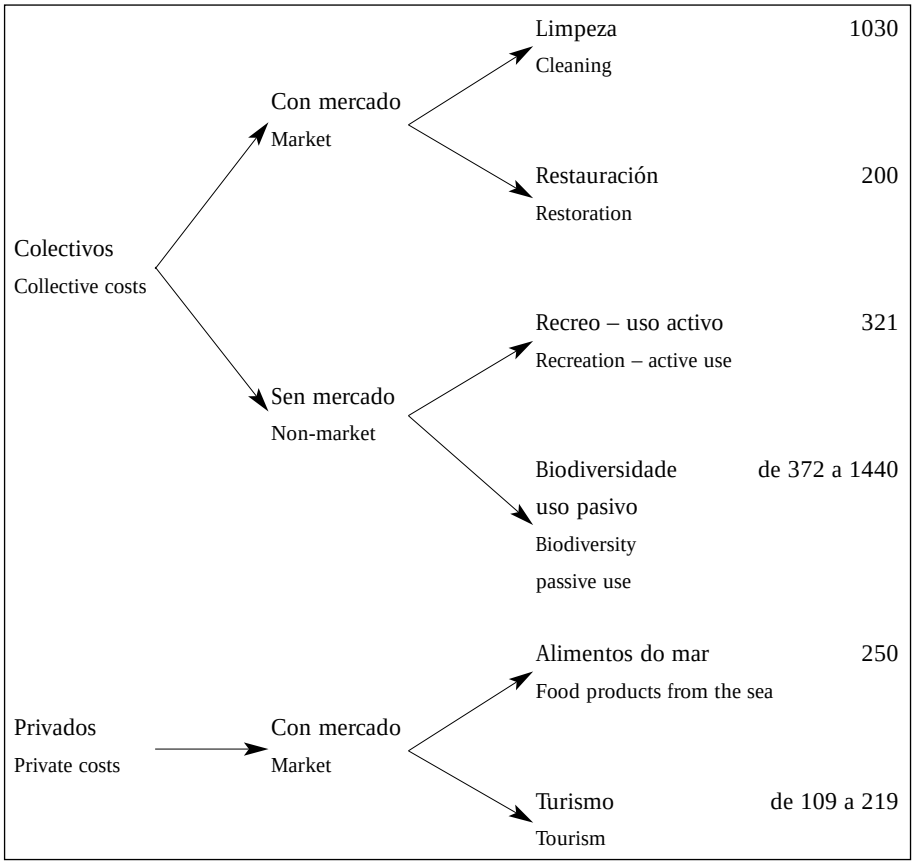
exist 19 coastal SCIs, using an excessively simple calculation, willingness to pay would be around 114 euros/family, which seems to show that the figure of 120 euros/family/year could be a not at all extravagant approximation. In the Nestucca case in Washington (Grigalunas and Opaluch 1993) the estimation, at the time, was 95 dollars/home.

47. The European Commission (2003) seems to consider (point 2.2.3.4.) as alternatives, both lines: if the IMO in its meeting scheduled for 16.5.2003 does not increase the fund to 1,000 million euros, the Commission should do so before the end of 2003.

Cadro / Table 8

Custo social: estimación preliminar[48]

Preliminary estimate[48] (Millions of €)



Elaboración propia, cifras en millóns de euros / Our chart.

48. En Recreo sumamos (118,7 e 202,4), en Turismo (87,5 e 131,2); para Alimentos do mar tomamos –excepcionalmente– a estimación máxima do propio FIDAC (Executive Commite 29.1.2003 punto 7.9).

48. In Recreation we take the sum (118.7 and 202,4), in Tourism (87.5 and 131.2); for food products from the sea we take – an exceptional case – the maximum IOPC estimate (Executive Committee 29.1.2003 point 7.9).

prexuízos de mercado[49] cos seus actuais 184 M €. En definitiva, se observamos o conxunto das estimacións obtidas, engadindo perdas privadas e colectivas, estimacións de mercado e de non mercado, a cifra acumulada (entre 2282 e 3460 M €) multiplicaría por máis de dez veces os topes de responsabilidade ambiental actualmente asumidos polo FIDAC.

Sen embargo, esta estimación debe ser matizada pois, nalgúns casos, as diferentes partidas de custos non se axustan a períodos de tempo equivalentes. Así, por exemplo, os custos asociados ó menor uso turístico-recreativo foron calculados para o ano 2003, os gastos de limpeza e restauración probablemente superen este ano e se prolonguen algúns máis, e, sen dúbida, as perdas en valores de uso pasivo teñen un prazo moito máis longo pois os ecosistemas precisan moito tempo para recuperárense. Como exemplo, no caso de Alasca, aínda hoxe en día, catorce anos despois, mantéñense os efectos sobre o medio natural[50]. Malia isto, os datos aquí obtidos poden ser indicativos da magnitude que é posible que acaden as estimacións baseadas en datos reais e non xa en extrapolacións ou escenarios hipotéticos coma os nosos.

49. Os danos de mercado –segundo as súas propias estimacións– situaríanse entre os 370 e os 720 M, o que obrigaría xa a ratear e limitar os pagos [Considerando 7.14 da reunión da súa Comisión Executiva de 29.1.2003 (nota do director)].

50. Ver a comunicación de McCammon neste mesmo libro.

remaining market damages[49] with its present €184 million.

All things considered, if we observe all the estimates obtained, adding private and collective losses and market and non-market estimates, the cumulative figure (between €2,282 and 3,460 million) is ten times the maximum for environmental liability currently accepted by the IOPC. However, this estimate must be qualified since in many cases the different cost entries do not correspond to equivalent periods of time. Thus, for instance, the costs associated with lower tourism-recreational use have been calculated for the year 2003, costs for cleaning and restoration will probably go beyond this year and be prolonged over coming years, and losses in passive use values are evidently connected with a much longer period, since ecosystems need a long time to recover. As an example, in the case of Alaska, even today, fourteen years later, effects on the natural environment still persist[50]. Nonetheless, the data obtained here can be indicative of the possible figures that may be reached by estimates based on real data and not on extrapolations or hypothetical scenarios.

49. Market damages – according to their own estimates – would be situated between 370 and 720 million euros which would oblige them to calculate on a pro rata basis and limit the payments (Consideration 7.14 of the meeting of the Executive Commission of 29.1.2003 (Director's note)).

50. See the paper by McCammon in this same book.

Nótese ademais que a cifra que aquí elaboramos como estimación preliminar non estaría lonxe do 0,6% do PIB español (3.000 M €), cifra que na UE delimitaría a posta en acción dun fondo *ad hoc* para *catástrofes naturais.* Fondo que, neste caso, habería que adaptar a unha causa diferente, a derivada de *catástrofes industriais, tecnolóxicas ou ambientais,* tal como a propia Comisión acordou a comezos deste ano[51].

Please note as well that the figure that we provide here as a preliminary estimate is not far from 0.6% of the Spanish GDP (€3,000 million), a figure that in the EU is the limit for the activation of an ad hoc fund for *natural catastrophes.* A fund that in this case would have to be adapted to a different cause, one deriving from *industrial, technological or environmental catastrophes,* as the Commission itself agreed at the beginning of this year[51].

51. Comisión Europea 2003 no seu acordo 3.5.

51. European Commission 2003 in its agreement 3.5.

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AVALIACIÓN DE DANOS DIRECTOS E INDIRECTOS. METODOLOXÍA E PLAN DE TRABALLO PARA O CASO DO *PRESTIGE*

EVALUATION OF DIRECT AND INDIRECT DAMAGES. METHODOLOGY AND WORK PROGRAMME FOR THE *PRESTIGE* CASE

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INTRODUCCIÓN

O obxectivo básico deste documento consiste en presentar, de xeito sintético e preliminar, a metodoloxía básica e os trazos xerais do plan de traballo que cómpre seguir nun futuro próximo para a avaliación de rendas cesantes na Economía da Comunidade Autónoma de Galicia derivadas da catástrofe do buque *Prestige*, así como dos seus posibles impactos sectoriais, territoriais e sociais.

Para poder levar a cabo esta tarefa, en primeiro lugar, resulta de especial interese definir e delimitar correctamente o escenario inicial previo á catástrofe, o que nos permitirá posteriormente avaliar os impactos en relación a ese referente. En segundo lugar, debemos realizar un seguimento dos niveis de impacto do vertido de cru ó longo do tempo e as conseguintes actuacións das administracións públicas para paliar ou amortecer os impactos económicos, sociais e territoriais máis inmediatos.

O anterior exercicio permitirá un primeiro achegamento á cuantificación dos efectos económicos a curto prazo. Sen embargo, para

INTRODUCTION

The basic objective of this document consists of presenting, in a very synthetic and preliminary fashion, the basic methodology and general characteristics of the work programme to be followed in the near future for the evaluation of income lost in the economy of the Autonomous Community of Galicia as a result of the catastrophe of the *Prestige*, as well as its possible sectorial, territorial and social impact.

To perform this task it is of particular interest, in the first place, to correctly define and demarcate the initial situation before the catastrophe, which will subsequently permit us to evaluate impact in relation to that point of reference.

In the second place, we should look at the levels of impact of the oil spill over the course of time and the corresponding measures taken by public administrations to mitigate or lessen the most immediate economic, social and territorial effects.

Data from the previous financial year provide the possibility of an initial approach to the evaluation of the short-term economic effects. However, in order to be able to do a gen-

poder facer unha avaliación xeral sobre o PIB cesante e os seus efectos sobre o conxunto da economía, é preciso contar cunha perspectiva temporal máis ampla e co imprescindible desenvolvemento do traballo de campo. Cuestións que tentaremos esbozar no último apartado deste capítulo.

Denantes de comezar a desenvolver estes puntos queremos deixar ben sentado que o tratamento, alcance e obxectivos deste estudio a penas teñen similitudes coa perspectiva seguida nos procedementos xudiciais de responsabilidade civil ou polos vencellados ó Convenio do Fondo Internacional de Indemnización de Danos Debidos á Contaminación por Hidrocarburos (FIDAC 92), auspiciado pola Organización Marítima Internacional (OMI). Como é ben coñecido, o FIDAC 92 proporciona unha indemnización complementaria (de ata 180 M € na actualidade e de 270 a partir do 1 de novembro de 2003) para cubrir danos se fosen resultado da contaminación por hidrocarburos transportados por buques (danos ós bens, custos de operacións de limpeza no mar e terra, perdas económicas de pescadores e mariscadores e perdas económicas do sector do turismo)[1]. Toda persoa física ou xurídica (incluídos organismos públicos) afectada por un vertido destas características poderá actuar como demandante e reclamar unha indemnización sempre que sufrise unha perda económica cuantificable (cada

1. Véxase FIDAC (2002).

eral evaluation of GDP loss and its effects on the overall economy, it is necessary to have a perspective over a longer period of time and to do field work. Questions that we will try to deal with in the last section of this paper.

Before starting to develop these points we should make it very clear that the treatment, scope and objectives of this study have scarcely any resemblance to the perspective employed in judicial procedures on civil liability or those connected with the Agreement on the International Fund for Compensation for Oil Pollution Damage (IOPC Fund 92), under the auspices of the International Maritime Organisation (IMO).

As is well known, the IOPC 92 provides for supplementary compensation (of up to 180 million euros at present and 270 million from 1 November. 2003) to cover damages resulting from pollution from oil transported by ship (damage to goods, costs of cleaning operations on sea and land, economic losses to fishermen and persons engaged in mariculture and economic losses in the tourism sector)[1]. Any natural or corporate person (including public bodies) affected by a spill having these characteristics may act as a claimant for compensation as long as they have suffered a quantifiable economic loss (each claimant must substantiate the amount of damages by providing accounts and other pertinent evidence).

1. See IOPC (2002).

demandante debe fundamentar a contía dos danos facilitando os libros de contabilidade ou outras probas pertinentes).

Trátase, entón, dun proceso que intenta paliar, polo menos parcialmente, os danos sufridos polos propietarios ou usuarios de bens contaminados a título individual ou colectivo, mentres que nós pretendemos realizar unha avaliación global sobre a renda cesante e os efectos sobre unha economía no seu conxunto, a de Galicia.

1 O ESCENARIO INICIAL: GALICIA, O LITORAL E A PESCA

Como xa adiantamos, a primeira tarefa que cómpre enfrontar nun estudio como o que nos ocupa consiste en definir e delimitar correctamente a situación inicial previa á catástrofe. Trátase de cuantificar as principais variables e elementos que se van considerar co fin de dispor dun escenario de referencia que nos permita, posteriormente, observar a evolución de todas esas variables e elementos tralo derramo e cuantificar o impacto deste a partir das diferencias existentes verbo dese escenario de referencia[2].

Por unha banda, dado o carácter internacional deste seminario, entendemos que é

2. Toda a información facilitada neste apartado foi recollida das seguintes fontes: Comisión Europea (2001), EUROSTAT (2001), IGE (2001), CES Galicia (2002), IGE (2002), INE (2002), Xunta de Galicia (2002), Consellería de Pesca, Marisqueo e Acuicultura (2003).

This then is a process which attempts to mitigate, at least in part, damage sustained by owners or users of goods affected by pollution, in a private or collective capacity, while we attempt to do an overall evaluation on income loss and effects on an economy in its entirety, the economy of Galicia.

1 INITIAL CIRCUMSTANCES: GALICIA, THE COST AND FISHERIES

As we indicated above, the first task to be confronted in a study like this one consists of correctly defining and demarcating the initial situation before the catastrophe. This is a question of quantifying the principal variables and aspects to be considered so as to provide a frame of reference which will permit us, later, to observe the evolution of all these variables and aspects after the spill and to quantify its impact on the basis of differences occurring with respect to this frame of reference[2].

On one hand, given the international nature of this seminar, we consider that it would be appropriate to begin with a general description of the basic features of Galicia and its economy, offering, insofar as possible, similar information for more extensive geo-

2. All the information offered in this section has been taken from the following sources: European Commission (2001), EUROSTAT (2001), IGE (2001), CES Galicia (2002), IGE (2002), INE (2002), Xunta of Galicia (2002), Ministry for Fishing, Shellfish Harvesting and Aquaculture (2003).

preciso comezar cunha descrición xeral dos trazos básicos de Galicia e a súa economía ofrecendo, na medida do posible, semellante información para ámbitos xeográficos máis amplos (principalmente referidos á Unión Europea). Isto axudaranos a establecer comparacións e a contextualizar mellor o noso ámbito territorial de estudio. Por outra banda, restrinxiremos parte da nosa intervención á actividade e recursos pesqueiros, evitando a saturación de información estatística e tratando máis de vagar os aspectos descritivos e metodolóxicos da análise.

Galicia é unha comunidade autónoma histórica española de case 30.000 km^2, dividida administrativamente en 4 provincias (A Coruña, Lugo, Ourense e Pontevedra) e 53 comarcas, das que 20 teñen franxa costeira marítima e ocupan aproximadamente o 25% do territorio da Comunidade (cadro 1). Os 2,7 M (millóns) de habitantes de Galicia supoñen o 6,7% do total español e é destacable que o 60% desta poboación está concentrada na franxa costeira. Como consecuencia, a densidade de poboación media das comarcas costeiras galegas sitúase nunha zona media alta, cuns 224 habitantes por km^2, case tres veces maior respecto á española e preto do dobre que a media da UE-15.

graphic areas (chiefly referring to the European Union). This will help us to make comparisons and better put into context the territorial scope of our study. On the other hand, we will restrict part of our presentation to fisheries and fishing resources, avoiding an avalanche of statistical information and dealing in more detail with descriptive and methodological aspects of the analysis.

Galicia is an Historic Autonomous Community of almost 30,000 km^2, divided administratively into four provinces (A Coruña, Lugo, Ourense and Pontevedra) and 53 districts, of which 20 have a maritime coastal strip that occupies approximately 25% of the territory of the Autonomous Community (see table 1*).

The 2.7 million inhabitants of Galicia represent 6.7% of the total population of Spain, and 60% of these inhabitants are concentrated on the coastal strip.

Consequently the average population density of the coastal districts of Galica is medium-high, with 224 inhabitants per km^2, almost three times higher than the Spanish average and close to double the average for the EU-15.

*Numbers in tables are written in latin style, that is, 287.000 would be 287,000 in english. The editors have maintained this criteria to simplify the tables

Cadro / Table 1
Poboación e territorio (2000)
Population and territory (year 2000)

	UE-15	España Spain	% UE-15	Galicia	% Esp.	Galicia Costeira Coastal Galicia	% Gal.
Superficie (1000 km²) Area (1000 km²)	3.157	560	17,7	29,7	5,3	7,3	24,5
Poboación (1000 persoas) Population (1000 people)	378.713	40.847	10,8	2.732	6,7	1.631	59,7
Densidade poboación (hab./km²) Population density (persons/ km²)	120	81	-33,3	92	13,6	224	143,5

Fonte: Eurostat e IGE / Source: Eurostat and IGE (Galician Statistics Institute).

Podemos deternos agora na caracterización da poboación da Galicia costeira afectada pola catástrofe do *Prestige*. Para isto separaremos o territorio por grandes comarcas costeiras en función da súa situación xeográfica e do seu carácter máis ou menos urbano: A Mariña Luguesa (A Mariña Central, Occidental e Oriental), Ortegal, Ferrol, A Coruña, A Coruña Occidental (Bergantiños, Terra de Soneira, Fisterra, Muros, Noia e Barbanza), Pontevedra Occidental (Caldas, O Salnés, O Morrazo e O Baixo Miño), Pontevedra e Vigo.

Como se pode comprobar no cadro 2, a poboación non se distribúe de forma uniforme na franxa costeira. Esta concéntrase en maior medida arredor dos núcleos urbanos

We can now proceed to describe the population of coastal Galicia affected by the *Prestige* catastrophe. For that purpose we will separate the territory by large coastal districts in terms of their geographical location and more or less urban character: A Mariña Luguesa (Mariña Central, Occidental and Oriental), Ortegal, Ferrol, A Coruña, A Coruña Occidental (Bergantiños, Terras de Soneira, Finisterre, Muros, Noia and Barbanza), Pontevedra Occidental (Caldas, O Salnés, O Morrazo and Baixo Miño), Pontevedra and Vigo.

As can be observed in table 2, the population is not uniformly distributed along the coast. It is chiefly concentrated around the most important

Cadro / Table 2
Territorio e poboación na Galicia Costeira
Territory and population in Coastal Galicia

	Superf. km² Area km²	Pob. 1000 h. Pop. 1000 persons	96/00 %	Densidade h/km² Density persons/Km²	% Pob. > 64 anos % Pop. > 64
A Mariña Luguesa	1395	76,2	-0,91	54,6	23,60
Ortegal	392	17,1	-4,44	43,9	28,45
Ferrol	625	164,1	-1,97	262,6	20,41
A Coruña	470	356,6	2,59	758,7	16,92
A Coruña Occidental	2163	237,8	-2,30	110,0	19,20
Pontevedra Occid.	1007	264,6	0,76	262,8	16,20
Pontevedra	626	115,2	0,44	184,0	16,67
Vigo	608	399,4	0,64	656,9	14,87
Total Galicia Costeira	7286	1.631,3	0,09	223,9	17,40

Fonte: IGE / Source: IGE.

de maior importancia (Vigo e A Coruña), que supoñen case un 50% do total da poboación costeira galega e onde se alcanzan densidades elevadas superiores ós 650 habitantes por km². Tamén podemos destacar que, ademais das zonas urbanas mencionadas, a densidade de poboación é significativamente maior na zona das Rías Baixas (comarcas de Muros, Noia e Barbanza na zona da Coruña Occidental; Pontevedra Occidental, Pontevedra e Vigo), onde tamén reside a poboación con menor grao de envellecemento.

Tamén consideramos de interese coñecer os trazos xerais e básicos da situación socioeconómica dos fogares costeiros de Galicia, pois as consecuencias dun desastre como o

urban centres (Vigo and A Coruña) which account for 50% of the total coastal population of Galicia and where figures for population density reach more than 650 persons per square km. We can also point out that, in addition to the urban areas cited, population density is significantly greater in the Rías Bajas zone (districts of Muros, Noia and Barbanza in the area of West Coruña; West Pontevedra, Pontevedra and Vigo), where, in addition, the population with the lowest level of aging is to be found.

We also consider it of interest to look at the general basic features of the socio-economic situation of families in coastal Galicia, since the consequences of a disaster such as the one we are

que nos ocupa han ter un impacto significativo sobre estas. De acordo cos datos dispoñibles, o PIB por habitante de Galicia, no ano 2001, situouse ó redor dos 12.600 €, fronte ós 16.000 de media en España e os 23.200 da UE-15. É dicir, a renda media dos galegos supón algo máis do 75% da media española e un 50% da media comunitaria. Tratase, xa que logo, dunha zona de elevada sensibilidade socioeconómica diante de impactos significativos na súa economía. No cadro 3 resumimos algúns indicadores sociais de interese que caracterizan os fogares galegos.

En xeral, os fogares compóñense de 2 a 4 persoas (o 66,9%) e os núcleos familiares responden á tipoloxía de parellas con fillos (o 62,6%). Tamén é significativo que algo máis dun 30% destes teñen como ingresos exclusivos as pensións ou os subsidios, situación que se acentúa na zona interior (provincia de Ourense). Por termo medio, hai 1,34 persoas activas por fogar e 1,13 ocupados (novamente Ourense sitúase moi por debaixo da media). Os fogares teñen uns ingresos medios anuais de 15.500 € e a maioría (case o 60%) sitúase no intervalo entre 7.200 e 21.600 € ó ano. É importante subliñar que ó redor do 7,5% dos fogares galegos sobreviven con rendas por baixo do límite da pobreza (menos do 50% da mediana dos ingresos equivalentes para todos os fogares galegos).

Na franxa costeira obsérvanse algunhas diferencias de interese verbo da situación xeral de Galicia (cadro 4). Así, agás os casos das comarcas de Ortegal e Ferrol, o número

dealing with can have an important effect on them.

According to available data, the GDP per inhabitant in Galicia in the year 2001 was around 12,600 euros, as opposed to an mean of 16,000 in Spain and 23,200 for the EU-15. In other words, the mean income of the people of Galicia represents a bit more than 75% of the Spanish mean and 50% of the average for the European Union. It is thus a zone that is highly sensitive, in socio-economic terms, to incidents of significant impact on its economy. In table 3 we summarise some social indicators of interest that characterise Galician homes.

In general, homes are composed of 2 to 4 persons (66.9%) and family units correspond chiefly to couples with children (62.6%). It is also significant that something more than 30% of them have income solely from pensions or benefits, a situation that is accentuated in the interior (province of Ourense). On mean there are 1.34 economically active persons per home and 1.13 employed (again Ourense is very far below the mean). Homes have an mean annual income of 15,500 Euros and the majority (almost 60%) are between 7,200 and 21,600 Euros per year. It is important to emphasise that around 7.5% of Galician homes live on incomes below the poverty level (less than 50% of the median of equivalent income for all Galician homes).

In the coastal zone some important differences may be observed with respect to the general situation of Galicia (see table 4). Thus, except in the cases of the districts of Ortegal and Ferrol, the mean number of

Cadro / Table 3

Características socioeconómicas dos fogares en Galicia. 2001

Socio-economic characteristics of homes in Galicia. 2001

	A Coruña	Lugo	Ourense	Pontev.	Galicia
Composición: de 2 a 4 persoas (%) Make-up: 2 to 4 persons (%)	66,6	62,2	68,2	68,6	66,9
Núcleos familiares: parella con fillos (%) Family units: Couple with children (%)	62,9	59,2	56,9	65,4	62,6
Ingresos: só pensións e subsidios (%) Income: only pensions and benefits (%)	29,3	33,5	38,7	26,7	30,3
Media de activos por fogar Average econ. active persons per home	1,35	1,26	1,13	1,44	1,34
Media de ocupados por fogar Average employed persons per home	1,14	1,11	0,89	1,22	1,13
Ingresos: media anual do fogar (€) Average annual household income: (euros)	15.660	14.928	13.440	16.464	15.516
% fogares con ingresos < 7.200 €/ano % homes with income < 7,200 €/year	21,3	26,0	29,6	17,9	22,0
% fog. ingresos 7.200-21.600 €/ano % homes with income 7,200-21,600 €/year	58,4	54,7	56,1	59,5	57,9
% fog. con ingresos > 21.600 €/ano % homes with income > 21.600 €/year	20,3	19,3	14,3	22,6	20,1
% fogares baixo o límite da pobreza % homes below poverty level	7,4	6,9	10,5	6,7	7,5

Fonte: IGE / Source: IGE.

medio de ocupados por fogar é maior que a media galega de 1,13. Os ingresos medios anuais son superiores nas zonas urbanas (A Coruña e Vigo) e no resto da provincia de Pontevedra (Pontevedra e Pontevedra Occidental), onde máis do 80% dos fogares teñen rendas superiores ós 7.200 € anuais. Por último, debemos facer notar que a zona

employed persons per home is higher than the Galician average of 1.13. Mean annual incomes are higher in urban areas (Coruña and Vigo) and in the rest of the Province of Pontevedra (Pontevedra and Pontevedra Occidental), where more than 80% of the homes enjoy incomes of over 7,200 Euros per year. Finally, we should note that the area most severely hit by

máis castigada polo vertido de cru, A Coruña Occidental, é precisamente a que ten maior porcentaxe de fogares que viven con rendas baixo o límite da pobreza (máis do 10%), cuestión á que debemos manternos atentos de cara ó futuro.

É ben coñecido que Galicia é a principal rexión pesqueira da Unión Europea. Esta afirmación non é só un tópico, senón que se basea nos datos xerais sobre flota, producción e emprego. Para contextualizar a realidade do sector pesqueiro en Galicia, en primeiro lugar ofreceremos unha síntese desta información en comparación cos datos globais españois e

the oil spill, West Coruña, is precisely the one that has the highest percentage of homes living on incomes below poverty level (more than 10%), a consideration that we should pay close attention to when considering the future.

It is well know that Galicia is the most important fishing region in the European Union. This statement is not a cliché, but is solidly based on general data on fleet, production and employment. For the purpose of putting into context the character of the fisheries sector in Galicia, we will first offer a synthesis of this information in comparison with overall

Cadro / Table 4

Algunhas características dos fogares costeiros galegos. 2001

Some characteristics of homes on the Galician coast. 2001

	Media Activos Average Econ. Active	Media Ocupados Average Employed	Ingresos €/ano Income eur/year	Ingresos 7.200-21.600 €/ano (%) Income 7,200-21,600 eur/year (%)	Ingresos > 21.600 €/ano (%) Income > 21,600 €/year (%)	% baixo límite pobreza % below poverty level
A Mariña Luguesa	1,36	1,20	15.840	60,5	19,8	4,87
Ortegal	1,24	1,09	14.220	54,5	16,1	9,74
Ferrol	1,23	0,95	15.012	61,6	17,3	7,42
A Coruña	1,37	1,16	16.644	60,4	28,2	4,82
A Coruña Occidental	1,32	1,15	13.908	58,2	15,8	10,15
Pontevedra Occid.	1,46	1,20	16.056	62,1	20,5	7,70
Pontevedra	1,47	1,29	17.352	62,7	26,2	3,74
Vigo	1,46	1,24	16.860	58,9	23,2	5,89

Fonte: IGE / Source: I.G.E.

europeos[3]. En segundo lugar, trataremos de concretar un pouco máis anotando as diferencias entre distintas zonas costeiras da nosa Comunidade. Por último, tamén revisaremos algunha información referida a outras actividades moi vencelladas co sector da pesca.

Como podemos observar (cadro 5), o sector pesqueiro galego representa ó redor do 10% do conxunto do sector na Unión Europea-15. A nosa Comunidade dispón dunha flota pesqueira semellante (en número e capacidade) á do conxunto de toda Francia ou do Reino Unido, que xera algo máis do 10% da producción pesqueira e un 18% da producción acuícola da UE. En Galicia, este sector emprega directamente a unhas 32.700 persoas, o que representa case o 11% do emprego comunitario neste sector.

Esta concentración da actividade pesqueira no litoral galego fai que o peso relativo deste sector no conxunto da economía multiplique por dez a media europea, de tal xeito que na UE-15 o sector pesca e acuicultura fornece a penas o 0,2% do PIB, mentres que en Galicia ese peso relativo chega ata o 2,4%.

A importante dimensión do sector pesqueiro en Galicia está vencellada a unha diversidade de actividades e procesos realiza-

Spanish and European data[3]. In the second place we will attempt to become a bit more specific, pointing out the differences between the various coastal areas of our Community. Finally, we will also introduce some information on other activities closely linked to the fisheries sector.

As we can observe in table 5, the Galician fisheries sector represents around 10% of the total for the European Union -15. This community has a fishing fleet similar (in number and capacity) to that of all France or the United Kingdom, and which is responsible for more than 10% of fishing production and 18% of the aquaculture production of the EU. In Galicia the sector directly employs some 32,700 persons, representing almost 11% of the employment for the whole EU in the sector

This concentration of fishing activity on the Galician coast makes the relative weight of this sector in the whole of the economy ten times the European average, so that in the EU-15, the fishing and aquaculture sector hardly accounts for 0.2% of the GDP, while in Galicia that relative weight goes up to 2.4%.

The importance of the size of the fisheries sector in Galicia is also linked to the variety of situations and processes centring around this activity. As can

3. Dada a dispersión e pouca homoxeneidade da información a nivel europeo, aquí utilizaremos preferentemente os datos oficiais que nos ofrece a Comisión Europea para distintos anos (de 1997 a 2000).

3. Given the diffuse character and lack of uniformity of information on a European level, here we will preferentially use official data offered by the European Commission for the different years (from 1997 to 2000).

Cadro /Table 5

O sector pesqueiro galego na Unión Europea-15

The Galician fisheries sector in the European Union-15

		UE-15	España	% UE	Galicia	% Esp	% UE
Flota Fleet	N.º barcos Nº ships	99.170	17.972	18,1	*7.754	43,1	7,8
	Capacidade (1000 TRB) Capacity (1000 GRT)	2.053	589	28,7	204	34,6	9,9
Producción Production	Desembarques (1000 t) Unloading (1000 tons)	4.594	950	20,7	**475	50,0	10,3
	Valor desemb. (1000 €) Value unloaded. (1000 €)	5.516	1.602	29,0	**801	50,0	14,5
	Prod. acuícola (1000 t) Aquaculture Prod. (1000 t)	1.373	321	23,4	253	78,8	18,4
	Valor pr. acuícola (1000 €) Value Aquaculture Prod. (1000 euros)	2.459	277	11,3	143	51,6	5,8
Emprego Employment	Acuicultura e pesca Aquaculture and fishing	308.071	83.120	27,0	32.700	39,3	10,6
Renda Income	V.A.B. sector pesca/ PIB (%) Fisheries sector G.A.V. / GDP (%)***	0,2			2,4		

* Non se inclúe flota auxiliar de acuicultura. **Datos aproximados. *** Inclúe pesca e acuicultura.

* Not including auxiliary aquaculture fleet. **Approximate figures. *** Includes fishing and aquaculture.

Fontes: Comisión Europea e IGE / Sources: European Commission and IGE.

dos ó redor desta. Como se comproba no cadro 6, algo máis do 90% do total de embarcacións pesqueiras traballan dentro das augas territoriais. A maioría destas embarcacións (o 87%) son de pequeno porte, menores de 12 TRB, encadradas nos segmentos de flota artesanal menor (menos de 2,5 TRB) e flota artesanal maior (de 2,5 a 12 TRB). Flotas artesanais e de litoral que dependen enteiramente

be seen in table 6, more than 90% of the total number of fishing ships work within territorial waters. The majority of these ships (87%) are of small size, less than 12 GRT, and they are grouped in the smaller artisanal fleet (less than 2.5 GRT) and the larger artisanal fleet (from 2.5 to 12 GRT).

These artisanal and coastal fleets depend entirely on the exploitation of nearby marine resources and the

Cadro / Table 6

Flota pesqueira de Galicia por zonas ecoxeográficas (2000)

Fishing fleet of Galicia by eco-geographic areas. 2000

	Artesanal < 2,5 TRB Artisanal < 2.5 GRT		Artesanal 2,5-12 TRB Artisanal 2.5-12 GRT		Litoral 12-150 TRB Coastal 12-150 GRT		Arrastreiros 150-500 TRB Trawlers 150-500 GRT		Conxelad. Freezer ships		Total Total	
	N.º Nº	TRB GRT	N.º Nº	TRB GRT	N.º Nº	TRB GRT	N.º Nº	TRB GRT	N.º Nº	TRB GRT	N.º Nº	TRB GRT
Mariña Lugo	44	77	99	576	91	7.422	67	13.217			301	21.292
Coruña Norte	66	91	73	409	56	2.686	1	184			196	3.370
Ría Ferrol	77	96	33	186							110	282
Arco Ártabro	165	169	82	504	49	1.760	34	8.129	9	7.466	339	18.028
Costa Noroeste	427	504	207	1.373	97	3.184	3	513	5	5.610	739	11.182
Muros-Noia	737	905	150	821	41	2.528	1	153			929	4.408
Ría Arousa	2.379	2.731	424	2.573	187	10.829	19	3.710	1	2.306	3.010	22.148
Ría Pontevedra	422	513	171	942	47	4.070	30	7.197	8	6.164	678	18.885
Ría Vigo	899	1.125	232	1.283	140	10.223	120	30.348	61	61.375	1.452	104.355
Total Galicia	5.216	6.211	1.471	8.667	708	42.702	275	63.451	84	82.920	7.754	203.951

Fonte: Consellería de Pesca e Asuntos Marítimos. Xunta de Galicia / Source: Ministry for Fishing and Maritime Affairs. Xunta of Galicia.

da explotación dos recursos mariños próximos e que na súa maioría concéntranse nas zonas das Rías Baixas (Muros-Noia, Arousa, Pontevedra e Vigo).

A estas 7.700 embarcacións pesqueiras debemos engadir unhas 1.060 que realizan labores auxiliares de cultivos mariños, case na súa totalidade relacionadas coa producción de mexillón (tamén en boa medida concentrada nas Rías Baixas).

Galicia tamén dispón dunha importante producción acuícola, especialmente de mexillón e rodaballo. Tal e como se pode apreciar no cadro 7, nas rías galegas están fondeadas unhas 3.355 instalacións acuícolas, coñecidas co nome de bateas, das que o 97% están destinadas ó cultivo e producción do mexillón e o resto a policultivos doutras especies (ostra e vieira). Ás anteriores instalacións debemos engadir os 1.134 parques de cultivo existen-

majority of them are found in the zones of the Rías Baixas (Muros-Noia, Arousa, Pontevedra and Vigo).

To the 7,700 fishing ships we should add about 1,060 that do auxiliary work for shellfish cultivation, almost all of them connected with mussel production (also principally in the Rías Baixas).

Galicia also has important aquaculture production, particularly of mussels and turbot. As can be seen in table 7, in the Rías Gallegas about 3,355 aquaculture installations, or *bateas*, are anchored, of which 97% are devoted to mussel production and the rest to mixed cultivation of other species (oysters and scallops). To these installations, we should add the 1,134 weir *bateas* in sandy coastal areas, devoted chiefly to the production of clams (grooved carpetshell, carpetshell and Japanese clam), which are the basis of an exploitation

Cadro / Table 7
A acuicultura en Galicia
Aquaculture in Galicia

Bateas de mexillón / Mussel *bateas*	3242
Bateas doutros cultivos / *Bateas* for other products	213
Parques de cultivos de moluscos (ameixas) / Weir *bateas* for molluscs (clams)	1134
Granxas mariñas (rodaballo e salmón) / Fish farms (turbot and salmon)	14
Criadeiros (alevíns de peixe e cría de moluscos) Hatcheries (fish hatcheries and mollusc *bateas*)	5

Fonte: Consellería de Pesca e Asuntos Marítimos. Xunta de Galicia.

Source: Ministry for Fishing and Maritime Affairs. Xunta of Galicia.

tes nos areais costeiros, destinados principalmente á producción de ameixas (fina, babosa e xaponesa) e que son a base da explotación a pé realizada nos areais por parte duns 9.200 mariscadores (dos que o 95% son mulleres). Das 14 granxas mariñas existentes, 9 están instaladas en terra e producen fundamentalmente rodaballo, mentres que as 5 restantes dedícanse á producción de salmón con gaiolas mergulladas no mar.

O sector pesqueiro e acuícola galego que depende dos recursos naturais propios xera anualmente unha producción anual de 400.000 toneladas, valoradas en case 500 M de €. Ós medios de producción dedicados á explotación directa de productos do mar (pesca e acuicultura) debemos engadir a industria de conservas de peixe, outras industrias de conxelado que realizan a transformación de materias primas do mar (moi dependentes das subministracións de entradas procedentes do sector pesqueiro e marisqueiro) e todas as actividades de comercialización dos productos. No seu conxunto, este grupo de actividades supoñen uns 21.500 empregos da economía galega que hai que engadir ás outras 32.700 persoas directamente ocupadas.

Na actualidade existen 60 plantas conserveiras operativas espalladas por todo o litoral, que xeran unha producción dunhas 200.000 toneladas, valoradas en 650 M de €, empregando preto de 12.000 traballadores. Os principais productos son as conservas de túnidos (case o 50% do valor), sardiña (10%) e mexillón (10%). As 28 empresas de industrias de

carried on, on the beaches, by some 9,200 shellfish harvesters (95% of whom are women). Of the 14 fish farms in operation, 9 are installed on land and basically produce turbot, while the other 5 are devoted to salmon production with cages in the sea.

The Galician fisheries and aquaculture sector depending on its own natural resources accounts for an annual production of 400,000 tons, valued at almost 500 million euros.

To types of production devoted to the direct exploitation of products from the sea (fishing and aquaculture) we should add the fish canning industry, other freezing industries that process inputs from the sea (highly dependent on the supply from the fishing and shellfish sectors) and all the activity of product marketing. All together, this group of activities accounts for 21,500 jobs in the Galician economy.

At present there are 60 operative canning plants distributed along the entire coastline, with a production of about 200,000 tons, valued at 650 million euros, and employing almost 12,000 workers. The most important products are tinned tunas (almost 50%), sardines (10%) and mussels (10%).

The 28 companies in frozen marine products industries are to be found in the the province of Pontevedra, have a turnover of 700 million euros per year (chiefly hake, flatfishes and cephalopods) and employ almost 3,000 people.

The social structure built up around fishing on the Galician coast

productos marítimos conxelados concéntranse na provincia de Pontevedra, facturan uns 700 M de € ó ano (principalmente pescada, peixes planos e cefalópodos) e empregan a case 3.000 persoas.

A rede pesqueira espallada no litoral galego (flota, acuicultura, almacéns frigoríficos, etc.) propiciou que a nosa Comunidade sexa un dos maiores centros mundiais de comercialización dos productos da pesca. A primeira venda dos productos frescos realízase a través das 63 lonxas existentes en todo o litoral. Outras 700 empresas de almacenistas-exportadores dedícanse ó acondicionamento, manipulación e empacado dos productos para dirixilos ós mercados. Tamén existen 466 almacéns frigoríficos con capacidade de almacenamento superior ós 300.000 metros cúbicos. Ademais das lonxas, existen 71 centros de expedición de moluscos que reciben, limpan, depuran e expiden os distintos moluscos procedentes da actividade marisqueira, e uns 140 establecementos (cetarias) que se dedican ó mantemento de crustáceos.

Daquela, o conxunto de actividades directamente afectadas pola contaminación do mar representa unha elevada porcentaxe da poboación ocupada na economía galega (ó redor das 90.000 persoas, o que suporía preto do 10% da poboación ocupada total da nosa economía). Dende os afectados no primeiro nivel (sector extractivo, acuícola e marisqueiro a pé), ata o conxunto de actividades vencelladas coa subministración de bens e servicios ós sectores directamente afectados, pasando por

(fleet, aquaculture, refrigerated warehouses, etc.) has made our community one of the most important centres for marketing fish products. First sales of fresh products from fishing take place in the 63 fish markets along the coast. 700 wholesale-export companies engage in the processing, handling and packaging of products to be sent to the markets. There are also 466 refrigerated warehouses with storage capacity of more than 300,000 cubic metres. In addition to the fish markets, there are 71 mollusc shipping centres which receive, clean, purify and ship the different molluscs coming from shellfish harvesting and some 140 establishments (stock ponds) devoted to the maintenance of crustaceans.

All in all, the whole of directly affected activities represents a high percentage of the employed population in the Galician economy (estimation is around 90,000 people, representing about 10% of the entire employed population in our economy). From those affected in the first instance: the extraction sector, aquaculture and shellfish harvesting on foot, to the entirety of activities connected with the supply of goods and services to the directly affected sectors, and including all those activities that depend to a great extent on the supply of raw materials coming from fishing, aquaculture and shellfish harvesting. This information is summarised in the following diagram (Figure 1).

aquel conxunto de actividades que dependen en boa medida das subministracións de materias primas procedentes da pesca, acuicultura e marisqueo. Esta información resumímola no seguinte esquema (figura 1).

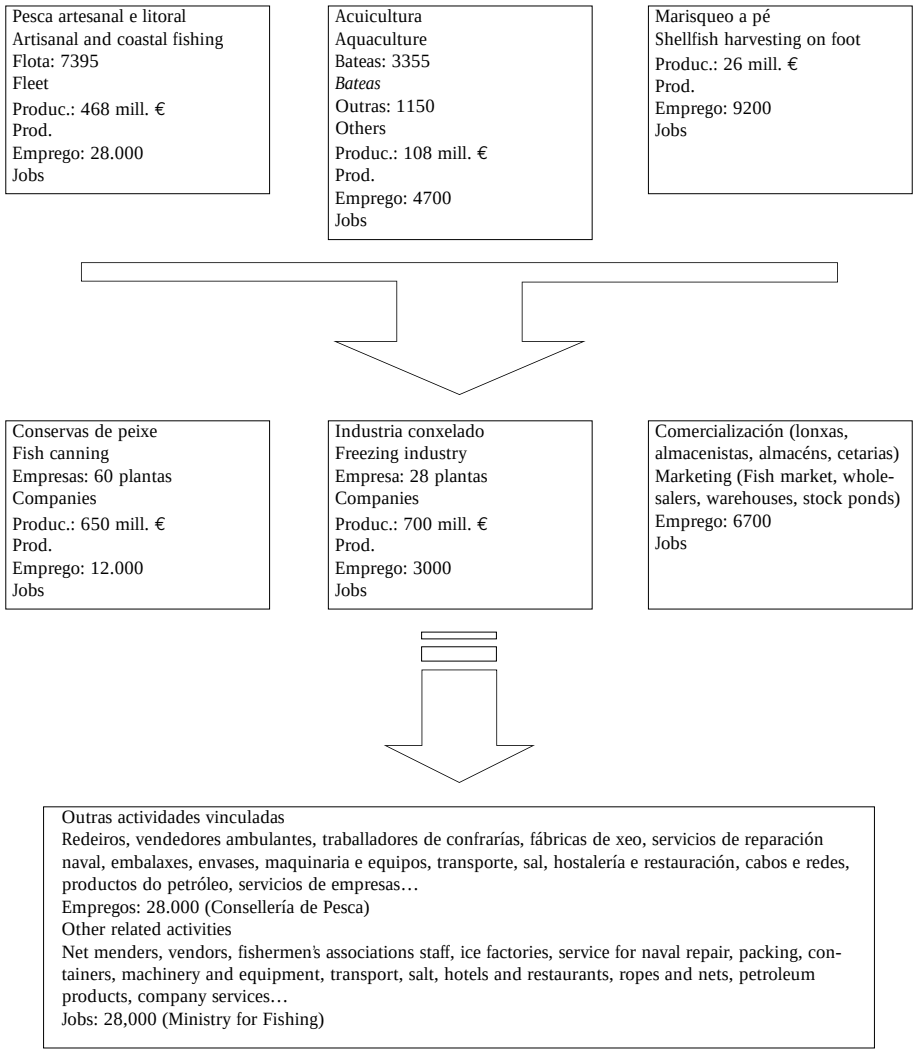
Cadro / Table 8
Industria e comercialización da pesca en Galicia
Industry and marketing of fish in Galicia

	N.º	Empregos Jobs
Industrias da conserva de peixe Fish canning industries	60	11.856
Industrias de transformación e conxelado Processing and freezing industries	28	2.922
Lonxas / Fish markets	63	400
Almacenistas-exportadores de pescado Fish wholesalers-exporters	700	2.300
Almacéns frigoríficos / Refrigerating warehouse	446	3.300
Centros de expedición de moluscos Mollusc shipping centres	71	350
Cetarias / Stock ponds	140	380
Total		21.508

Fonte: Consellería de Pesca e Asuntos Marítimos. Xunta de Galicia.

Source: Ministry for Fishing and Maritime Affairs. Xunta of Galicia.

Figura / Figure 1
Sector pesqueiro directa e indirectamente afectado en Galicia
Fisheries sector directly and indirectly affected in Galicia



2 O IMPACTO DO DERRAMO DO *PRESTIGE*

O 18 de novembro de 2002, o petroleiro *Prestige* (77.000 t), despois de navegar cunha fenda no seu casco, verteu boa parte da súa carga de fuel de tipo pesado (empregado para a combustión industrial), afundíndose a unhas 133 millas da costa galega coa metade das toneladas nos seus tanques. Este derramo provoca un grande impacto ecolóxico que atinxiu en sucesivas mareas negras a case toda a costa galega (estímase que uns 900 km de costa), norte de España e sudoeste de Francia. Dadas as fendas existentes no casco afundido, resulta moi difícil determinar con exactitude a cantidade de toneladas finalmente vertidas ó mar. Sen embargo, se contabilizamos todo o fuel que transportaba o petroleiro, esta catástrofe poderíase situar entre as 10 de maior cantidade vertida ó mar (cadro 9).

O caso do *Prestige* presenta unhas características específicas que diferencian esta catástrofe doutras. En primeiro lugar, como xa apuntamos, está afectando a unha ampla zona costeira (Galicia, Cantábrico e sudoeste de Francia), nalgúns casos altamente dependentes da explotación dos recursos naturais mariños (especialmente Galicia), e segue constituíndo unha ameaza potencial dada a difícil solución que ten o rescate do cru aínda almacenado nos tanques (a máis de 3.000 metros de profundidade).

No que se refire ás zonas afectadas polas mareas negras sucesivas procedentes do

2 THE IMPACT OF THE *PRESTIGE* OIL SPILL

On 18 November, 2002, the oil tanker *Prestige*, after navigating with an opening in its hull, spilled between 12,000 and 15,000 tons of heavy type fuel oil (used for industrial combustion) and sank about 133 miles off the coast of Galicia with about 77,000 tons in its tanks. This spill caused great ecological damage which in successive oil slicks affected almost the entire coast of Galicia (it is estimated that some 900 km were affected), the north of Spain and southwest of France. Given the cracks in the sunken hull it was quite difficult to determine with precision the number of tons finally spilled into the sea. Nonetheless, if we count all the fuel oil the tanker was transporting, this catastrophe could be ranked among the 10 spills involving the largest amount of oil dumped into the sea (see table 9).

The *Prestige* case has specific characteristics that make this catastrophe different from the others. In the first place, as we have already pointed out, it affects an extensive coastal area (Galicia, Cantabria and the southwest of France), in some cases highly dependent on the exploitation of natural marine resources (particularly Galicia), and continues to be a potential threat given the difficulty involved in recovering the oil still contained in the tanks (at a depth of more than 3,000 metres).

With regard to the areas affected by successive oil slicks coming from the

Cadro / Table 9
Grandes accidentes de petroleiros con más de 90.000 toneladas derramadas
Important tanker accidents with more than 90,000 tons of fuel oil lost

	Barco Ship	Ano Year	Localización Location	Cru perdido (t) Oil lost (tons)
1	*Atlantic Empress*	1979	Tobago	280.000
2	*ABT Summer*	1991	700 millas de Angola	260.000
3	*Castillo de Bellver*	1983	Sudáfrica / South Africa	257.000
4	*Amoco Cadiz*	1978	Bretaña Francesa / Brittany	227.000
5	*Haven*	1991	Xénova, Italia / Genoa, Italy	140.000
6	*Odyseey*	1988	700 millas de Nova Escocia 700 miles off Nova Scotia	132.000
7	*Torrey Canyon*	1967	Illas Scilly / Scilly Islands	119.000
8	*Urquiola*	1976	A Coruña, España / A Coruña, Spain	108.000
9	*Hawaiian Patriot*	1977	300 millas de Honolulú 300 miles off Honolulu	99.000
10	*Independenta*	1979	Bósforo, Turquía / Bosporus, Turkey	93.000
	Prestige	2002	130 millas de Galicia 130 miles off Galicia	¿93.000?

Fonte: International Tanker Owners Pollution Federation (recompilada en CETMAR, 2003).
Source: International Tanker Owners Pollution Federation (published in CETMAR, 2003).

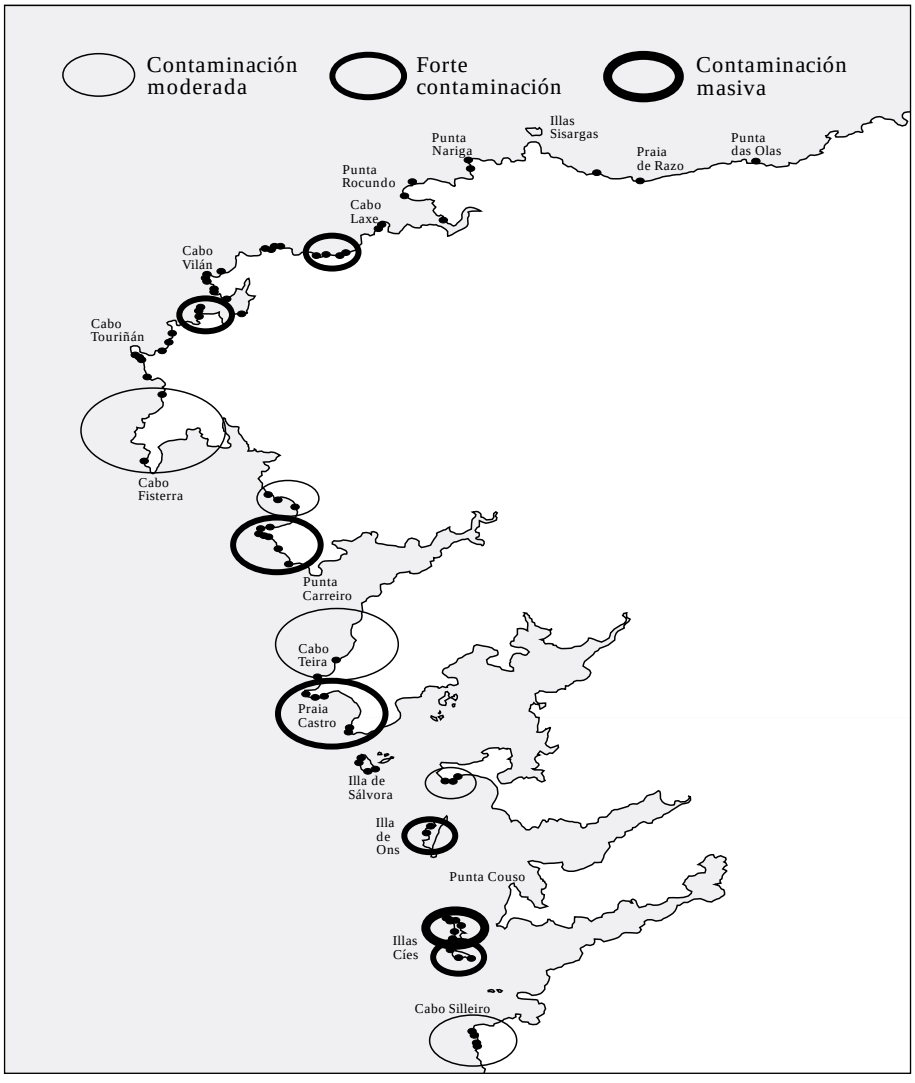
derramo do *Prestige*, podemos distinguir as de contaminación masiva, forte contaminación e contaminación moderada. Na figura 2 pódese observar a situación das distintas zonas á altura do mes de decembro.

Dentro das zonas de forte contaminación, podemos resaltar a área das Illas Atlánticas (Sálvora, Ons e As Cíes, principalmente) e a de Corrubedo, das que dependen gran parte da flota artesanal e de litoral das Rías de Arousa, Pontevedra e Vigo (por tratarse dunha reserva de elevada riqueza natural).

Prestige spill, we can distinguish areas of massive pollution, heavy pollution and moderate pollution. In figure 2 we can see the location of the different areas in December.

Of the areas of heavy pollution, we can point particularly to the area of the Islas Atlánticas (Sálvora, Ons and Cies, chiefly) and the area of Corrubedo, which a large part of the artisanal and coastal fleets of the Rías de Arousa, Pontevedra and Vigo depend on (since this is a reserve of great natural wealth). We should remember that almost 80% of the

Figura / Figure 2
Zonas afectadas polo vertido do *Prestige* en Galicia (febreiro 2003)
Areas affected by the *Prestige* spill in Galicia. February, 2003.



Lembremos que nesta zona localízase case o 80% da flota artesanal galega (unhas 5.400 embarcacións) e a maior parte das instalacións acuícolas (principalmente bateas de mexillóns).

Outra das zonas fortemente afectadas sitúase na costa noroccidental da provincia da Coruña, dende Cabo Fisterra ata as Illas Sisargas. Aínda que con menor flota verbo do total galego, esta zona amosa unha gran dependencia do sector pesqueiro artesanal e litoral, tanto na súa achega á renda coma ó emprego (nalgúns casos os ocupados no sector pesqueiro supoñen máis do 25% do total).

Dada a magnitude da catástrofe, as administracións públicas, nos seus diferentes niveis, promoveron actuacións que podemos clasificar en dous grupos. Un primeiro grupo de actuacións preventivas encamiñadas a que non cheguen ó mercado productos pesqueiros e marisqueiros en condicións non aptas para o consumo humano e para non dificultar as tarefas de loita contra a contaminación. Un segundo grupo de actuacións encamiñadas a paliar as repercusións máis inmediatas sobre a actividade pesqueira, marisqueira e outras vencelladas a estas, a través de diferentes tipos de axudas ós afectados.

A cronoloxía de actuacións públicas de tipo preventivo, fundamentalmente da Consellería de Pesca e Asuntos Marítimos, amósase no cadro 10. Entre este conxunto de medidas destaca a delimitación de zonas prohibidas para a

artisanal fleet of Galicia (some 5,400 craft) is to be found in this area, along with the greater part of the aquaculture installations (mainly mussel *bateas*).

Another of the heavily affected zones is located on the northwest coast of the province of A Coruña, from Cabo Finisterre to the Islas Sisargas. Though with a smaller fleet with respect to the whole of Galicia, this area is highly dependent on artisanal and coastal fishing, both in terms of its contribution to overall income and in employment (in some cases those employed in the fisheries sector amount to more than 25% of the total workforce).

Given the magnitude of the catastrophe, public administrations at their different levels have taken action in the form of measures which we can classify into two groups: a first group of preventive measures directed at preventing fishing and shellfish harvesting products in conditions not suitable for human consumption from reaching the market and at facilitating the fight against pollution; and a second group of measures aimed at mitigating the more immediate repercussions in fishing, shellfish harvesting and other related activities through different types of aids for those affected.

The chronology of public measures of a preventive nature, principally taken by the Ministry for Fishing and Maritime Affairs, is shown in table 10. Of this series of measures of particular importance is the designation of prohibited zones for fishing and shellfish harvesting and of the groups of fishermen

pesca e o marisqueo e os colectivos de pescadores e mariscadores afectados por estas[4].

Tal e como se pode observar na figura 3, as zonas de prohibición iniciais (16 de novembro de 2002) centráronse na costa noroccidental da provincia da Coruña (entre Cabo Fisterra e Oleiros), afectando a mariscadores e pescadores das flotas artesanais. Sucesivamente a zona de prohibición foise ampliando, primeiro cara ó norte (ata Punta Candelaria), incluíndo a flota de cerco, palangre, volantas e rascos; e máis tarde cara ó sur, chegando ata a desembocadura do río Miño e afectando a outros colectivos (percebeiros, arrastre de fondo, acuicultores, etc.).

O segundo tipo de medidas públicas (que se resume no cadro 11) refírense a aquelas que intentan paliar os efectos derivados do cesamento da actividade. Estas medidas comezaron o 17 de novembro de 2002 e consistiron basicamente na articulación dunha serie de axudas económicas para os armadores, tripulantes e mariscadores afectados pola prohibición de exercer as súas actividades habituais. Máis tarde arbitráronse medidas complementarias como o incremento do volume de axudas, a Redución do Imposto sobre Actividades Económicas, beneficios fiscais nas declaracións do IRPF, bonificacións no pago das cotas á Seguridade Social, posta en marcha de campañas de promoción dos productos pesqueiros galegos e liñas de créditos preferenciais para os afectados.

4. Para un seguimento detallado das distintas actuacións públicas consultar Xunta de Galicia (2003).

and shellfish harvesters affected by them[4].

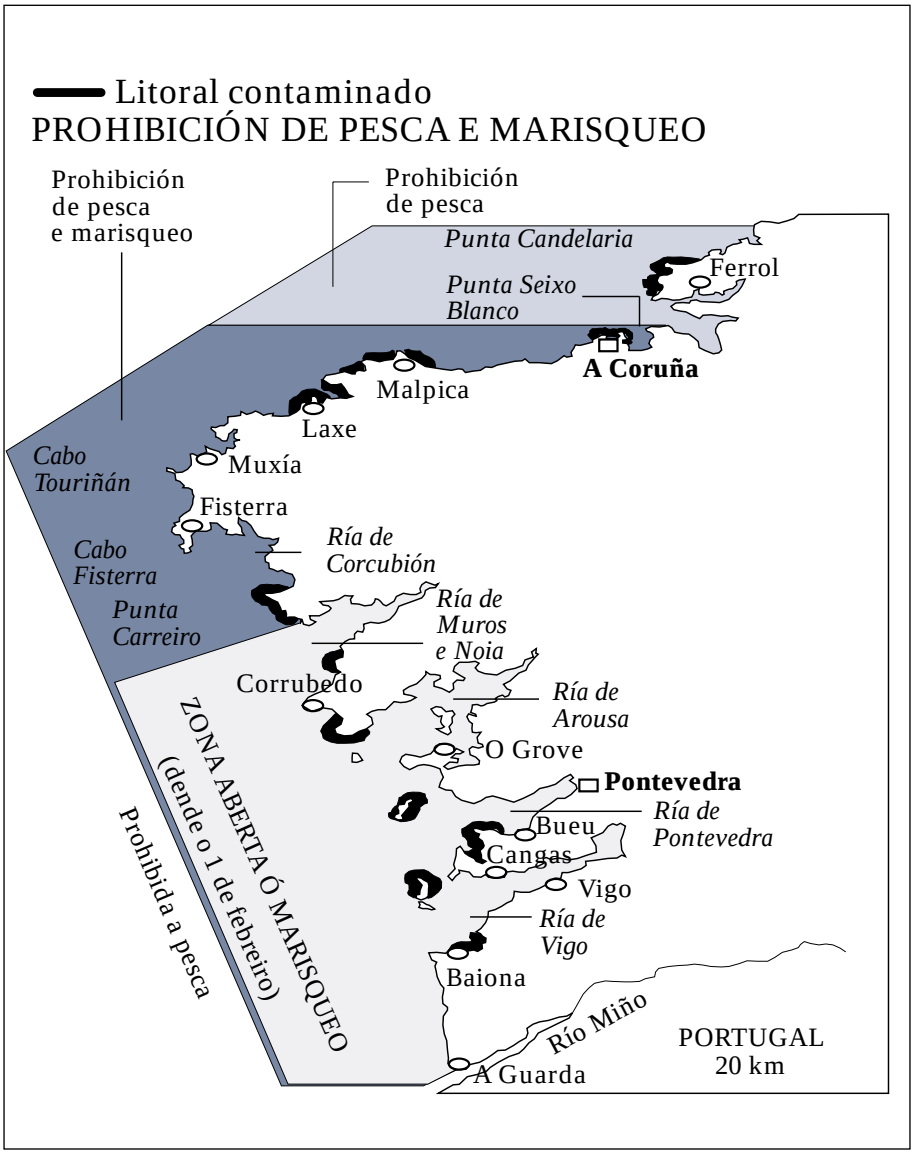
As can be observed in figure 3, the initial prohibited zones (16 November, 2002) were concentrated on the northwest coast of the province of A Coruña (between Cabo Finisterre and Oleiros), affecting shellfish harvesters and fishermen on artisanal fleets. The prohibited area was steadily extended, first to the north (to Punta Candelaria), to include the seine fleet, longline, gillnet and trawls; and later to the south, reaching the mouth of the Miño River and affecting other groups (goose barnacle harvesters, bottom trawlers, persons working in aquaculture, etc...).

The second type of public measures (summarised in table 11) are those that attempt to mitigate the effects arising from the suspension of the activity. These measures began on 17 November, 2002, and basically consist of the coordination of series of economic aids for operators, crew and shellfish harvesters affected by the prohibition of their normal activities.

Later, complementary measures were introduced, such as the increase in the amount of aid, reduction of the Tax on Economic Activities, Income Tax benefits, discounts on Social Security payments, launching of promotional campaigns for products of the Galician fishing industry and preferential credit lines for those affected.

4. For a detailed report on the different public measures consult Xunta of Galicia (2003).

Figura / Figure 3
Zonas de prohibición para a pesca e o marisqueo (13.02.03)
Zones where fishing and shellfish harvesting are prohibited (13.02.03)



Tamén, a medida que os efectos do derramo se estenderon temporal e espacialmente cara a outras zonas do litoral, fóronse incorporando máis colectivos de afectados en disposición de acceder ó conxunto de axudas: pescadores e mariscadores doutras zonas afectadas, redeiros, persoal de confrarías, operarios de lonxas e fábricas de xeo, comercializadores de primeiro nivel, retallistas e vendedores de peixe e marisco. Na figura 4 concretamos as principais axudas e colectivos afectados.

A partir da Orde do 30 de xaneiro da Consellería de Pesca e Asuntos Marítimos empezouse a establecer un calendario de reinicio da actividade nas zonas de prohibición. Este calendario dende o seu comezo estivo condicionado ás negociacións cos colectivos de pescadores e mariscadores afectados e polo principio de precaución, ante a detección de novas localizacións de vertidos e do estado dos fondos mariños onde se sedimentaron parte destes.

Segundo a información facilitada polo Instituto Español de Oceanografía, os fondos mariños con maior concentración de sedimentos de fuel localízanse, principalmente, nas mesmas áreas atinxidas pola contaminación costeira amosada en figuras anteriores[5].

Also, as the effects of the spill continued and extended to other areas of the coast more groups of affected persons were included as being eligible for aid: fishermen and shellfish harvesters of other affected zones, net menders, fishermen's associations staff, workers in fish markets and ice factories, first level marketers, retailers and fish and shellfish vendors.

In figure 4 we specify the most important aids and groups affected.

Starting with the Order of 30 January of the Ministry for Fishing and Maritime Affairs, a calendar began to be set for the resumption of activity in prohibited zones. This calendar is from the beginning conditioned by negotiations with the groups of fishermen and shellfish harvesters affected and by the principle of precaution as to the possibility of the localization of new spills and the condition of the sea floor where part of them have settled.

According to information provided by the Spanish Institute of Oceanography the sea floors with the greatest concentration of fuel oil sediments are chiefly located in the same area affected by the coastal pollution shown in previous figures[5].

5. Información detallada en IEO (2003).

5. Detailed information in IEO (2003).

Figura 4
Principais medidas paliativas para os sectores afectados en Galicia

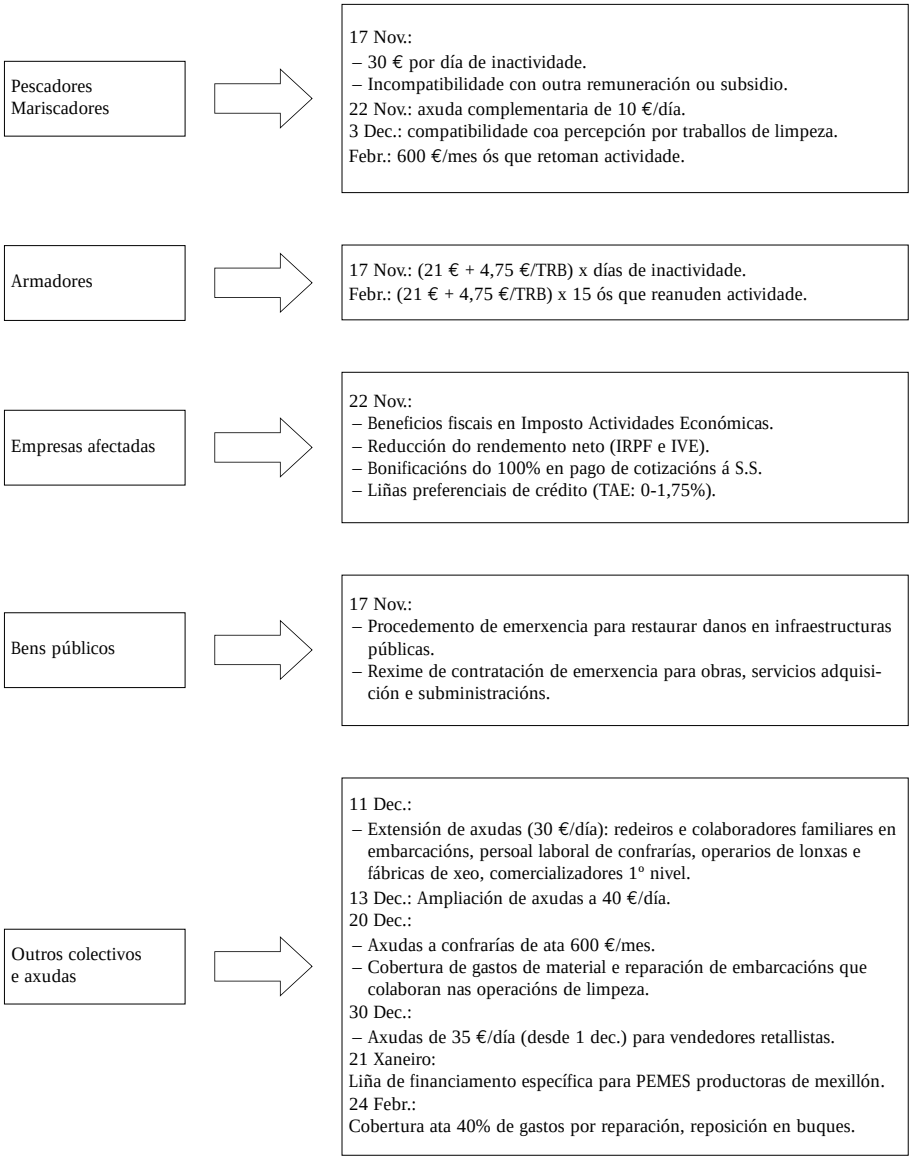


Figure 4
Principal palliative measures for affected sectors in Galicia

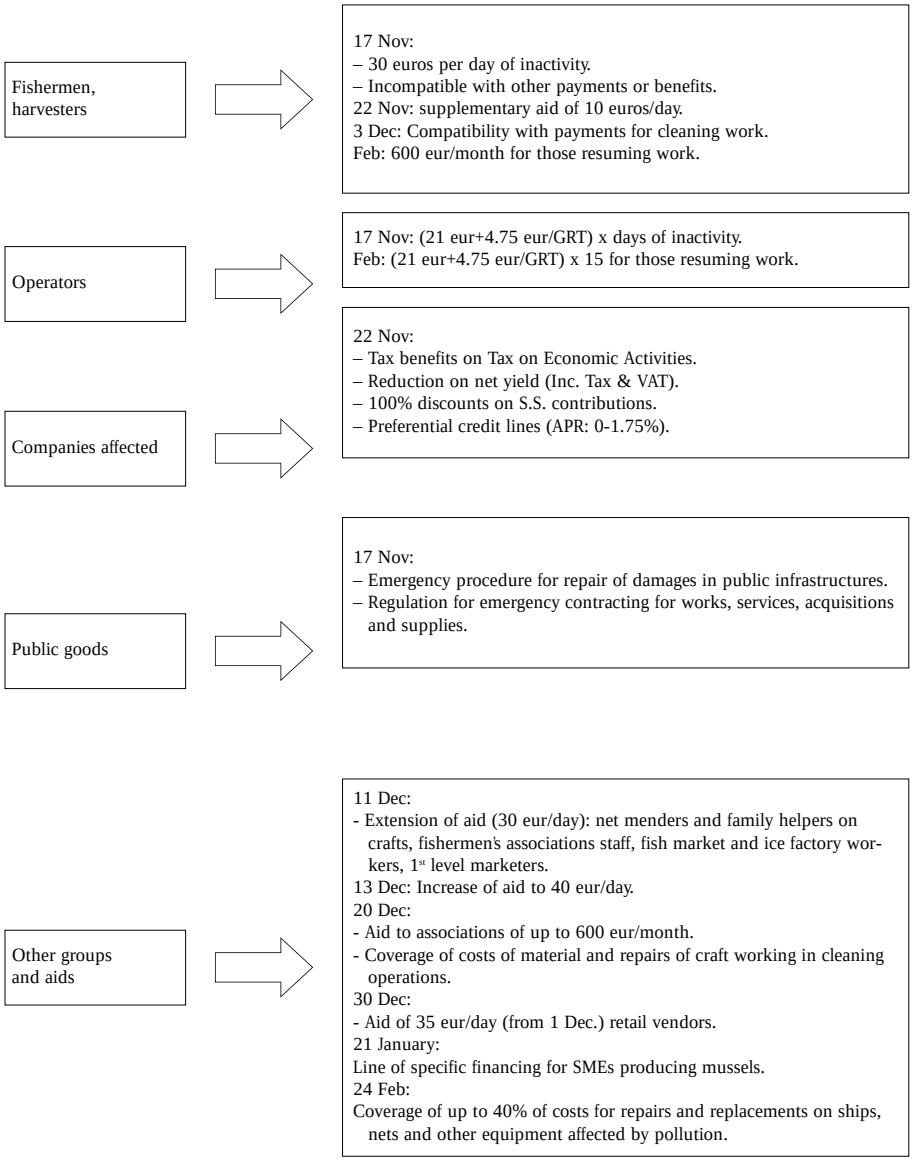
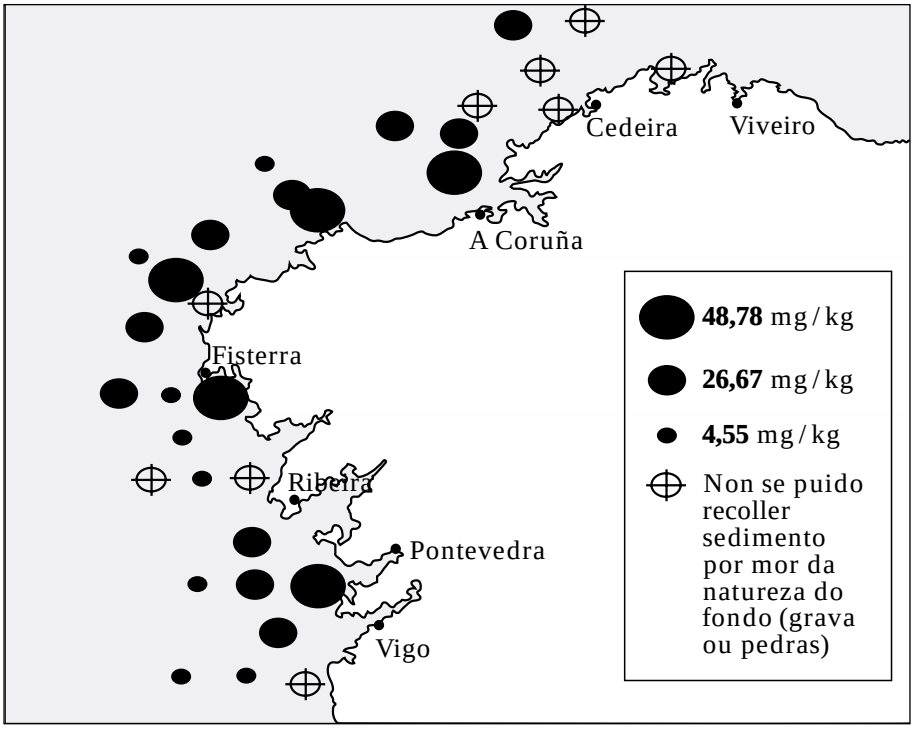


Figura / Figure 5
Concentracións de sedimentos de fuel nos fondos mariños
Concentrations of fuel oil sediment on the sea floor



Fonte: Instituto Español de Oceanografía (IEO).

Tal e como se observa na figura 5, as maiores concentracións de sedimentos contaminantes localizáronse nas Illas Atlánticas (Sálvora, Cíes e Ons) e ó longo da costa noroccidental da provincia da Coruña.

En función da información dispoñible, a apertura da actividade comezou polo marisqueo nas Rías Baixas dende o 1 de febreiro. Trala Orde do 24 de febreiro, tamén se auto-

As may be observed in figure 5, the largest concentrations of polluted sediment were located in the Islas Atlánticas (Sálvora, Cies and Ons) and along the northwest coast of the province of A Coruña.

On the basis of all the information available, the reopening of activity for shellfish harvesting began in the Rías Baixas starting 1 February. After the Order of 24 February, fishing in the

rizou a traballar en augas interiores desas mesmas Rías a algunhas modalidades de pesca artesanal (trasmallos e voitirións dirixidos fundamentalmente á pesca de choco e anguía, respectivamente).

Todo este sistema de medidas preventivas e paliativas foi xerando cuantiosos desembolsos por parte das distintas administracións públicas. Na figura 6, coa teima de ofrecer unha primeira avaliación de custos efectivos (e outros previstos a curto e medio prazo) como resultado da contaminación, podemos observar de xeito resumido a distribución dos aproximadamente 1.100 M de € nestes conceptos para o sector do litoral (extractivo, transformador e acuicultura).

inner waters of the Rías Baixas was also authorised for some types of artisanal fishing (flue nets and stow nets mainly fishing for cuttlefish and eel, respectively).

This entire process of preventive and palliative measures has occasioned substantial outlays for the different public administrations. In figure 6, in order to offer an initial evaluation of expenses paid and others foreseen for the short or medium term as a result of the pollution, we can observe, in a summary form, the distribution of the approximately 1,100 million euros for these concepts in the fisheries sector (extraction, processing and aquiculture).

Figura 6
Medidas paliativas e de estímulo da actividade pesqueira

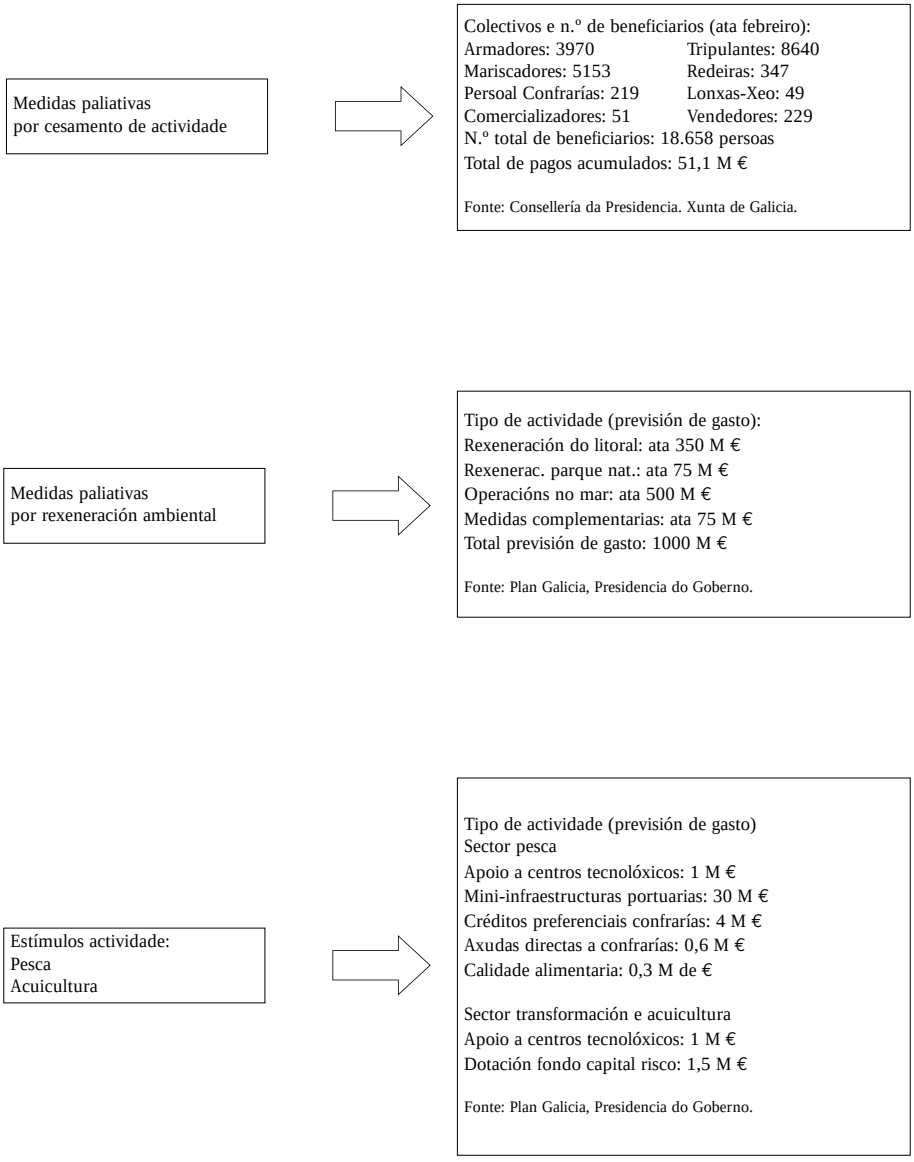
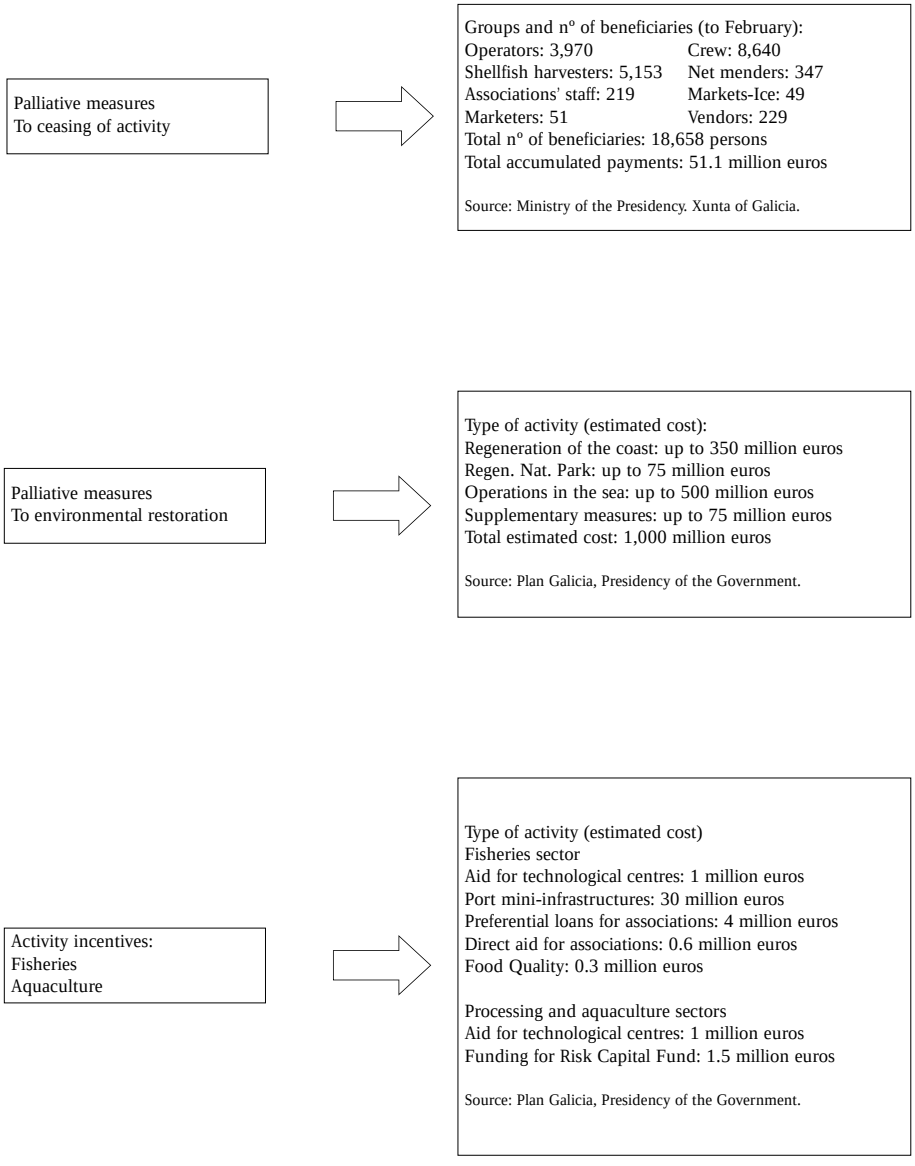


Figure 6
Palliative and incentive measures for fishery activity



3 A ESTIMACION DO PIB CESANTE NO LITORAL

Neste apartado presentaremos de forma sintética as liñas básicas e o procedemento que cómpre seguir para avaliar as perdas económicas, en termos de renda, que este desastre está a ocasionar sobre o sector pesqueiro e o conxunto da economía galega no medio e longo prazo. En principio, tal e como se amosa na figura 7, en todo este proceso distinguimos catro fases diferenciadas.

A primeira fase consistirá na correcta definición e delimitación da poboación pesqueira afectada pola contaminación. Distinguimos cinco segmentos en función das súas características: flota artesanal menor de 2,5 TRB, artesanal entre 2,5-12 TRB, flota de litoral, o marisqueo a pé e as actividades de acuicultura (bateas, instalacións en terra, etc.). Ademais precisamos definir a distribución da poboación destes segmentos en función de criterios espaciais ou territoriais, pois non todas as zonas e actividades están sufrindo coa mesma intensidade os efectos da contaminación. A nosa proposta baséase en distinguir 9 zonas diferentes, que coinciden basicamente coas unidades ecoxeográficas definidas nas bases de datos do Servicio de Información Pesqueira da Xunta de Galicia, de nordeste a sudoeste: A Mariña Lucense, Coruña Norte, Ría de Ferrol, Arco Ártabro, Costa Noroeste, Ría de Muros-Noia, Ría de Arousa, Ría de Pontevedra e Ría de Vigo.

3 VALUATION OF GDP LOSS

In this section we will present in synthesis the basic lines and procedural phases to be followed in order to evaluate economic losses in terms of income which this disaster can cause to the fisheries sector and the economy of Galicia as a whole in the medium and long term.

To begin with, as is shown in figure 7, in this entire process we can distinguish four different phases.

The first phase consists of the correct definition and demarcation of the fishing population affected by the pollution. We distinguish 5 segments, according to their characteristics: artisanal fleet of less than 2.5 GRT, artisanal fleet between 2.5 and 12 GRT, coastal fleet, shellfish harvesting on foot and aquaculture activities (*bateas*, installations on land etc.) In addition we need to define the distribution of the population of these segments using spatial or territorial criteria, since not all areas and activities suffer the effects of the pollution to the same degree. Our proposal is based on distinguishing 9 different zones, which basically coincide with the eco-geographic units defined in the databases of the Fishery Information Service of the Xunta of Galicia, from northeast to southeast: Mariña Lucense, Coruña Norte, Ría de Ferrol, Arco Ártabro, Costa Noroeste, Ría de Muros-Noia, Ría de Arousa, Ría de Pontevedra and Ría de Vigo.

The second phase is the collection of all available statistical information. On one hand, it is important

Figura 7
Fases para a valoración do PIB cesante

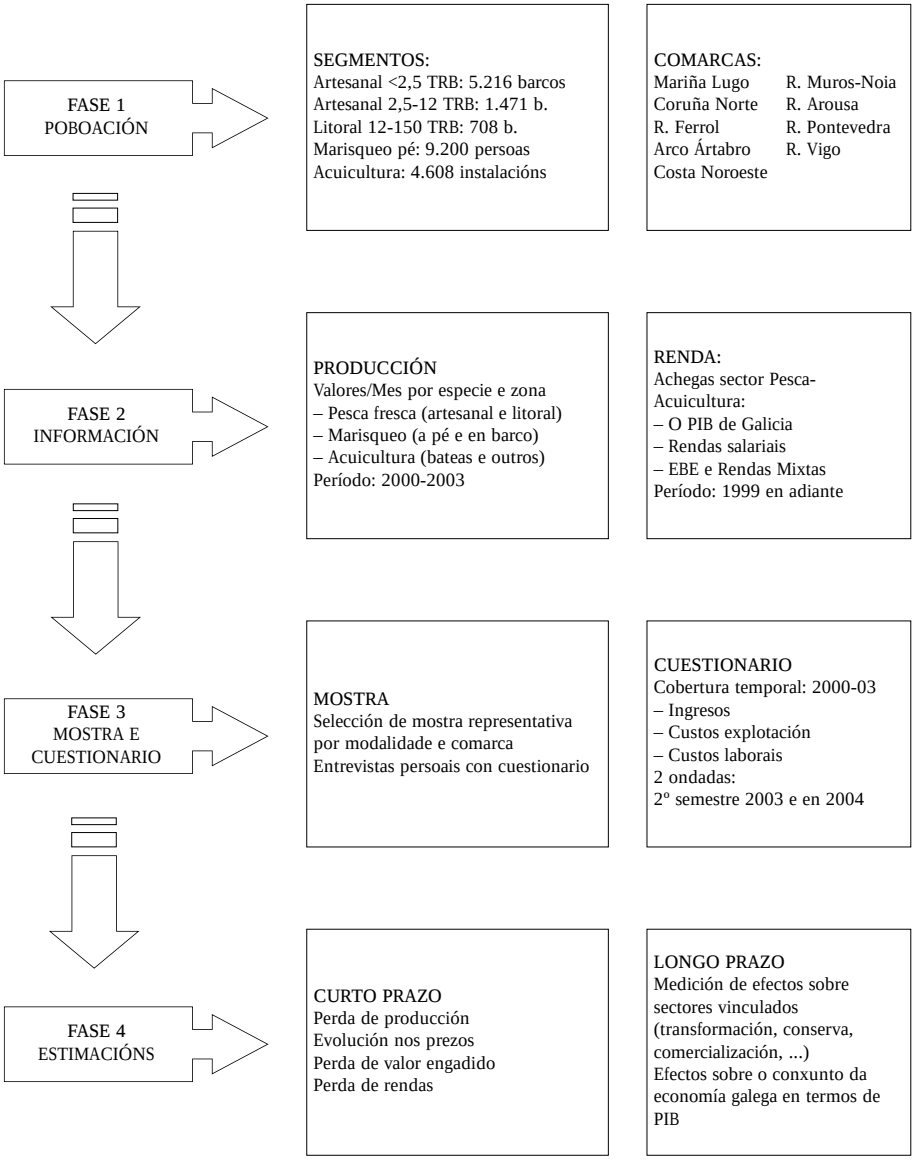
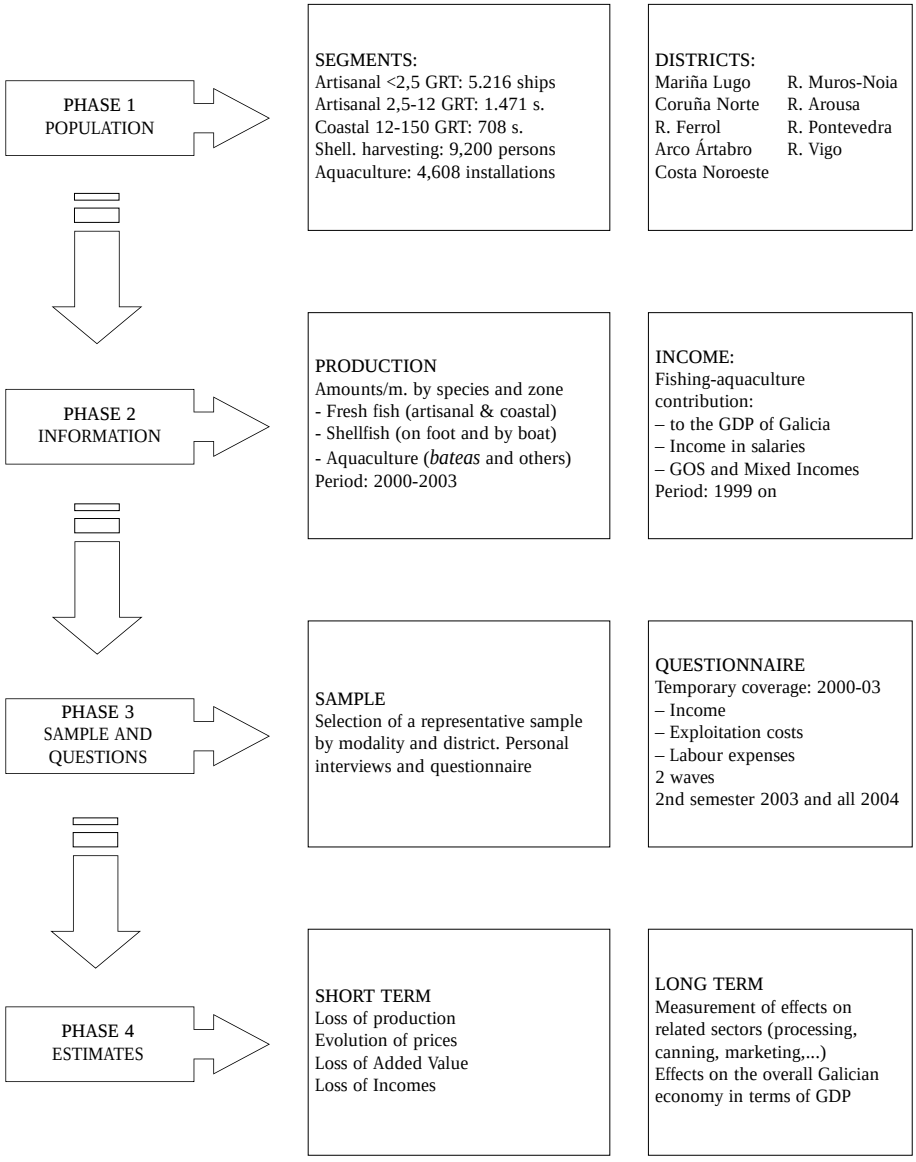


Figure 7
Phases for the valuation of GDP loss



A segunda fase é de recolla de toda a información estatística dispoñible. Por unha banda é relevante para o estudio a obtención de datos mensuais (peso, valor e prezos) sobre producción pesqueira de fresco desembarcada polas flotas artesanais e de litoral, a producción marisqueira (a pé e en barco) e a acuícola (granxas flotantes e terrestres), durante o período 2000 ata o máis recente dispoñible (finais de 2003). Por outra banda, tamén é necesaria a obtención de información macroeconómica sobre a achega que o sector de "Pesca, marisqueo e servicios asociados" realizou ó conxunto do PIB da economía de Galicia, a súa achega á xeración de rendas do traballo e ó Excedente Bruto de Explotación--Rendas Mixtas deste 1999 para adiante.

Con esta información é posible obter unha primeira aproximación sobre o valor da producción cesante. Sen embargo, dado o atraso e a agregación con que están dispoñibles as series de PIB e VAB xerado sectorialmente, e dada a necesidade de obter información máis detallada que nos permita avaliar impactos sub-sectoriais e territoriais, é preciso levar a cabo un traballo de campo directo mediante cuestionarios.

Con toda a información anterior ordenada, estaremos en disposición de construír unha mostra representativa de acordo coa segmentación realizada por tipos de actividade e territorio. A estas empresas e axentes pasaráselles un cuestionario por escrito que deberá ser cuberto, principalmente, baseándose en entrevistas persoais. Neste cuestionario a informa-

for our study to obtain monthly data (weight, value and prices) on fresh fish unloaded by the artisanal and coastal fleets, on shellfish harvesting (on foot and from boats) and on aquaculture (floating and land installations) during the period from the year 2000 to the most recent data available (2003). On the other hand it is necessary to obtain macroeconomic information on the contribution that the sector of "Fishing, shellfish harvesting and associated services" has made to the GDP of the Galician economy in its entirety, its contribution to the creation of earned income and to Gross Operating Surplus-Mixed Incomes, during the period from 1999 on.

With this information it is possible to make an initial approximation of the value of production loss. However, given the delay with which the GDP and GAV series are produced by sector and given the need to obtain more detailed information that would permit us to evaluate sub-sector and territorial impact, it is necessary to do field work using questionnaires.

With all the above information in order, we are in a position to construct a representative sample in accordance with the segmenting done by type of activity and territory. These samples will be studied using a written questionnaire that should be filled in chiefly on the basis of personal interviews. In this questionnaire the information asked for will mainly be connected with the evolution of production (both physical and in terms of value) since the year 2000, of basic exploitation costs (by type of goods

ción demandada estará principalmente relacionada coa evolución dende o ano 2000 da producción (física e en termos de valor), dos custos básicos de explotación (por tipo de ben e servicio consumido intermediariamente) e dos custos laborais (indicando evolución no nivel de emprego). Tampouco descartamos incorporar algunha cuestión que nos permita coñecer se os productores detectan algún cambio significativo nos mercados (perda ou variación da demanda) ou na estratexia empresarial dalgúns demandantes (sobre todo transformadores, que poidan desviar as súas fontes de subministración cara a outras zonas). En principio está previsto realizar dúas ondas de cuestionarios, a primeira durante o segundo semestre de 2003 e a segunda, máis intensa, ó longo de 2004.

A cuarta fase consistirá na elevación dos resultados mostrais para a estimación. Dentro desta fase distinguimos dous tipos de exercicios. No primeiro preténdese estimar os efectos da catástrofe a curto prazo e exclusivamente para os sectores analizados (pesca, marisqueo e acuicultura). Aquí queremos realizar unha primeira avaliación das perdas ocasionadas na producción, os prezos dos productos (o que nos permitirá detectar se existen efectos sobre a súa imaxe exterior), a perda na xeración de valor engadido e as repercusións sobre as rendas do traballo e capital. Nun segundo exercicio preténdese realizar unha estimación máis ampla, e a medio prazo, sobre os efectos no conxunto da economía galega, tendo presente as fortes

and services obtained through intermediaries) and of labour costs (indicating evolution of employment levels). Nor will we rule out including some question that would allow us to find out if producers have detected a significant change in the markets (loss or variation of demand) or in the business strategy of some claimants (particularly processors, who can shift their sources of supply to other areas). Initially plans are to do two waves of questionnaires, the first during the second semester of 2003 and a second, more intensive one throughout 2004.

The fourth phase consists in the elevation of the sampling results for estimation. In this phase we distinguish two types of exercise. In the first an attempt is made to estimate the effects of the catastrophe in the short term and solely for the sectors analysed (fishing, shellfish harvesting and aquaculture). Here the intention is to make an initial evaluation of losses in production, in the prices of products (which will permit us to discover if their public image has been affected), loss in the production of added value and repercussions on earned income and capital. In a second exercise we try to make a broader, medium-term estimation of the effects on the Galician economy as a whole, keeping in mind the important intersectorial relations between the complex of industries connected with the sea and other sectors of activity in our economy.

Finally, we must keep in mind that this entire process must be accompanied by other types of analyses, such as

relacións intersectoriais existentes dentro do complexo mar-industria con outros sectores de actividade da nosa economía.

Por último, debemos ter presente que todo este proceso debe acompañarse con outros tipo de análise, como a avaliación das perdas de capital relacionadas cos stocks naturais que van ter períodos de reconstitución de longo prazo (para o cal será imprescindible contar con avaliacións previas do estado dos recursos por parte dos biólogos e ecólogos), ou outros efectos sociais que unha catástrofe destas características pode xerar a longo prazo sobre as localidades costeiras e sobre a xente que depende do mar.

the evaluation of losses of capital relating to natural stocks that tend to have long-term periods of regeneration (for which it will be essential to have prior evaluations on the condition of resources done by biologists and ecologists), or of the social effects that a catastrophe with these characteristics can cause in the long term.

Cadro 10
Cronoloxía das resolucións preventivas

Data	Organismo	Medida	Colectivos afectados
16-nov.-2002	CPeAM	Prohibición da actividade pesqueira e marisqueira entre o Cabo Fisterra e Punta Seixo Branco (Oleiros, A Coruña).	Flota censada na modalidade de artes menores con porto base na zona prohibida. Mariscadores da zona.
18-nov.-2002	CPeAM	Ampliación da prohibición da pesca dende Cabo Fisterra ata o Cabo Prioriño (Ferrol).	Flota das modalidades artes menores e cerco. Para marisqueo mantense a prohibición nos límites do 16-11-02.
20-nov.-2002	CPeAM	Mantense zona de prohibición da resolución do 18-11-02.	Ampliación ás modalidades de palangre, volantas e rascos.
21-nov.-2002	CPeAM	Ampliación da zona de prohibición. Para a pesca dende Cabo Prioriño ata Ribeira; para o marisqueo dende Seixo Branco a Monte Louro.	Modalidades de artes menores, cerco, palangre, rascos e volantas. Mariscadores da zona.
22-nov.-2002	CPeAM	Ampliación da zona de prohibición. Pesca: dende Cabo Prioriño Grande (Ferrol) ata Punta Falcoeira (Aguiño). Marisqueo: dende Seixo Branco a Punta Carreiro (Muros). Prohibición de extracción de percebe.	Mesmas modalidades e mariscadores da resolución 21-11-02 e os percebeiros da confraría de Porto do Son.
22-nov.-2002	RD MP	Creación da Comisión Interministerial para o seguimento dos danos.	
24-nov.-2002	CPeAM	Ampliación da zona de prohibición para a pesca: dende Cabo Prioriño Grande (Ferrol) ata Punta Candelaria (Cedeira).	Mesmas modalidades de pesca con porto base en zona de prohibición.
29-nov.-2002	Orde MAPeA	Prohibición da pesca na franxa das 12 millas entre Punta Falcoeira e Punta Candelaria.	Modalidades de artes fixas, cerco e arrastre.
1-dec.-2002	CPeAM	Ampliación da zona de prohibición para a actividade marisqueira ás Rías de Ferrol e Cedeira.	Mariscadores e percebeiros de Ferrol e Cedeira.
2-dec.-2002	CPeAM	Prohibición de extracción de percebe nas zonas das confrarías de Aguiño e Ribeira.	Percebeiros de Aguiño e Ribeira.
4-dec.-2002	CPeAM	Refundición de anteriores resolucións. Ampliación da zona de prohibición: Actividade marisqueira dende Punta Seixo Branco ata a desembocadura do río Miño; Actividade pesqueira dende Punta Candelaria ata a desembocadura do río Miño.	Mariscadores e flotas con porto base na zona de prohibición. Percebeiros de Ferrol e Cedeira.
10-dec.-2002	CMA	Prohibición da pesca da angula na desembocadura dos ríos en Galicia.	Pescadores de angula.
11-dec.-2002	CPeAM	Prohibición de extracción de moluscos bivalvos cultivados en viveiros flotantes do polígono B do distrito de Corme.	Acuicultores da Ría de Corme (Laxe, A Coruña).
27-dec.-2002	CPeAM	Aprobación do Plan Xeral de Explotación Marisquera para o ano 2003.	Mariscadores.
24-xan.-2003	RD MAP	Creación dos Comisionados dos Ministerios de Fomento e Medio Ambiente e o coordinador do Ministerio de Defensa para a catástrofe.	
24-xan.-2003	RD MP	Disposicións complementarias para o funcionamento da Comisión Interministerial para o seguimento dos danos.	
30-xan.-2003	CPeAM	Levantamento da prohibición para o marisqueo entre a desembocadura do río Miño e Punta Carreiro (regulación da extracción a través do Plan Xeral de Explotación Marisqueira para 2003). Mantense zona prohibida para a pesca. Mantense prohibición para a actividade marisqueira entre Punta Carreiro e Punta Seixo, na Ría de Ferrol e Cedeira.	Mesmas modalidades de pesca. Mariscadores da zona de prohibición.

CPeAM: Consellería de Pesca e Asuntos Marítimos da Xunta de Galicia; MP: Ministerio da Presidencia; CMA: Consellería de Medio Ambiente; MAPeA: Ministerio de Agricultura, Pesca e Alimentación; MAP: Ministerio de Administracións Públicas.

Table 10
Chronology of preventive resolutions

Date	Org.	Measure	Groups affected
16-Nov-2002	CPeAM	Prohibition of fishing and shellfish harvesting activity between Cabo Finisterre and Punta Seixo Branco (Oleiros, A Coruña).	Fleet registered as the small net type with home port in the prohibited zone. Shellfish harvesters of the zone.
18-Nov-2002	CPeAM	Extension of fishing prohibition from Cabo Finisterre to Cabo Prioriño (Ferrol).	Fleet of the small net and seine types. For shellfish harvesting the prohibition maintains the limits of 16-11-02.
20-Nov-2002	CPeAM	The zone of prohibition established in resolution 18-11-02 is maintained.	Extension to longline, gillnet and trawl fishing.
21-Nov-2002	CPeAM	Extension of the prohibited zone. For fishing from Cabo Prioriño to Ribeira, for shellfish harvesting from Seixo Branco to Monte Louro.	Small net, seine, longline, trawl and gillnet fleets. Shellfish harvesters of the zone.
22-Nov-2002	CPeAM	Extension of the prohibited zone. Fishing: from Cabo Prioriño Grande (Ferrol) to Punta Falcoeiro (Aguiño). Shellfish harvesting: from Seixo Branco to Punta Carreiro (Muros). Prohibition of goose barnacle harvesting.	Same fleets and shellfish harvesters as in resolution 21-11-02 and goose barnacle harvesters of the Association of Porto do Son.
22-Nov-2002	RD MP	Creation of the Interministerial Commission for monitoring of damage.	
24-Nov-2002	CPeAM	Extension of the prohibited zone for fishing: from Cabo Prioriño Grande (Ferrol) to Punta Candelaria (Cedeira).	Same types of fishing with home port in prohibited zone.
29-Nov-2002	Order MAPeA	Prohibition of fishing in the 12 mile strip between Punta Falcoeiro and Punta Candelaria.	Fixed net, seine and trawl fleets.
1-Dec-2002	CPeAM	Extension of the prohibited zone for shellfish harvesting to the Rías de Ferrol and Cedeira.	Shellfish and goose barnacle harvesters of Ferrol and Cedeira.
2-Dec-2002	CPeAM	Prohibition of goose barnacle harvesting in the zones of the Associations of Aguiño and Ribeira.	Goose barnacle harvesters of Aguiño and Ribeira.
4-Dec-2002	CPeAM	Adaptation of previous resolutions. Extension of the prohibited zone: Shellfish harvesting from Punta Seixo Branco to the mouth of the Miño River; Fishing from Punta Candelaria to the mouth of the Miño River.	Shellfish harvesters and fleets with home port in the prohibited zone. Goose barnacle harvesters of Ferrol and Cedeira.
10-Dec-2002	CMA	Prohibition of elver fishing in the mouths of the rivers of Galicia.	Elver fishermen.
11-Dec-2002	CPeAM	Prohibition of harvesting of bivalve molluscs cultivated in floating hatcheries of Polygon B of the district of Corme.	Persons engaged in aquaculture in the Ría de Corme (Laxe, A Coruña).
27-Dec-2002	CPeAM	Approval of the General Plan for Shellfish Exploitation for the year 2003.	Shellfish harvesters.
24-Jan-2003	RD MAP	Appointment of Commissioners of the Ministries of Promotion and Environment and the Coordinator of the Ministry of Defence for the catastrophe.	
24-Jan-2003	RD MP	Complementary regulations for the functioning of the Interministerial Commission for monitoring damages.	
30-Jan-2003	CPeAM	Lifting of the prohibition for shellfish harvesting between the mouth of the Miño River and Punta Carreiro (regulation of harvesting through the General Plan for Shellfish Exploitation for the year 2003). The prohibited zone for fishing is maintained. Prohibition for shellfish harvesting is maintained between Punta Carreiro and Punta Seixo, in the Ría de Ferrol and Cedeira.	Same types of fishing. Shellfish harvesters in the prohibited zone.

CPeAM: Ministry for Fishing and Maritime Affairs of the Xunta of Galicia; MP: Ministry of the Presidency; CMA: Ministry of Environment; MAPEA: Ministry for Agriculture, Fisheries and Food Products; MAP: Ministry of Public Administrations.

Cadro 11
Cronoloxía das resolucións paliativas

Data	Acción	Principais Medidas
18-nov.-2002	Orde da CPeAM	Axudas a armadores, tripulantes e mariscadores afectados pola prohibición. Período: 17-nov. a 17-dec.-2002. Contía: armadores= (21 Eur+4,75 Eur/TRB) por días de inactividade; Tripulantes e mariscadores= 30 €/día. Incompatibles con outra actividade laboral e prestacións de desemprego.
22-nov.-2002	Real Decreto 7/2002	Medidas paliativas e reparadoras para os bens e as persoas e empresas afectadas por cesamento de actividade pesqueira ou marisqueira: redución do Imposto sobre Actividades Económicas, redución do rendemento neto no IRPF, bonificación do pago das cotas á Seguridade Social, dotar do carácter de emerxencia as obras de reparación ou reposición de infraestructuras afectadas, concesión de axudas complementarias a pescadores e mariscadores (10 €/día), campaña de promoción de productos pesqueiros galegos, concesión de créditos preferenciais para a reparación ou reposición de instalacións afectadas (fondo de 100 M de € con 1,75% TAE).
3-dec.-2002	Orde CPeAM	Modificacións técnicas da Orde do 18-nov.-2002. Compatibilidade das axudas coas percepcións por traballos de limpeza. Exímese á flota galega de cerco e arrastre de fondo de ter o seu porto base na zona de prohibición.
3-dec.-2002	Orde MTeAS	Normas para a aplicación das bonificacións no pago de cotas á SS establecidas no RD Lei 7/2002.
3-dec.-2002	Orde MP	Determinación dos termos municipais e núcleos de poboación onde resultan de aplicación as medidas do RD Lei 7/2002.
9-dec.-2002	Orde MP	Ampliación do territorio de aplicación das medidas do RD Lei 7/2002, incluíndo A Pobra do Caramiñal, Boiro e Rianxo (provincia da Coruña) e todos os municipios costeiros da provincia de Pontevedra.
11-dec.-2002	Orde CPeAM	Ampliación de axudas (30 €/día) a outros colectivos: redeiros, persoal laboral de confrarías, operarios de lonxas e fábricas de xeo, comercializadores de primeiro nivel.
13-dec.-2002	RD Lei 8/2002 XdoE	Extensión das axudas ás comunidades de Asturias, Cantabria e País Vasco. Modificacións do RD Lei 7/2002: ampliación das axudas a 40 €/día, mellora de condicións para acceso a créditos preferenciais, redución do Imposto sobre Actividades Económicas, beneficios fiscais en IRPF e IVE, bonificacións do 100% no pago da cota á SS.
19-dec.-2002	Orde CPeAM	Definición dos comercializadores afectados que poden solicitar axudas.
19-dec.-2002	Resolución Parlam. Eur.	Solicitude de aplicación de medidas para incrementar a seguridade marítima e algunhas medidas para paliar os efectos da catástrofe.
20-dec.-2002	Orde CPeAM	Axudas ás confrarías de pescadores para poder continuar as súas actividades (ata 600 € mensuais), axudas ós armadores para reparar avarías e deterioración das embarcacións que participan nos labores de limpeza.
30-dec.-2002	Orde CPeAM	Establecemento de indemnizacións polo cesamento de actividade de retallistas e vendedores ambulantes de peixe e marisco.
15-xan.-2003	Orde CPeAM	Modificación da Orde do 30-dec.-2002 para as indemnizacións a retallistas e vendedores de peixe e marisco.
17-xan.-2003	Orde MTeAS	Normas de aplicación do disposto no RD Lei 8/2002 sobre as bonificacións no pago de cotas da SS.
21-xan.-2003	Resolución IGPE	Convenio con entidades financeiras para o financiamento de PEMES galegas productoras de mexillón afectadas pola catástrofe.
22-xan.-2003	Orde MdeF	Desenvolvemento das medidas de redución de cargas fiscais (IRPF e IVE) para os contribuíntes directamente afectados, contempladas no RD Lei 7/2002.
27-xan.-2003	Orde MP	Ampliación do territorio de aplicación das medidas do RD Lei 7/2002 e RD Lei 8/2002, incluíndo os municipios da costa de Lugo, Principado de Asturias e Cantabria.
30-xan.-2003	Orde CPeAM	Establecemento dun programa de reinicio da actividade, con axudas de 600 € en febreiro para tripulantes e mariscadores e para armadores= (21 €+4,75xTRB)x15. Terminan axudas á flota de arrastre nas 12 millas en canto o dictamine o MAPeA. Cesamento de axudas nas zonas marisqueiras onde se levante a prohibición.
24-feb.-2003	Orde CPeAM	Ampliación temporal a marzo das axudas únicas establecidas na Orde do 30 de xaneiro para os que reinicien a actividade.
24-feb.-2003	Orde CPeAM	Cobertura de ata o 40% dos gastos de reparación ou reposición en embarcacións, artes e equipos danados pola contaminación.

CPeAM: Consellería de Pesca e Asuntos Marítimos da Xunta de Galicia; MP: Ministerio da Presidencia; MAPeA: Ministerio de Agricultura, Pesca e Alimentación; IGPE: Instituto Galego de Promoción Económica; MdeF: Ministerio de Facenda; MTeAS: Ministerio de Traballo e Asuntos Sociais; XdoE: Xefatura do Estado.

Table 11
Chronology of palliative resolutions

Date	Action	Principal Measures
18-nov-2002	Order of the CPeAM	Aid to operators, crew and shellfish harvesters affected by the prohibition. Period: 17-Nov to 17-Dec-2002. Amount: Operators= (21 Eur+4.75 Eur/GRT) for days of inactivity; Crew and shellfish harvesters= 30 euros/day. Incompatible with other work activity and unemployment benefits.
22-Nov-2002	Royal Decree 7/2002	Palliative and repair measures for goods and for persons and companies affected by suspension of fishing or shellfish harvesting activity. Reduction of the Tax on Economic Activities, reduction of the net yield in income tax, discounts on Social Security contributions, granting emergency character to work on repair and replacement of affected infrastructures, concession of supplementary aid for fishermen and shellfish harvesters (10 euros/day), promotional campaign for Galician fishery products, concession of preferential loans for repair or replacement of affected installations (fund of 100 million euros with 1.75% TAE).
3-Dec-2002	Order CPeAM	Technical modifications on the Order of 18-Nov-2002. Compatibility of aids with payment for cleaning work. The Galician seine and trawling fleet of Galicia is exempted from having its home port in the prohibited zone.
3-Dec-2002	Order MTeAS	Regulations for the application of discounts on the payment of SS contributions established in the RD Law 7/2002.
3-Dec-2002	Order M P	Determination of the municipal areas and population centres where the provisions of the RD Law 7/2002 are to be applied.
9-Dec-2002	Order M P	Extension of the territory for application of the provisions of RD Law 7/2002 to include A Pobra do Caramiñal, Boiro and Rianxo (Province of A Coruña) and all the coastal municipalities of the province of Pontevedra.
11-Dec-2002	Order CPeAM	Extension of aid (30 euros/day) to other groups: net menders, fishermen's associations staff, fish market and ice factory workers, first level marketers.
13-Dec-2002	RD Law 8/2002 XdoE	Extension of aid to the Communities of Asturias, Cantabria and the Basque Country. Modifications of RD Law 7/2002: increase of aid to 40 euros/day, improvement of conditions for access to preferential loans, reduction of the Tax on Economic Activities, tax benefits for income tax and VAT, discounts of 100% on SS contributions.
19-Dec-2002	Order CPeAM	Definition of affected marketers who can apply for aid.
19-Dec-2002	Resolution Eur. Parl.	Request for application of measures to increase maritime safety and some measures to mitigate the effects of the catastrophe.
20-Dec-2002	Order CPeAM	Aid for Fishermen's Associations in order for them to continue their activities (up to 600 euros per month), aid for operators to repair damage and deterioration of craft that participate in cleaning work.
30-Dec-2002	Order CPeAM	Establishment of compensation for suspension of activity for retailers and fish and shellfish vendors.
15-Jan-2003	Order CPeAM	Modification of the Order of 30-Dec-2002 for compensations for retailers and fish and shellfish vendors.
17-Jan-2003	Order MTeAS	Regulations for application of the provisions of RD Law 8/2002 on discounts on SS contributions.
21-Jan-2003	Resolution IGPE	Agreement with financial institutions for the financing of Galician mussel producing SMES affected by the catastrophe.
22-Jan-2003	Order MdeF	Development of measures for the reduction of tax burdens (income tax and VAT) for taxpayers directly affected, covered by the RD Law 7/2002.
27-Jan-2003	Order MP	Extension of the territory for application of the measures of the RD Law 7/2002 and RD Law 8/2002, to include municipalities of the coast of Lugo, Principality of Asturias and Cantabria.
30-Jan-2003	Order CPeAM	Establishment of a programme for resumption of activity, with aids of 600 euros in February for crew and shellfish harvesters and for operators= (21 euros+4.75xGRT) x15. Suspension of aid for the 12 mile trawling fleet when ordered by the MAPeA. Suspension of aid in shellfish harvesting zones where prohibition is lifted.
24-Feb-2003	Order CPeAM	Temporary extension to March of aid established in the order of 30 January for resumption of activity.
24-Feb-2003	Order CPeAM	Coverage of up to 40% of costs of repair or replacement on craft, nets and equipment damaged by the pollution.

CPeAM: Ministry for Fishing and Maritime Affairs of the Xunta of Galicia; MP: Ministry of the Presidency; MAPeA: Ministry of Agriculture, Fishing and Food Products; IGPE: Galician Institute of Economic Promotion; MdeF: the Treasury; MTeAS: Ministry of Labour and Social Affairs; XdoE: Office of the Chief of State.

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CONSIDERACIÓNS SOBRE O ESTUDO DOS DANOS ECONÓMICOS NOS SECTORES PRODUCTIVOS DIRECTAMENTE VINCULADOS ÁS ACTIVIDADES MARIÑAS. O CASO DO *AEGEAN SEA*

CONSIDERATIONS ON THE STUDY OF ECONOMIC DAMAGE IN PRODUCTIVE SECTORS DIRECTLY LINKED WITH MARINE ACTIVITIES. THE CASE OF THE *AEGEAN SEA*

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1 DESCRICIÓN DO SINISTRO

Na madrugada do 3 de Decembro de 1992 o buque petroleiro *Aegean Sea* dispuxo-se a entrar no porto da Coruña co fin de descarregar as case 80.000 toneladas de cru que transportaba. Nas manobras de entrada no porto o buque encalla. Horas despois abre-se unha fenda no costado que permite a expulsión de parte do petróleo almacenado. Xa pola mañá comenza haber explosións que farán arder o petróleo derramado.

Moi esquematicamente estes son os feitos que anunciaban o início da catástrofe que, en pouco tempo, afectará a unha zona costeira que vai das illas Sisargas á Ponta do Cadro. A extensión do hidrocarburo viu-se favorecida polos distintos cámbios de vento e as condicións meteorolóxicas rexistradas o dia do

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1 DESCRIPTION OF THE ACCIDENT

In the morning of the 3rd of December, 1992, the oil tanker *Aegean Sea* prepared to enter the port of A Coruña to unload the almost 80,000 tons of crude oil it was carrying. During the manoeuvres made while entering the port the ship ran aground. Hours later a crack opened on the side of the boat, allowing part of the crude oil to escape. By morning explosions began to occur, setting the spilled oil on fire.

Very schematically, these are the facts surrounding the beginning of the catastrophe which in a short period of time was to affect a coastal area running from the Sisargas Islands to Ponta do Cadro. The spread of the crude oil was assisted by the different changes of wind direction and the weather conditions prevailing on the day of the

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sinistro, con un mar de fondo con ondas de 5-6 metros de altura, no momento do acidente.

Na zona habitan algo máis de médio millón de persoas, segundo o Censo de povoación de 1991, é dicer, aproximadamente un 20% dos habitantes de toda Galiza, zona, por outra parte, con forte vinculación ao mar. Non é estraño, pois, que calquer suceso de gravidade como o que nos ocupa se deixe notar en todos os ámbitos da economia da zona e mesmo, pola cantidade de povoación que aglutina, na economia galega.

A gravidade deste sinistro ve-se agudizada polo feito de o suceso non ser o único deste tipo que ten acontecido nas costas galegas, e mesmo na zona polucionada. O 4 de Marzo de 1970 embarrancou o buque noruegués *Andros Patria* na boca norte da Ria de Vigo, que transportaba 50.000 toneladas de cru. Máis perto da zona afectada, o 31 de Decembro de 1978, o petroleiro *Andros Patria* provoca ao norte do cabo Ortegal unha forte contaminación. Na zona do cabo Fisterra, o 5 de Decembro de 1987, o buque *Casón* sofre un acidente cando transporta unha carga de 2.000 bidóns de produtos químicos corrosivos. Pero o máis grave é o encadeamento de catrástrofes que ao longo do tempo se producirán na zona que nos interesa: o 31 de Outubro de 1970 o cargueiro *Erkowit,* tendo chocado á altura de cabo Vilano é transportado á altura de Bastiagueiro, onde os 2.000 bidóns de pesticidas que transportaba provocarán un forte impacto na Ria da Coruña, non suficientemente estudado. Seis anos despois,

accident, with a swell with waves of up to 5-6 metres high at the moment of the accident.

More than half a million people live in the zone, according to the 1991 census, in other words, approximately 20% of the total of inhabitants of Galicia, and it is a zone, at the same time, with close ties to the sea. It is thus not surprising that an event as serious as the one we are concerned with left its mark on all aspects of the economy of the area and on the Galician economy as a whole, given the population affected here.

The seriousness of this accident was aggravated by the fact that this was not the only event of its type that has occurred on the coasts of Galicia, precisely in the polluted zone. On March 4, 1970, the Norwegian ship *Andros Patria* ran aground at the north mouth of the Ría de Vigo, while carrying 50,000 tons of crude oil. Closer to the affected zone, on 31 December, 1978, the oil tanker *Andros Patria* caused serious pollution north of Cape Ortegal; in the area of Cape Fisterra, on 5 December, 1987, the *Casón* suffered an accident when transporting a cargo of 2,000 barrels of caustic chemicals. But more serious was the chain of catastrophes that have occurred in the course of time in the zone we are considered with. On 31 October, 1970, the cargo ship *Erkowit,* having been damaged before Cape Vilano, was transported to Bastiagueiro, where the 2,000 barrels of pesticides it was carrying caused a strong impact on the Ría de A Coruña, in an incident that has never been sufficiently studied. Six years later, on 12 May, 1976, the tanker

o 12 de Maio de 1976, o buque tanque *Urquiola,* cargado con unhas 100.000 toneladas de cru procedente de Lïbia, tocou fondo na entrada do porto da Coruña causando un escape de fuel-óleo, que tras un segundo choque provocará o derramamento da carga, que se vai extendendo por uns límites case coincidentes cos afectados polo sinistro do *Aegean Sea.* Na luita contra a maré negra provocada polo *Urquiola* empregaron-se de modo masivo deterxentes e dispersantes que producirán efeitos máis perniciosos a longo prazo para a flora, a fauna piscícola e marisqueira da zona afectada.

É de supor, á vista dos estudos feitos sobre poluizón das augas, que estes dous sucesos *Erkowit* e *Urquiola* tan pertos no tempo supuxesen un duro revés ao ecosistema da zona dificilmente recuperábel en pouco tempo. Non é só a cercania dos sucesos senón o facto de o meio estar en contínua agresión, por mor da presión demográfica da costa. Todo isto conleva necesariamente un retardo no reequilíbrio do meio mariño[1]. Cando en Marzo de 1978 naufraga nas costas de Bretaña o petroleiro *Amoco Cadiz*, xusto once anos despois do primeiro gran desastre deste tipo e, na mesma zona, do *Torrey Canyon* (Marzo de 1967), non se tiñan ainda recuperado as espécies máis lentas como os bogavantes, nécoras ou navallas, polo que se preveu que até o

1. Bonnieux, F; Dauce, P. e Rainelli, P., *Impact socio-économique de la marée noire provenant de l'Amoco Cadiz*, U.V.L.O.E.-I.N.R.A, 1980.

Urquiola carrying 100,000 tons of oil from Libya touched bottom at the entrance to the port of A Coruña causing a leak of fuel oil that after a second collision led to a spill of the cargo that spread to extents almost coinciding with the area affected by the *Aegean Sea* accident. In the fight against the effects of the oil slick caused by the *Urquiola* massive use was made of dispersant detergents that produced long-term destructive affects on the flora, fish and shellfish of the zone affected.

It is to be supposed, in view of studies done on the pollution of the waters, that these two events involving the *Erkowit* and the *Urquiola*, so close together in time, signified a serious reverse for the ecosystem of the area that could not be easily repaired in a short period of time. It is not just the nearness in time of the events but also the fact that the environment is subject to continual aggression due to the demographic pressure of the coast. All this necessarily entails a delay in the reestablishment of the marine environment[1]. When the oil tanker *Amoco Cadiz* shipwrecked in March of 1978 on the coasts of Britanny, precisely eleven years after the first great disaster of this type – in the same area – that of the *Torrey Canyon* (March, 1967), the species that are slowest in recovering, lobsters, velvet crabs, and razor clams, had still not recovered, so it was expected that the effects of the *Amoco Cadiz* spill would not have disappeared

1. Bonnieux, F; Dauce, P. and Rainelli, P., *Impact socio-économique de la marée noire provenant de l'Amoco-Cadiz*, U.V.L.O.E.-I.N.R.A, 1980.

2000 non desaparecerian os efeitos do *Amoco Cadiz*. É dicer, pola interación dos dous naufráxios terán que pasar 33 anos até o reequilíbrio do meio. Deste xeito a maré negra do *Aegean Sea* intervén como elemento desestabilizador sobre un meio estresado, en recomposición, co que aos efeitos perniciosos dun sinistro deste tipo se lle suma a interacción sobre un meio mariño sobrado de agresións.

Non só o meio mariño, mais tamén a economia mariña local, a sua economia en conxunto, ve truncada a sua estabilización, por non falar da dificuldade que isto conleva para unha economia que en casos como o da zona de Ferrol salvou parte dos perxuízos da crise industrial que sofreu volcando-se cara o mar.

2 APROXIMACIÓN Á FACIANA FÍSICA DO VERQUIDO

Ainda que se poida pensar que o derramamento acidental de petróleo nunha pequena zona do médio mariño ten pouca importáncia dentro da sua imensidade, cabe dicer que isto apenas é unha apariéncia xeográfica que nada ten que ver con unha realidade biolóxica ou ecolóxica e, en definitiva, económica. Unha grande parte da riqueza marítima situa-se, precisamente, nas plataformas continentais, máis ainda se nos estamos a referir aos aproveitamentos pesqueiros. Con perto dun 7,6% da superfície do océano mundial, case o 90% das aportacións totais de pesca e a prática totalidade dos mariscos son capturados nestas zonas.

until 2000. In other words, due to the interaction of the two shipwrecks, 33 years would have to go by before recovery of environmental balance. Thus the *Aegean Sea* oil slick occurs as a destabilising agent on an environment already strained and in process of recovery, so that to the destructive effects of an accident of this type there must be added the aspect of their action on a marine environment already suffering a considerable amount of aggression.

It is not only the marine environment but also the local social environment and the whole of the economy that finds stability undermined, not to mention the difficulty that this entails for an economy like that of Ferrol that had recovered from some of the damages suffered as a result of the crisis in industry by turning to the sea.

2 AN APPROXIMATION OF THE PHYSICAL ASPECT OF THE SPILL

Although it might be thought that an accidental oil spill in a small area of the marine environment is of little importance within the immensity of the sea, it should be pointed out that this is little more than a geographical impression that has nothing to do with biological, ecological and, ultimately, economic reality. A great part of the sea's wealth is located on continental shelves, and much more if we refer to fishing resources. Representing close to 7.6% of the surface area of the world's oceans, almost 90% of the total of fish and practically all shellfish are caught in these zones.

É por isto que calquera alteración nestas zonas terá fortes repercusións nas economias locais, máxime se nelas a actividade pesqueira e marisqueira ten certa importáncia.

Os hidrocarburos, ainda que relativamente pouco solúbeis, poden dar lugar a finas emulsións estábeis que duran vários dias, xa sexa baixo o efeito dunha violenta axitación natural ou pola utilización de deterxentes para a sua degradación. Afloramentos foron observados nas costas de Bretaña meses despois do desastre do *Amoco Cadiz*, tras temporais e non só no inverno[2].

A isto debe-se-lle engadir o tipo de hidrocarburo que foi derramado, neste caso tipo Brent, calificado de bastante lixeiro, cun maior degrau de evaporación e dispersión que permite dar unha apariéncia de menor contaminación por ser menos visíbel, pero é admitido o feito de este tipo de hidrocarburos aromáticos seren os máis tóxicos e con maior poder para producir alteracións fisiolóxicas. Ao arder este petróleo unha grande parte sofriu o proceso de combustión e outro evaporou-se; o que ficou no mar foron os componentes mais pesados (breas, alcatráns,...), que é o que constituirá, en definitiva, a maré negra.

A combustión dunha cantidade de crude tan importante criou unha grande nube de gases tóxicos como o NO_X, SO_2, CO_2, CO, hidrocarburos volátis e cancerígenos que unha vez na atmósfera contribuen ao incremento do

It is for this reason that any alterations in these zones will have serious repercussions in local economies, much more so if fishing and shellfish harvesting activity is important there.

Hydrocarbons, though relatively speaking not every soluble, can lead to fine stable emulsions over periods of several days, either as a result of violent natural turbulence or due to the use of detergents for their degradation. Surfacing was observed on the coasts of Brittany months after the *Amoco Cadiz* incident, after storms and not just in winter[2].

To this should be added the type of hydrocarbon that was spilled, in this case the Brent type, qualified as fairly light, with a high level of evaporation and dispersion that allows it to give the appearance of a lesser degree of pollution, since it is less visible; but it is generally acknowledged that this type of aromatic hydrocarbons are the most toxic of all and have a greater potential for producing physiological alterations. When this oil burned a large part of it underwent the process of combustion and another part evaporated. What was left in the sea were the two heaviest components (pitches, tars…) which is what makes up, in short, the oil slick.

The combustion of such a large amount of crude oil created a great cloud of toxic gases such as NO_X, SO_2, CO_2, CO, volatile and carcinogenic hydrocarbons that once in the atmosphere contribute to the increase

2. Bonnieux, F; Dauce, P. e Rainelli, P., *op. cit.*

2. Bonnieux, F; Dauce, P. and Rainelli, P., *op. cit.*

efeito invernadoiro ou as chúvias acedas, ademais de arrastar cinzas, petróleo ou chapapote. Isto que xa en por si supón unha grave consecuéncia sobre a saúde dos cidadáns, mesmo de zonas alonxadas da costa polo feito de poder ser respirado[3], tamén terá outras consecuéncias importantísimas sobre a economia en xeral ao ser precipitada en forma de chuvias (e non hai que esquencer que o acidente foi en Decembro). Asi, no caso que nos ocupa, os efeitos deixaron-se notar en zonas como a Terra Chá ou Viveiro, a máis de 50 quilómetros do lugar do sinistro, onde se diron fenómenos de chúvias negras, o cual repercutirá sobre as colleitas dos campos afectados reducindo a cantidade e a calidade do producido. Pola mesma razón pode afectar tamén aos acuíferos e, portanto, retornar en parte ao mar baixo a forma de diversas componentes tóxicas. Dias despois do acidente do petroleiro *Braer*, o 5 de Xaneiro de 1993, en Escócia, observou-se[4] como tras analisar os niveis de concentración de hidrocarburos na erba na zona, estes eran da orde de 1-1,5%, o que supoñia fortes concentracións que chegaban a ser 20 veces superiores ao que se observaria normalmente. Altas concentracións daban-se tamén noutras zonas algo mais alonxadas á

of the greenhouse effect and to acid rains, in addition to carrying ashes, oil or tar. This, which in itself supposes serious consequences for citizens' health even in zones far from the coast, due to the fact that it can be breathed[3], will also have very important consequences for economy when it falls in the form of rain (and it should not be forgotten that the accident occurred in December). Thus in the case we are concerned with, effects were felt in zones such as Terra Chá and Viveiro, more than 50 kilometres from the point where the accident took place, where black rains occurred, with damaging effects on the harvests from the fields, reducing the quantity and quality of the production. In the same way hydrocarbon wastes can also affect aquifers and thus return in part to the sea in the form of various toxic components. Days after the accident of the oil tanker *Braer*, on 5 January in 1993, in Scotland, it was observed[4], after analysing the levels of concentration of hydrocarbons in the vegetation in the area, that they were at a level of 1-1.5 %, which signified concentrations up to 20 times the levels normally observed. High levels of concentration were also seen in other zones further away from the site of

3. E o que é indubidábel é que a saúde das persoas que traballan determina en grao sumo a sua capacidade de traballar e, polo tanto, de producir.

4. The Ecological Steering Group on the Oil Spill in Shetland, *An interim report on survey and monitoring*, The Scotish Office-Environment Department, Maio, 1993.

3. And it is undoubtable that the health of working people determines to a great extent their capacity to work, and thus to produce.

4. The Ecological Steering Group on the Oil Spill in Shetland, *An interim report on survey and monitoring*, The Scottish Office- Environment Department, May, 1993.

sinistrada. Segundo se aponta nos informes do caso *Braer,* o tipo de hidrocarburos aromáticos polinucleares que transportaba o petroleiro (o mesmo tipo de hidrocarburo que o transportado polo *Aegean Sea*) constituen, en concentracións elevadas como a observada, un risco potencial para os humanos, animais domésticos e fauna selvaxe. Un mes despois as concentracións eran xa baixas, seguramente por lavado das plantas; isto non resta a posibilidade de asimilación por parte de vexetais e animais e que, finalmente, pola cadeia trófica sexan asimilados, á sua vez, polas persoas. O lavado o que fai é trasladar as componentes dos hidrocarburos aos acuíferos.

Mesmo supoñendo que o petróleo estive-se desprovido de toda toxicidade real, existirian danos importantes debido á sua acción puramente física ao recobrir os resíduos petrolíferos a fauna e flora bentónicas, xa que suprime as suas transferéncias alimentárias ou de oxixenación, co que isto supón para a sua supervivéncia e desenvolvimento. Ademais, pode exacerbar a nocividade de outro tipo de polucións como os pesticidas ou deterxentes que se atoparán, polas suas emulsións, cunha concentración mais elevada e cunha distribuizón mais ampla que se non estiveran en contacto cos hidrocarburos. Non debemos esquencer que nos estamos a referir a unha zona de forte urbanización e onde este tipo de verquidos están necesariamente presentes en cantidades importantes, polo que á nocividade dos axentes do hidrocarburo se lle vai sumar a elevación da nocividade destes outros axentes.

the accident. According to information appearing in reports on the *Braer* case, the type of polynuclear aromatic hydrocarbons that the oil tanker was transporting (the same type of hydrocarbon that was transported by the *Aegean Sea*) constitutes, at high levels of concentrations such as those that have been reported, a potential risk for humans and for domestic and wild animals. A month later the levels were low, undoubtedly because plants had been cleaned; but this does not remove the possibility of assimilation by vegetation and animals and finally, through the trophic chain, absorption by people. What cleaning does is to move the components of the hydrocarbons to the aquifers.

Even supposing that the oil were devoid of real toxicity, significant damage would exist given the purely physical action of petroleum waste covering the bentic flora and fauna, since this would eliminate transferences of nutrients or oxygenation, with all that supposes in terms of survival and development. In addition, it could increase the harmful effects of other types of pollution such as pesticides or detergents, which will be found, due to emulsions, at a higher level of concentration and greater extension than if they had not been in contact with the hydrocarbons. We should not forget that we are referring to an area with a high level of urban development, where these types of pollution are necessarily present in significant amounts, so that the harmful aspects of the agents of the hydrocarbon are combined with the rise in

Por outra banda, e como xa indicamos, a situación do mar permitiu que os axentes contidos no petróleo non quedaran na superfície senón que pasaron a atopar-se emulsionados coa auga do mar, o que eleva a sua toxicidade. Deste xeito os recursos mariños e, máis concretamente, os recursos mariños explotados economicamente ou susceptíveis de se-lo, pasan a unha situación de sério perigo ao entrar en contacto con estes axentes xa que os hidrocarburos poden producir nos peixes alteracións fisiolóxicas, ou mesmo a morte.

As repercusións nas distintas espécies e nos distintos estádios da cadeia trófica non van ser iguais, e mesmo non van ser iguais nunha mesma espécie ou estádio en cada momento do tempo en que permanezan en contacto. As derivacións desta situación conlevan que, desde un princípio, se asista a un proceso de desequilíbrio no ecosistema que non desaparece en pouco tempo senón que se seguirá a agrandar até que os distintos elementos dunha cadeia trófica trasladen as suas próprias modificacións a todos os demais elementos. Isto significa que o proceso de reequilíbrio non se conseguirá até un longo prazo[5], asi como tamén se deixarán notar os efeitos en zonas afastadas da polucionada, cando nesas cadeas tróficas participan espé-

5. En Bonnieux, F; Dauce, P. e Rainelli, P., *op. cit.*, vemos como os tempos de recuperación do equilíbrio cualitativo de povoación é necesariamente o das espécies mais lentas. En Bretaña estimou-se que espécies como o *Cancer Pagurus* (boi) tardarian en recuperar-se 25 anos tras o desastre.

the harmful potential of these other agents.

On the other hand, and as we have indicated, the condition of the sea caused the agents contained in the oil not to remain on the surface, but rather to undergo emulsion with sea water, elevating the level of toxicity. In this way marine resources, and more specifically, marine resources that are exploited economically or could potentially be exploited, are put into a situation of serious danger on entering in contact with these agents, since hydrocarbons can produce physiological alterations and also death in fish.

The repercussions on the different species and on different stages of the trophic chain are not going to be the same, not even in the same species or stage at each moment of time that they are in contact. This situation results, right from the beginning, in a process of imbalance in the ecosystem that will not disappear in a short time but will rather continue to increase until the different elements of a trophic chain extend their own modifications to all the other elements. This means that the process of restoration of the balance will not be completed except in the long term[5] and that effects will also be felt in zones distant from the original area of pollution,

5. In Bonnieux, F; Dauce, P. and Rainelli, P., *op. cit.*, we see how the time for recovery of the qualitative balance of a population is necessarily that of the slowest species. In Brittany it was estimated that species such as the *Cancer Pagurus* (Brown crab) would take 25 years from the time of disaster to recover.

cies migratórias que permanecen nalgunha época nesa zona e se alimentan de espécies que se viron afectadas.

Os organismos filtradores que absorben pequenas cantidades de produtos petrolíferos dun xeito regular ven-se seriamente afectados. Estes acompañarán aos lípidos no seu metabolismo fixando-se en parte nos tecidos de reserva, polo que terán un sabor moi desagradábel. Esta absorción comenza a nivel planctónico, e prosegue na via trófica por via dixestiva e respiratória. Se ben a comprobación directa das polucións petrolíferas sobre as povoacións plantónicas fai-se difícil, e non observando-se en ocasións mortalidades importantes nas mesmas, si se teñen apontado anomalias nas diatomeas e flaxelados un mes despois do acontecimento[6]. A respeito do zooplancton, pode-se dicer[7] que ainda que non desaparece si asimila parte do petróleo que inxeriu, o que o convirte na forma en poténcia máis importante que pode introducir os hidrocarburos na cadeia trófica.

Os ovos e larvas dos peixes asi como as larvas nauplius dos crustáceos son particularmente sensíbeis. Tal e como demostra Nelson Smith ao estudar a zona polucionada polo *Torrey-Canyon*, os ovos de sardiña estaban mortos nunha proporción do 50-90%, estan-

6. Nelson Smith, "Oil pollution and Marine ecology" en *Plenum Press*, Nova Iorque, 1973.

7. Butler, M.J.A.; Berkes, F. e Powles, H., "Biological aspects of oil polution in the marine enviroment" en *Marine Sciences Centre*, Manuscript Report, n.º 22, Mc Gill University, 1974.

when these trophic chains include the participation of migratory species that remain in the affected zone during a particular period and feed on affected species.

The filter organisms that absorb small amounts of oil products on a regular basis will be seriously affected. These products will join with the lipids in the metabolism, attaching themselves in part to the reserve tissues, which will make for a very unpleasant taste. This absorption begins at the level of plankton and follows along the trophic route through the digestive and respiratory tracts. Though direct confirmation of oil pollution in plankton populations is difficult and on some occasions significant levels of mortality have not been observed in them, anomalies were found in diatoms and flagella one month after the event[6]. With respect to zooplankton, it can be said[7] that though it does not disappear it does assimilate part of the oil it ingests, which makes it potentially the most important route by which hydrocarbons may be introduced into the trophic chain.

Fish eggs and larvae, along with the nauplius larvae of crustaceans are particularly sensitive. As Nelson Smith showed in his study of the area polluted by the *Torrey-Canyon*, sardine eggs died

6. Nelson Smith, "Oil pollution and Marine ecology" in *Plenum Press*, New York, 1973.

7. Butler, M.J.A.; Berkes, F. and Powles, H. "Biological aspects of oil pollution in the marine environment" in *Marine Sciences Centre*, Manuscript Report, nº 22, Mc Gill University, 1974.

do ausentes ou sendo escasas as larvas nas mostras de plancton[8]. Asi, aquelas espécies nas que habia neses momentos unha povoación importante nesta fase, deixarán notar os seus efeitos por longo tempo. Isto agravaria-se no caso de continuar a captura de adultos, ao non recompoñer-se a povoación total do xeito que é habitual, co que isto supón, ao cair o número de adultos no futuro, na capacidade de reprodución da espécie. Malia non semellar haber afectación no curto prazo, no medio prazo poderia-se chegar a notar unha caída das capturas.

Pero a auséncia de ovos e larvas dunha espécie non repercute unicamente sobre ela senón tamén sobre toda a cadeia trófica na que está inmersa. Pode levar a deixar sen alimento a outras espécies ou manifestar-se o desequilíbrio reducindo o número de predadores doutra. En calquera caso, presentara-se unha situación anómala que provoca perda na bio-diversidade e, en termos económicos, perda de espécies comercializábeis, o desequilíbrio ecolóxico será un desequilibrio económico, máis cando as espécies desaparecidas ou diminuídas son obxecto de captura por persoas especializadas nisto. Os custos produtivos que conlevaria a modificación da orientación dos produtores, á marxe da importáncia da sua cuantia, sosteñen-se sobre a inseguridade dun meio que, por desequilibrado, está en contínuo cámbio.

8. Nelson Smith, *op. cit.*

on a scale of 50-90%, with few or no larvae in plankton samples[8]. Thus those species in which there was a sizable population in this phase at the time of the accident will feel its effects for a long time. This circumstance will be worsened if the capture of adults is continued, since the overall population will not be restored in the usual fashion, with all that this supposes - with a fall in the number of adults in the future - for the reproductive capacity of the species. Although short term effects do not appear, at medium term a descent in the amount of the catch may be observed.

But the absence of eggs and larvae of a given species does not only have an impact on the species itself but also on the entire trophic chain of which it forms a part. It can lead to other species being left without food supply, or the imbalance may manifest itself in the reduction of the number of predators of another. In any case, an anomalous situation will appear, occasioning a loss of biodiversity and, in economic terms, loss of marketable species. The ecological imbalance will turn into an economic imbalance, more so when the species that have disappeared or diminished are the object of fishing or harvesting by persons specialising in these activities. The productive costs involved in the reorientation of the producers, aside from the significance of the amounts, have their roots in the insecurity of an environment that, given its imbalance, is in a state of constant change.

8. Nelson Smith, *op. cit.*

Outro efeito importante dos hidrocarburos atinxe á interferéncia nos mecanismos químicos de regulamento dos ecosistemas, alterando un regulamento natural. O comportamento de moitas espécies ve-se afectado ao bloquear-se os órgaos quimiorreceptores ou inducindo falsas respostas por imitación de estímulos naturais. Asi, está demostrado que perturban o quimiotactismo, en particular dos crustáceos. Este tipo de interferéncias son un perigo real para a supervivéncia das espécies mais sensíbeis ou as afectadas pola desaparición do seu alimento habitual. O comportamento sexual e, polo tanto, a fecundidade poden alterar-se; case sempre a supervivéncia dos espermatozoides na auga é moi curta e a fecundación debe ter-se efectuado pouco despois da expulsión dos gámetos; se hai alteracións ou retardo neste proceso a reprodución pode resultar un completo fracaso. O comportamento das espécies afectadas por estas interferéncias torna totalmente incoerente, tal e como sinalan en 1974 Butler et al.[9] ao referir-se a un verquido acidental de hidrocarburos, onde se observou como animais que sobrevivian manifestaban un comportamento anormal, de xeito que peixes de fondo estaban na superfície, bacallaos e anguias eran capturados coa man ou cangrexos que non escapaban ao aproximar-se a eles senón que permanecian no sítio, á vez que amosaban a cor do momento da reprodución cando ainda esta non ía ter lugar. Isto permi-

Another important effect of the hydrocarbons concerns the interference in chemical regulatory mechanisms of the ecosystems, altering natural regulation. The behaviour of many species is affected when chemoreceptor organs are blocked or false responses induced due to imitation of natural stimuli. Thus it has been demonstrated that they perturb chemotactism, particularly in crustaceans. This type of interferences are a real danger for the survival of more sensitive species or those that are affected by the disappearance of their usual food supply. Sexual behaviour and thus fertility can be altered; survival time for spermatozoa in water is very short and fertilisation must take place shortly after the expulsion of the gametes; if there are alterations or delay in this process reproduction can turn out to be a total failure. The behaviour of species affected by these interferences becomes totally erratic, as was pointed out in 1974 by Butler et al.[9] referring to an accidental oil spill, where it was observed how surviving animals displayed abnormal behaviour, so that deep water fish came to the surface, cod and eels were caught by hand and crabs did not attempt to escape when approached but remained where they were, while at the same time displaying the colour corresponding to the moment of reproduction when this was not going to take place. This permits us to explain the considerable increase over expected figures in

9. Butler, M.J.A.; Berkes, F. e Powles, H., *op. cit.*

9. Butler, M.J.A.; Berkes, F. and Powles, H., *op. cit.*

te-nos explicar o aumento consideravelmente por riba do previsível das capturas dalgunha espécie; o aumento das capturas non implica un aumento da povoación, trata-se dunha povoación enfeblecida, onde a sobrecaptura non é máis que a evidéncia dos efeitos da catástrofe. Este aumento é só temporal e contribui a aumentar o desequilíbrio do ecosistema ao incidir en maior medida sobre os adultos non mortos pero si afectados; asi, contribui-se a deprimir a posteriori o número de indivíduos e, portanto, as capturas. O aparente benefício económico que se dé nos primeiros momentos nesas espécies, é iso, só apariéncia, que finalmente se vai saldar cunha perda económica inevitábel.

Pero os alteráxenos non afectarán só o comportamento das espécies sedentárias, tamén os peixes migradores sofrirán as consecuéncias da preséncia dos hidrocarburos. Pode ver-se retardada a velocidade de migración, con todo o que iso implica na pesca e supervivéncia da espécie, xa que se o migrante se desvia do seu lugar habitual de freza, por mor dun axente polucionante, a povoación pode verse afectada dun xeito esaxerado.

No que se refire aos bivalvos en contacto con estes axentes contaminantes, dicer que teñen un poder de aillamento que lles permite protexer-se durante alguns dias. Mais a actividade valvar destes moluscos atopa-se reducida en preséncia de hidrocarburos e bloquea-se a produción de glucóxeno. Como ademais estamos, normalmente, diante de filtradores, atopamo-nos con que inxiren partículas en sus-

the catch of some species; the increase in catch does not imply an increase in population, but rather that this is a weakened population in which the excess catch is no more than evidence of the effects of the catastrophe. This increase is only temporary and contributes to the increase in the imbalance of the ecosystem since it strikes adults that have not died but have been affected; thus it contributes to diminishing, *a posteriori*, the number of individuals and thus the amount of catch. The apparent economic benefit that arises in the earliest moments in those species is just that, only apparent, since it will ultimately result in unavoidable economic loss.

But those agents causing alterations will not only affect the behaviour of sedentary species; migratory fish will also suffer the consequences of the hydrocarbons. The speed of migration may be reduced, with all that implies to fishing and to the survival of the species, since if the migrant strays from its usual spawning ground due to a polluting agent, the population may find itself affected to an extreme degree.

With regard to bivalves in contact with pollutants, these have a capacity for isolation that permits them to protect themselves for a few days. But the valve activity of these molluscs is reduced in the presence of hydrocarbons, blocking the production of glycogen. Since in addition we are dealing with filter organisms, we find that they ingest particles in suspension in the water, which, given the presence of polluting agents, will cause rapid alterations in them.

pensión na auga, o que, de existir axentes polucionantes, lles provoca rápidas alteracións.

Ademais do sinalado está a alteración do sabor que o fai non comerciábel, como temos observado co acontecido na zona galega afectada pola maré negra do *Aegean Sea*, e que evidénciaba claramente esta alteración do sabor e despedia un cheiro característico ao ser cociñado. Mesmo un intento de descontaminación por inmersión nunha zona sana durante dous meses non logrará eliminar totalmente os hidrocarburos inicialmente asimilados.

Ainda que se levou a cabo a limpeza da area superficial das praias e a das rochas da ria con auga a presión para desprender o crude incrustado e logo recolle-lo, o petróleo permanecerá disolto nas augas ou nos fondos. Este petróleo é capaz de filtrar-se através das areas e descender a máis de 30 cm, como xa se observou noutros acidentes, polo que nalgun tempo poderia volver a sair á superfície e afectar, de novo, aos bancos marisqueiros. En Alaska, e anos despois do acidente do *Exxon Valdez*, observou-se que algunhas espécies estaban ainda a sofrer as suas consecuéncias; nesta experiéncia constataron-se filtracións de petróleo na area a 1,5 metros de profundidade.

In addition to the above is the change in flavour, which makes the product non-marketable, as we have observed in what happened in the area of Galicia affected by the *Aegean Sea* oil slick, where the product evidenced this change of flavour and gave off a smell of having been cooked. Not even an attempt at decontamination by immersion in a healthy zone during two months succeeded in totally eliminating the initially assimilated hydrocarbons.

Although cleaning is done on the surface area of the beaches and rocks of the ria using water under high pressure to detach the embedded crude oil and then collecting it, the oil will remain dissolved in the water or on the sea floor. This oil is capable of filtering through these areas, going down to a depth of more than 30 cm., as has been observed in other accidents, so that it can at some time return to the surface and again affect the shellfish banks. In Alaska, years after the *Exxon Valdez* accident, certain species were observed to be still suffering the consequences; in this experience oil filtrations were verified in the area down to a depth of 1.5 metres.

3 RESULTADOS DO INFORME DENOMINADO *AVALIACIÓN DOS DANOS PROVOCADOS POLA MARÉ NEGRA DO AEGEAN SEA. INFORME 1997**

O estudo realizado comprende a avaliación das perdas sufridas pola pesca da zona afectada. Se definimos pesca galega como o sector de actividade económica que integra todos e cada un dos procesos produtivos conducentes á criación do produto pescado-marisco-conserva, neste caso a pesca afectada comprende os subsectores de baixura/litoral, marisqueo e miticultura.

A pesca de baixura/litoral inclue o conxunto de unidades de produción que faenan dentro dos límites das rías e no litoral acantilado, captura espécies próprias das rías para venda só en fresco, ao dia. Produce pescado de alta calidade para o mercado local, o interior galego e o mercado español.

Marisqueo é o subsector da pesca que obten un produto diferenciado con técnica singular e con especificidade nos seus procesos produtivos.

Miticultura é a acuicultura própria da Galiza, representando esta actividade a primeira europeia en cantidade e valor. O mexillón é un produto próprio da pesca galega, é diferenciado, ten procesos de produción específicos e un mercado integrado no mundial da pesca.

A zona afectada é aquela zona ou comarca costeira compreendida entre Sisargas e Ponta Langosteira máis a denominada ZONA VIII

3 RESULTS OF THE REPORT TITLED *VALUATION OF THE DAMAGES CAUSED BY THE AEGEAN SEA OIL SLICK. REPORT 1997**

The study done covers evaluation of losses sustained by fishing in the affected zone. If we define Galician fishing as the sector of economic activity that includes each and every one of the productive processes that lead to the cultivation of the fish-shellfish-preserve product, in this case the fishing affected covers subsectors of inshore/coastal activity, shellfish harvesting and mussel culture.

Inshore/coastal fishing includes the totality of production units that fish within the bounds of the rias and on the rocky coast, and that harvest species that live in the rias only for sale fresh, on the same day. It produces high quality fish for the local market, the interior of Galicia and the Spanish market.

Shellfish harvesting is a subsector that obtains a specific product with a particular technique and specific productive processes.

Mussel culture is the aquaculture that is characteristic of Galicia, first in Europe in this activity in terms quantity and total value. The mussel is a typical product of Galicia, is differentiated, has specific production processes and a market that is integrated in the world fishing market.

The zone affected is the coastal zone or region between Sisargas and Ponta Langosteira, also called ZONA VIII of goose barnacle harvesting (to

de extracción percebeira (até Ponta do Cadro) tal e como quedou delimitada nos decretos de paralización de capturas no seu día.

A marca temporal, entraña unha dificuldade considerábel xa que precisa concretar através dos dados estatísticos dispoñíbeis nun tempo tan próximo ao próprio desastre, a cuantia dos efeitos económicos. Agás os custos asociados á própria limpeza, non se pode recoñecer, por imposición do ciclo biolóxico, o estado do recurso denantes de se comprir o período dese ciclo. O ciclo biolóxico no caso mais curto é dun ano e noutros requeriria-se un período polo menos igual ao ciclo meio das espécies submetidas a deterioro e/ou desaparición. Neste informe elaborou-se unha proposta para cinco anos.

Dado que non existe un estudo continuado sobre as povoacións mariñas da zona que constituen o recurso económico non é viábel a utilización dun método directo de análise do dano sofrido por esas povoacións. Só no caso do marisqueo de moluscos de praias se dispuxo de mostreos sobre as povoacións no momento do desastre; isto permitiu aplicar un método de cálculo diferente do empregado no caso da pesca, baseado no estudo das povoacións e perspectivas de recuperación das mesmas.

No caso da pesca foron utilizados dados referidos aos desembarcos de peixes, crustáceos e moluscos, que si poden ser comparados con estatísticas prévias.

As comparacións dos desembarcos permitiron aproximar-se –en igualdade de circunsdo Cadro) as demarcated in the decrees for stoppage of harvesting when these were issued.

The time framework presents considerable difficulty since it makes it necessary to establish, using statistical data available at a time so close to the disaster itself, the amount of economic effects. Aside from the costs associated with the cleaning itself, it is not possible to examine, by imposition of the biological cycle, the status of the resource without compressing the period of this cycle. The biological cycle in its shortest instance, is one year, and in other cases it would require a period at least equal to the average cycle of the species submitted to deterioration and/or disappearance. In this report a proposal was prepared for a five year period.

Given that there does not exist a continued study on the marine populations of the area that constitute the economic resource, the use of a direct method of analysis of the damage suffered by those populations is not viable. Only in the case of the harvesting of molluscs on beaches were samplings available on populations at the moment of the disaster. This made it possible to apply a method of calculation different from that employed in the case of fishing, based on the study of the populations and prospects for their recovery

In the case of fishing, data was used that referred to the landing of fish, crustaceans and molluscs that could be compared with prior statistics.

Comparisons of the landings made it possible to provide an approach – in

táncias económico-biolóxicas– ás modificacións que nas povoacións suxeitas á pesca son debidas á maré negra. Este mesmo ponto de partida foi utilizado en traballos anteriores, tanto para aproximar-se ao coñecimento de tamaño povoacional como para avaliar impactos externos.

As fontes utilizadas foron:

- Desembarcos da frota de portos pesqueiros afectados subministrados polas próprias confrarias. Válidos, polo tanto, para todos os portos excepto A Coruña. Traballamos unha série de 5 anos 1988-1992.
- Desembarcos-vendas na lonxa do porto da Coruña reconstruída através dun modelo que contempla a corrección cun coeficiente de aplicación ás estatísticas iniciais. Este coeficiente foi xerado através da aplicación dun cuestionário DELPHI entre expertos.
- Valoración das perdas económicas ocasionadas nos bancos de moluscos na zona afectada, a partires dos mostreos realizados pola Conselleria de Pesca, Marisqueo e Acuicultura: Decembro 1992 e Febreiro 1993.
- Valoración das perdas a meio prazo nas bateas mexilloeiras na Ria de Sada-Lorbé, através da reconstrución teórica da produción nun suposto de condicións normais de funcionamento.

Desde o ponto de vista teórico estatístico mui poucas das fontes dispoñíbeis gozan dos requisitos que academicamente se sinalan para

equality of economic-biological circumstances – to the modifications that in populations subject to fishing are due to the oil slick. This same starting point was used in prior studies, both as an approach to an estimate of the size of the population and to evaluate external impacts.

Sources used were:

- Landings of the fleet of affected fishing ports, supplied by the fishermen's associations. Valid, thus, for all ports except A Coruña. We worked with a series of 5 years, 1988-1992.
- Landings-sales in the market of the port of A Coruña reconstructed through a model that considers correction with a coefficient applied to initial statistics. This coefficient was arrived at through the use of a DELPHI questionnaire among experts.
- Valuation of the economic losses occurring in mollusc banks in the affected zone, based on samplings done by the Department of Fishing, Shellfish Harvesting and Aquaculture: December, 1992, and February, 1993.
- Valuation of the losses at medium term in the mussel *bateas* of the Ria of Sada-Lorbé, through the theoretical reconstruction of production with a model of normal operational conditions.

From a theoretical-statistical point of view very few of the sources available possess requisites academically approved of for a census or survey. The enormous difficulty involved in the

un censo ou enquisa. É recoñecida internacionalmente a grande dificuldade que acompaña a recollida de dados censais no sector primário no seu conxunto e, por suposto, organismos internacionais, a FAO por exemplo, contentan-se, no caso das estatísticas pesqueiras, con que exista homoxeneidade de contidos en magnitudes, denominacións e períodos.

No noso caso, tomamos como referéncia próxima (de obrigada aplicación pola Administración española) o regulamento CEE 1382/9 modificado polo 2104/93 e que contempla para Itália exención parcial do seu comprimento por unha decisión da Comisión. Este regulamento relativo á transmisión de dados sobre os desembarcos de produtos da pesca nos Estados Comunitários considera que a xestión do mercado de produtos da pesca melloraria coa existéncia de estatísticas comunitárias harmonizadas. Isto implica recoñecer, por pasiva, que á altura de Maio de 1991 tales fontes non existian.

O confronto das fontes utilizadas con este mandato comunitário situa moi por riba en detalle e fiabilidade ás manexadas, polo que declinamos calquera outra consideración teórica sempre razonábel pero carente de senso no informe presente.

Levou-se a cabo asimesmo (1998) unha revisión dos estudos biolóxicos realizados, e concretamente dos que corresponden ao Instituto Español de Oceanografía (1994) –"Seguimiento de la contaminación producida por el accidente del buque *Aegean Sea*"–, e Mora (1995) -"Seguimiento de la macro y

collection of census data in a primary sector in its totality is internationally recognised, and of course, international organisms, the FAO for example, accept, in the case of fishing statistics that there exists a homogeneousness of contents in amounts, designations and periods.

In our case, we take as close reference (of obligatory application for the Spanish administration) the regulation EEC 1382/9 modified by regulation 2104/93, which provides for a partial exemption of compliance for Italy by virtue of a decision of the Commission. This regulation relating to the transmission of date on landing of fishing products in countries of the EU considers that market operations for fishery products would improve with the existence of harmonised EU statistics. This implies a recognition, in a passive form, that in May of 1991, such sources did not exist.

A comparison of the sources used here with data from the EU regulation put our sources far above the latter in terms of detail and reliability; hence other theoretical considerations, however reasonable they might be, will not be considered in the present report.

A review was also done (1998) on biological studies, specifically those of the Spanish Institute of Oceanography (1994) - "Follow-up on the pollution occurring due to the accident of the ship *Aegean Sea*" - and Mora (1995) - "Follow-up on the inter-sea and under-sea macro and media-fauna of the rias affected by the accident of the oil tanker *Aegean Sea*". The most recent period of the study is the year 1994, and no subsequent analyses were done

meiofauna intermareal y submareal de las rías afectadas por el siniestro del petrolero *Aegean Sea*". O período máis recente de estudo é o ano 94, e non foron realizadas análises posteriores que permitan observar a evolución das condicións da zona, mesmo cando aqueles estudos consideraban necesário un seguimento periódico continuado. É por iso que a deixación das administracións responsábeis imposibilitou a utilización dun soporte técnico indispensábel de idénticas características ao do primeiro período.

Realizou-se tamén unha análise da variación do esforzo pesqueiro que se aplica na zona afectada. A pesca extractiva é un sector económico no que a cantidade de output obtido –os desembarcos– ten unha relación directa e proporcional co número e capacidade das unidades produtivas –os barcos que faenan–. Cando se elaborou o modelo de avaliación dos danos, estabeleceu-se o suposto de que a frota non ia variar a curto prazo para adecuar-se á nova situación despois do sinistro; considerou-se necesário porén, atender ás posíbeis modificacións a médio e longo prazo, tendo en conta que estas podian ter a sua orixe nun amplo abano de factores, entre os que se atopaba, naturalmente, o próprio sinistro. Transcorridos 5 anos desde o derramamento de cru, pudemos observar a validez daquel suposto inicial, xa que o número e capacidade de embarcacións da zona afectada apenas tiñan variado.

Para estudar esta posíbel variación do esforzo pesqueiro, realizou-se unha comparación do esforzo pesqueiro que se aplica na zona afectada. A pesca extractiva é un sector económico no que a cantidade de output obtido –os desembarcos– ten unha relación directa e proporcional co número e capacidade das unidades produtivas –os barcos que faenan–. Cando se elaborou o modelo de avaliación dos danos, estabeleceu-se o suposto de que a frota non ia variar a curto prazo para adecuar-se á nova situación despois do sinistro; considerou-se necesário porén, atender ás posíbeis modificacións a médio e longo prazo, tendo en conta que estas podian ter a sua orixe nun amplo abano de factores, entre os que se atopaba, naturalmente, o próprio sinistro. Transcorridos 5 anos desde o derramamento de cru, pudemos observar a validez daquel suposto inicial, xa que o número e capacidade de embarcacións da zona afectada apenas tiñan variado.

Para estudar esta posíbel variación do esforzo pesqueiro, realizou-se unha comparación

that would allow us to observe the evolution of conditions in the area, although those studies considered a continued, periodical follow-up necessary. It is for this reason that the slackness of the administrations responsible rendered impossible the use of the indispensable technical support of characteristics identical to those of the same period.

An analysis was also done of the variation in fishing efforts in the affected area. Extractive fishing is an economic sector in which the quantity of output obtained – landings – has a direct, proportionate relation with the number and capacity of the productive units – the fishing boats. When the model for valuation of damages was prepared, the supposition was established that the fleet was not going to vary in the short term to adapt to the new situation following the accident; so it was considered necessary to deal with possible modifications in the medium and long term, taking into account that they could be originated by a vast range of factors, including, naturally, the accident itself. 5 years after the spill of the crude oil we could observe the validity of the original supposition, since the number and capacity of vessels in the affected area had changed very little.

In order to study possible variations in the fishing effort, a comparison was done between the census of the fleet before the accident and the most recent count, from the year 1997, considering the number of vessels, their capacity (GRT) and power, as well as the most significant equipment used for our data on landings.

ción entre o censo da frota anterior ao sinistro, e o máis recente, do ano 97, atendendo ao número de barcos, capacidade dos mesmos (TRB) e poténcia, dentro das artes máis significativas para os nosos dados de desembarcos.

Constatou-se, dese xeito, a imposibilidade de lle atribuir o descenso nos desembarcos a unha redución do esforzo pesqueiro aplicado na zona afectada.

Por último, a avaliación dos danos ocasionados á produzón mexilloeira, que se realizou mediante a elaboración dun modelo teórico, necesita ser revisada neste informe cos dados de vendas realizadas polas empresas produtoras. Non obstante, ante a negativa destas empresas a facilitar dita información, optamos por utilizar as vendas teóricas proporcionadas polo modelo, e desconta-las do valor total das perdas.

Utilizamos unha división convencional por portos de desembarco e coas estatísticas oficiais construímos os cadros que apresentamos. Neles figuran somentes peixes, crustáceos e moluscos capturados a frote e coa frota de baixura própria destes portos. Adicamos capítulo aparte aos moluscos sedentários de ceifa nos bancos marisqueiros da zona por considerar que o degrau de afectación require un tratamento distinto. A caída-modificación é a que se reflicte directamente nelas, non embargantes, dado que debe ser aillado o efeito daquelas variacións temporais próprias da pesca, considera-se modificación atribuíbel ao desastre aquela que se manifesta como desviación do comportamento esperábel segundo os 6 últimos anos (média do volume de capturas).

In this way it was established that it was not possible to attribute the fall in landings to a reduction of the fishing effort in the affected zone.

Finally, the valuation of the damages caused to mussel production, which was done by preparing a theoretical model, needs to be revised in this report with data on sales from the producer companies. However, with the refusal of these companies to provide such information, we chose to use the theoretical sales figures provided by the model and discount them from the total amount of the losses.

We used a conventional division in terms of ports of landing and with official statistics we constructed the tables that we present here. Figuring in them are only fish, crustaceans and molluscs caught by the inshore fleets belonging to these ports. We devote a separate chapter to sedentary, culture molluscs in the shellfish banks of the zone, considering that the importance of effects on them require a different treatment. The fall-modification that is reflected directly in them, however, given that the effect of seasonal variations typical of fishing must be isolated, is considered a modification attributable to the disaster when it appears as a deviation from expectable behaviour over the last 6 years (average volume of catch).

We divided the ports affected into two sub-groups, with that of A Coruña being representative of the majority of catches in the zone, and we included in the second sub-group the rest of the ports, for which we use

Dividimos en dous subgrupos os portos afectados por ser o da Coruña representativo da maioria das capturas que comprende a zona e incluímos no segundo subgrupo os restantes portos dos que utilizamos as estatísticas correspondentes aos desembarcos de pescado de baixura e negociados nas seguintes lonxas de contratación:

Malpica, Caión, Miño-Pontedeume, Ares e Sada.

O listado de prezos utilizado foi elaborado a partir dos prezos médios mensuais do período Novembro 91 a Novembro 92 xa que se considerou que ese período era o máis próximo isento das perturbacións que no mercado se poderian producir con posterioridade á maré negra.

A determinación do prezo médio anual a partir dos mensuais elimina os posíbeis efeitos da estacionalidade que se deixa sentir no mercado de alimentos perecedoiros[10].

O cálculo final apresentado é resultado dunha actualización financeira desde 1992 a 1997.

Deste xeito observamos que o descenso nos portos obxecto da nosa avaliación é moito máis acusado do que noutras zonas de Galiza, efeito que nós lle atribuímos ao derramamen-

statistics corresponding to the landing of inshore fishing products, sold in the following trading markets:

Malpica, Caión, Miño-Pontedeume, Ares and Sada.

The price list used was prepared on the basis of average monthly prices for the period November, '9, to December. '92, since it was considered that this period was the closes one exempt from the disturbances that would occur in the market subsequent to the oil slick.

Determination of the average annual price on the basis of monthly prices eliminates possible seasonal effects that can be brought to bear on the market of perishable food products[10].

The final calculation presented is the result of a financial updating from 1992 to 1997.

In this way we observe that the fall in the ports we have evaluated is much more pronounced than in other parts of Galicia, an effect that we attribute to the oil spill. Though it would be possible to accept that the reduction in landings shown in this model is due to the accident, it is not totally to be ascribed to it. Thus a percentage similar to that of the port of Portosin will be discounted,

10. En 1997 revisaron-se as cuestións que a continuación se citan por se poideran constituir reservas verbo do uso da mesma metodoloxia para a cuantificación: as análises de estado do recurso nun exame biolóxico, o esforzo pesqueiro, asi como a existéncia de vendas de mexillón producido nas bateas da zona. Co fin de contrastar os resultados da nosa avaliación con outros métodos alternativos utilizados en situacións semellan-

10. In 1997 the questions cited here were revised to see if they might suggest reservations with regard to the use of the methodology for quantification: analysis of the status of the resource in a biological examination, the fishing effort, as well as the existence of sales of mussels produced in the *bateas* in the zone. In order to compare the results of our valuation with other alternative methods used in sim-

to de petróleo. Non obstante, seria posíbel aceptar que a redución de desembarcos recollida no noso modelo, e totalmente atribuída

attributing this fall to another series of factors. We provide these clarifications for the consideration of those

tes, pudemos consultar o informe –ainda non publicado– do eco-biólogo Dr. Joan Domènec Ros, no que se realiza unha cuantificación do impacto producido através da perda de funcionalidade dos aspectos máis relevantes para o autor, e do que reproducimos a seguinte táboa resumo:

ilar situations, we were able to consult the report – as yet unpublished – of the eco-biologist Dr. Joan Domènec Ros, in which he quantifies the impact produced through the loss of functionality of what are the most relevant aspects for the author, which we reproduce here in the following summary-table.

Funcionalidade dos distintos compartimentos, conceitos ou funcións ao ano do verquido do *Aegean Sea*
Functionality of the different compartments, concepts and functions in the year of the *Aegean Sea* spill

Compartimento, conceito ou función Department, concept or function	Funcionalidade ao ano do verquido (%) Funcionality as of year of the spill (%)
Bateas / *Bateas*	20,3
Valor comercial / Commercial value	25
Sedimentos submareais / Undersea sediments	25
Capacidade de rexeneración de nutrintes / Capacity for regeneration of nutrients	26,3
Parques marisqueiros / Shellfish harvesting banks	27,9
Capacidade de depuración natural / Capacity for natural purification	42
Biodiversidade / Biodiversity	43,4
Reclutamento / Recruitment	45,5
Caladoiros de pesca / Fishing ground	48,8
Produción de matéria orgánica / Production of organic material	51,5
Sedimentos intermareais / Intersea sediments	61,4
Praias / Beaches	75,8
Aguas / Waters	76,4
Paisaxe / Landscape	79,5
Rocas / Rocks	79,8
Dinámica hidrográfica e sedimentária / Hydrographic and sedimentary dynamics	96,1

Consideramos que os resultados obtidos deste xeito, ainda que proveñen dunha avaliación biolóxica do sinistro, asemellan-se en boa medida á avaliación económica que nós realizamos, o que nos permite afianzar a validez do modelo empregado no informe.

Ros, Joan Domènec, "Dictamen sobre los efectos del accidente del *Aegean Sea* sobre las comunidades ecológicas litorales de la zona" en Garcia Negro, Mª do Carme (dir.), *Dictame sobre os efeitos do acidente do Aegean Sea. Avaliación económica e ecolóxica*, 1995, Universidade de Santiago de Compostela, pp. 7-83.

We consider that the results obtained in this way, though they come from a biological valuation of the accident, are similar to a great extent to the economic valuation we have done, which permits us to confirm the validity of the model used in the report.

Ros, Joan Domènec, "Dictamen sobre los efectos del accidente del *Aegean Sea* sobre las comunidades ecológicas litorales de la zona" in García Negro, Mª do Carme (dir.), *Dictame sobre os efeitos do acidente do Aegean Sea. Avaliación económica e ecolóxica*, 1995, University of Santiago de Compostela, pp. 7-83.

ao sinistro, se lle descontara unha percentaxe semellante á que presenta o porto de Portosín, atribuindo-lle este descenso a outra série de factores. Deixamos, polo tanto, estas aclaracións á consideración por parte de quen consulte os resultados da nosa avaliación.

3.1 Porto da Coruña

Presentamos en primeiro lugar unha táboa –resume dun grupo de espécies representativas dos desembarcos no porto da Coruña e que son:

- Sardiña, Xurelo, Pescadiña Terciada, Lírio, Parrocha, Rape, Castañeta, Cóngrio, Meiga, Dorada, Robaliza e Ollomol no subgrupo de pescados.
- Polbo e pota no subgrupo de moluscos.
- Nécora, Centola, Percebe, Cigala, Camarón, Boi, Lubrigante, Gambas, Santiaguiño, Langosta e Cangrexos no subgrupo dos crustáceos.

Este grupo de espécies reúnen en comun:

- O conxunto de todas elas representa o 80% do volume de capturas negociadas nesa lonxa atribuíbeis á pesca de baixura e/ou procedentes de baixura da zona afectada.
- O conxunto delas representa o 80% do valor dos desembarcos de baixura con orixe A Coruña e/ou orixe na zona afectada.

Ainda incluindo espécies non claramente de baixura, as presentes son obxecto de capwho consult the data presented in our valuation.

3.1 Port of A Coruña

To begin with we present a table summarising a group of species representative of landings in the port of A Coruña:

- Pilchard, Mackerel, Whiting, Hake, Blue Whiting, Sardine, Angler, Pomfret, Conger, Gaper, Gilthead Sea bream, Sea Bass, Read Sea Bream in the fish subgroup.
- Octopus and flying squid in the mollusc subgroup.
- Velvet crab, spider crab, Barnacle, Norway lobster, Shrimps, Ox crab, European lobster, Prawns, Santiaguiño, Lobster, Crabs in the crustacean subgroup.

This group of species have in common:

- Altogether they represent 80% of the volume of catch handled in that market attributable to inshore fishing and/or coming from the estuary of the affected zone.
- Altogether they represent 80% of the value of landings of inshore fishing with origin in A Coruña and/or the affected zone.

Even including species that are not clearly inshore, those present are object of catch only by the inshore fleet of the affected ports.

All of them form part of an average seasonal series of the usual catch in the zone. In other words, they are neither

tura somentes pola frota de baixura dos portos afectados.

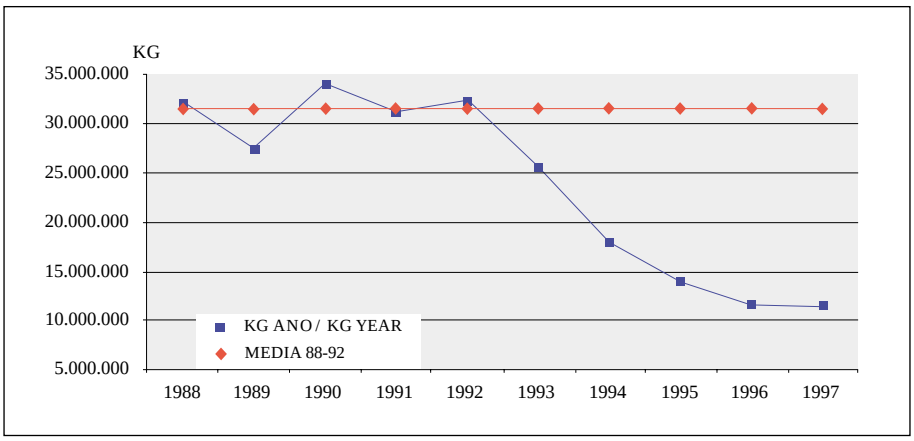
Todas elas forman parte dunha série temporal média das capturas habituais da zona; é dicer, non son recentes nen novidosas nos desembarcos e nas lonxas deses portos.

Calquer modificación no comportamento do desembarco das espécies dese grupo ten notábel e segura repercusión sobre os ingresos dos pescadores-mariscadores da zona afectada. Alén dos efeitos biolóxicos no ecosistema, que non se reflicten no cálculo, é coñecido e valorábel o económico das espécies dese grupo.

recent nor novel in the landings and in the markets of these ports..

Any modification in the character of the landing of the species of that group has significant and certain repercussions on the income of the fishermen-shellfish harvesters of the affected zone. Over and above the biological effects on the ecosystem, which are not reflected in the calculations, the economic significance of the species of this group is known and can be evaluated.

Figura / Figure 1
Pesca de baixura: A Coruña 1988-1997
Inshore fishing: A Coruña 1988 - 1997



Fonte: Elaboración própria a partir de Garcia Negro, Mª do Carme (dir.) (1998): *Avaliación dos danos provocados pola maré negra do Aegean Sea. Informe 1997,* Equipo de Investigación de Economia Pesqueira e Recursos Naturais, Universidade de Santiago de Compostela.

Source: Own elaboration based on García Negro, Mª do Carme (dir.) (1998): *Valuation of the damages caused by the Aegean Sea oil slick. Report 1997*. Research Team on Fishery Economics and Natural Resources of the University of Santiago de Compostela.

Pesca de baixura: A Coruña 1988 - 1997

Inshore fishing: A Coruña 1988 - 1997

ANO / YEAR	VALOR / VALUE	KG	P. UNIT.
1988	5.595.896.103	32.099.678	174,33
1989	6.746.297.466	27.527.790	245,07
1990	8.148.684.020	34.037.493	239,40
1991	8.202.547.496	31.117.703	263,60
1992	8.943.291.053	32.235.838	277,43
1993	6.721.240.754	25.564.897	262,91
1994	4.950.841.562	18.004.773	274,97
1995	4.009.243.710	13.942.072	287,56
1996	3.790.449.910	11.556.408	328,00
1997	4.801.530.437	11.419.303	420,5
MÉDIA Kg 88-92 / AVERAGE Kg 88-92		31.403.700	

Fonte: Garcia Negro, Mª do Carme (dir.) (1998): *Avaliación dos danos provocados pola maré negra do Aegean Sea. Informe 1997*, Equipo de Investigación de Economia Pesqueira e Recursos Naturais, Universidade de Santiago de Compostela.

Source: García Negro, Mª do Carme (dir.) (1998): *Valuation of the damages caused by the Aegean Sea oil slick. Report 1997*. Research Team on Fishery Economics and Natural Resources of the University of Santiago de Compostela.

3.2 Restantes portos

Os mariscadores e pescadores afectados pertencen ás confrarias de: Malpica, Caión, Mugardos, Barallobre, Miño, Mera, Ares, Pontedeume, Sada e Ferrol. Os portos comprendidos nesta zona afectada que dispoñen de lonxa de contratación son: Malpica, Caión, Sada, Miño-Pontedeume, Ares, Ferrol.

A análise efectuada mide a traxectória dos desembarcos recollidos en lonxa, a evolución do recurso considerado como un todo. Isto permite obviar a precisión de considerar porto a porto ou embarcación por embarcación, para realizar un reconto de desembarcos, xa que o que interesa é medir a tendéncia da sua evolución.

Os dados de desembarcos recollidos na lonxa de Malpica representan o 48% dos desembarcos –en volume– e o 32% do valor dos da zona afectada, excepto A Coruña. Esta significación ten permanéncia suficiente ao longo do tempo como para se converter en representativa. De aí que partindo desa significación se elabora-se un modelo que descrebe as tendéncias na evolución das distintas espécies, onde aparecen os primeiros indícios do quebranto sofrido polo recurso como consecuéncia da maré negra.

A reacción imediata –ano 1993– manifesta-se no cámbio de tendéncia nos desembarcos das distintas espécies obxecto de captura. Agrupamos estas reaccións considerando tres tipos distintos de modificacións e que poden ser consideradas como reacción imediata á catástrofe:

3.2 Other ports

The shellfish harvesters and fishermen belong to the associations of: Malpica, Caión, Mugardos, Barallobre, Miño, Mera, Ares, Pontedeume, Sada and Ferrol. The ports included in the affected zone, which have trading markets are: Malpica, Caión, Sada, Miño-Pontedeume, Ares, Ferrol.

The analysis looks at the course of the landings at the market, the trend of the resource taken as a whole. This makes it possible to avoid the need to consider port by port or vessel by vessel in order to make a count of landings, since what is of interest here is to measure the tendency of developments.

Data on landings made at the Malpica market represent 48% of landings – in volume – and 32% of the value of landings in the affected zone, except A Coruña. This significance has sufficient permanence over the course of time to become representative. Thus starting from that significance a model is prepared which describes tendencies in the evolution of the different species, in which there appear the first indications of the breakdown suffered by the resource as a consequence of the oil slick.

The immediate reaction – in the year 1993 – is shown in the change of trend in the landing of different species subject to catch. We group these reactions considering three different types of modification that can be considered as immediate reactions to the catastrophe:

- Aquelas que decrecen modificando a tendéncia que viñan observando. Son representadas polas seguintes espécies: boga, boi, calamar, cabra, chepa, cóngrio, doncella, dorada, faneca, langosta, parrocha, pinto, polbo, quenlla, rabada, robaliza, salmonete, sargo, sollo, xurelo.
- Aquelas que aumentan a sua preséncia tamén á contra da tendéncia anterior: badexo, barbada, centola, escacho, lenguado, muxe, nécora, pancho, percebe, pescada, pescadiña, raia, rodaballo, sardiña.
- Aquelas que non varian significativamente: agulla, bocarte, bogavante, bonito, camarón, lírio, marraxo, mero, ollomol, perrilla, rape, reo, saboga, santiaguiño, xarda, zurdo.

A partir da tendéncia coñecida observada nos anos anteriores: Xaneiro 1988 -Novembro 1992, elaborou-se un cadro de capturas esperadas e sobre el trazou-se o das capturas reais, esa diferenza xa coñecida é a que aporta a primeira valoración das perdas reais. Os prezos que se utilizaron para cada espécie son os que habia en Decembro de 1991, e no caso en que nese mes non se comercializara algunha espécie utilizou-se o prezo médio do ano 1991.

A cuantia final recolle non só o valor atribuíbel aos desembarcos dos restantes portos da zona senón tamén a corrección de aproximación á cuantia real do vendido.

No primeiro informe a estimación fixo-se calculando a meia xeométrica dos anos 88-

- Reactions that decrease, modifying the tendency that had been observed. These are represented in the following species: bogue, ox crab, squid, blue mouth, horned octopus, conger rainbow wrasse, gilthead sea bream, pouting, lobster, sardine, cat shark, octopus, blue shark, monkfish, sea bass, goatfish, white sea bream, flounder, mackerel.
- Reactions that increase their presence, also in contrast to the previous trend: Pollack, greater fork beard, spider crab, gurnard, sole, mullet, velvet crab, small horse mackerel, barnacles, hake, whiting, thornback ray, turbot, pilchard.
- Reactions that do not vary significantly: garfish, anchovy, European lobster, tuna fish, shrimp, blue whiting, short fin mako, grouper, sea bream, *perrilla*, angler, brown trout, salerna, locust lobster, Atlantic mackerel, bullet tuna.

On the basis of the tendency known to have been observed in previous years: January, 1988, – November, 1992, a table of expected catches was prepared and on it were traced the real catches. That difference is what gives an initial evaluation of real losses. The prices that were used for each species are those that were in effect in December, 1991, and in the event that a certain species was not on the market in that month, the average price for the year 1991 was used.

The final amount includes not only the value attributable to the landings at the other ports of the zone but also the

92 e supoñendo que despois do desastre se manteria o ritmo na evolución, cando menos no ano 1993. Nese mesmo informe anunciábamos a necesidade de introducir modificacións no cálculo para anos posteriores a 1993. Esta necesidade deriva do feito que para unha série de 5 anos anteriores ao desastre consideramos que resultaba fiábel o cálculo para un ano, pero para períodos maiores é menos distorsionadora, por exemplo, a meia arimética, que é a que utilizamos no informe.

No cálculo da meia arimética 88-92 (ao igual que para a meia xeométrica no informe anterior) e dado que o último ano está xa afectado polo desastre no mes de Decembro, o que fixemos foi supor para este mes unha cuantia de acordo co comportamento que os desembarcos das distintas espécies tiveron en anos anteriores. Deste xeito estabelece-se a posibilidade dunha comparación na que:

- Os dados estimados e reais para os anos 88-91 coincidirán plenamente.
- En 1992 poderemos xa apreciar, en muitas espécies, unha diferenza entre os desembarcos esperados e reais. Esa diferenza é, necesariamente, imputábel, en exclusiva, ao mes de Decembro, mes no que tivo lugar o sinistro. Nas espécies en que non hai diferenza debe-se, ou ben a que coincide plenamente o nível esperado co real, ou ben a que o mes de Decembro non é un mes no que haxa habitualmente capturas.

correction of the approximation of the real amount of sales.

In the first report the estimation was made calculating the geometric average of the years 88-92 and supposing that after the disaster the rhythm of developments would be maintained, at least through the year 1993. In the same report we announced the need to introduce modifications in the calculation for the years following 1993. This need derives from the fact that for a series of 5 years subsequent to the disaster we consider that the calculation for a year would be reliable, but for longer periods less distortion is produced, for example, by the arithmetic mean which is what we used in the report.

In the calculation of the arithmetic mean 88-92, (as with the geometric mean in the previous report), given that the last year was already affected by the disaster in the month of December, what we did was to suppose for this month an amount in accordance with the behaviour of landings of the different species as shown in previous years. In this way the possibility is established of a comparison in which:

- Estimated and real data for the years 88-91 would fully coincide.
- In 1992 we will be able to appreciate in a number of species a difference between expectable and real landings. That difference is necessarily imputable exclusively to the month of December, the month in which the accident took place. In species in which there is no difference, this is due either to the fact that the expected level coincides totally with the real one or that the

- En 1993 e 1994, as diferenzas deben-se, necesariamente, en todo o ano ás posíbeis repercusións do sinistro. O mesmo ocorre para o 95 e 96, pero nestes últimos anos haberia que diferenciar entre os efeitos directos e indirectos daquel.

Destas comparacións obtemos uns saldos atribuíbeis ás diferenzas entre valores estimados e reais 92, 93, 94, 95 e 96, que, no caso de seren positivos, indican unha caída nos níveis de desembarcos. Pola contra, os valores negativos indican unha subida nos mesmos. Ademais observa-se os desembarcos dalgunhas espécies cun saldo 0.

Cando estes dados son representados graficamente, tanto no primeiro caso (caída), como no segundo (subida), amosan *anormalidade* no comportamento dos desembarcos. A morte directa de parte das povoacións de peixes, moluscos e crustáceos ou a migración dunha parte contribuen á caída das capturas e, polo tanto, dos desembarcos. Pero hai outros efeitos, como os apontados antes, a respeito do bloqueo dos quimiorreceptores e alteración no comportamento de muitas espécies que induce ao aumento das capturas pero non da povoación das mesmas, polo que o aparente incremento convirte-se en sobrecaptura, e evidéncia os efeitos da catástrofe. Este aumento vai ser temporal e contribui a aumentar o desequilíbrio.

Na cuantificación global, considerou-se como se fosen efeitos positivos do sinistro, ainda sabendo que non o son; ao non poder

month of December is not a month when there is normally a catch.

- In 1993 and 1994, the differences over the whole year are necessarily due to possible repercussions of the accident. The same occurs for the years '95 and '96, but in these later years we must distinguish between direct and indirect effects.

From these comparisons we obtain balances attributable to the differences between estimated and real values for the years '92, '93, '94, '95 and 96, which, when positive, indicate a fall in the levels of landings. On the other hand, negative values indicate a rise in them. In addition, we observe landings of some species with a balance of 0.

When these data are graphically presented, both in the first case (fall) and in the second (rise), they show *abnormality* in the behaviour of the landings. The immediate death of part of the populations of fish, molluscs and crustaceans or the migration of part of those populations contribute to a fall in the catch and thus of landings. But there are other factors, such as those indicated above, with respect to the blocking of the chemo-receptors and alterations in the behaviour of many species, which lead to the increase of catches but not of population, so that the apparent increase becomes over-catch and evidences the effects of the catastrophe. This increase will be temporary and will contribute to increase the imbalance.

In overall quantification these were considered as positive effects of the accidents, though we knew they were not. Not being able to know, at that

coñecer, no seu momento, o comportamento dos desembarcos futuros optamos por estabelecer un cuantum que deberá ser considerado sempre como un mínimo sobre o que existen evidéncias dabondo para demostra-lo.

moment, the behaviour of future landings, we opted for establishing a quantum that should always be considered a minimum for which plentiful evidence exists to demonstrate.

Pesca de baixura: restantes portos 1988 - 1994 (kg)
Inshore fishing: other ports 1988 - 1994 (kg.)

	1988	1989	1990	1991	1992	1993	1994
SUBGRUPO PEIXES FISH SUBGROUP							
AGULLA GARFISH	0	15.517	8.276	37.241	920	0	0
ALBACORA ALBACORE	0	0	0	1.163	1.223	241	62
ALPABARDA GARPIKE	0	97.356	0	31.379	0	0	0
BADEXO POLLACK	123.991	146.023	126.437	110.995	101.000	120.156	134.260
BARBADA FORK BEARD	3.262	5.345	3.782	1.975	2.389	4.011	5.526
BOCARTE ANCHOVY	26.667	2.759	86.494	63.759	0	0	14.310
BOGA BOGUE	30.747	257.094	154.260	186.320	158.343	136.345	116.432
CABRA BLUE MOUTH	18.846	14.605	15.874	16.584	13.121	10.954	8.078
CÓNGRIO CONGER	240.878	223.434	234.048	200.030	270.575	267.025	215.409
DONCELLA RAINBOW WRASSE	10.821	19.989	10.324	7.044	10.078	8.510	11.616
DORADA GILT HEADED SEA BREAM	221	0	0	0	69	0	143
ESCACHO GURNARD	40.607	32.490	40.717	34.910	29.878	57.570	49.621
FANECA POUTING	90.655	65.455	125.772	120.724	128.021	137.301	111.869

	1988	1989	1990	1991	1992	1993	1994
SUBGRUPO PEIXES FISH SUBGROUP							
LENGUADO COMMON SOLE	12.005	10.154	5.731	10.283	11.894	21.634	18.545
LÍRIO BLUE WHITING	2.782	0	0	0	0	2.952	10.097
MARRAXO SHORT FIN MAKO	720	0	782	0	62	44	78
MERO GROUPER	851	1.526	921	775	1.678	2.044	1.685
MISTURA *MISTURA*	1.074.802	554.108	645.333	311.448	46.552	662.644	0
MUXE MULLET	12.648	7.611	12.566	5.030	3.738	4.018	9.451
OLLOMOL RED SEA BREAM	2.310	283	386	255	156	129	600
PANCHO SMALL MACKEREL	21.706	33.439	32.356	49.375	23.830	32.860	24.503
PARROCHA SARDINE	374.655	64.310	2.299	26.690	158.391	0	19.540
PERRILLA *PERRILLA*	36.255	407.184	292.995	869.609	98.563	151.747	8.816
PESCADA HAKE	106.409	44.326	62.793	83.752	23.657	44.368	66.308
PESCADIÑA WHITING	101.890	97.989	85.662	39.474	41.720	68.499	93.094
PINTO CAT SHARK	82.460	85.538	80.414	72.090	64.945	63.669	57.177
QUENLLA BLUE SHARK	55.363	8.984	34.402	29.540	139.064	3.917	38.239
RABADA MONKFISH	79.503	75.308	33.657	39.251	94.497	37.602	0
RAIA THORNBACK RAY	96.816	61.474	51.253	55.428	80.382	80.706	78.386
RAPE ANGLER	1.598	1.310	2.322	816	1.329	1.331	2.678
REO RAINBOW TROUT	1.917	492	421	639	366	216	441

	1988	1989	1990	1991	1992	1993	1994
SUBGRUPO PEIXES FISH SUBGROUP							
ROBALIZA SEA BASS	52.310	43.857	28.848	27.094	19.428	20.598	30.874
RODABALLO TURBOT	8.170	7.467	5.177	4.667	7.185	9.368	10.094
SABOGA SALERNA	3.448	1.469	0	0	0	8.563	0
SALMONETE GOATFISH	14.874	12.792	16.182	13.614	18.405	16.759	8.809
SARDIÑA PILCHARD	9.203.207	8.990.384	5.779.271	2.000.099	5.157.915	6.431.690	8.052.416
SARGO WHITE SEA BREAM	25.515	21.526	20.037	43.232	31.087	24.280	18.871
SOLLO FLOUNDER	5.172	4.287	4.400	3.897	8.332	6.869	5.345
VÁRIOS VARIOUS	107.880	146.345	133.805	137.209	105.234	439.471	401.657
XARDA ATLANTIC MACKEREL	159.894	210.611	318.198	944.685	517.837	727.274	833.506
XURELO HORSE MACKEREL	8.609.260	4.496.917	3.841.848	8.768.846	5.487.246	3.200.303	4.628.552
ZURDO BULLET TUNA	0	0	2.172	0	0	60	57
TOTAL PEIXES TOTAL FISH	20.841.115	16.269.760	12.298.043	14.349.920	12.859.107	12.805.669	15.087.090

Fonte: Garcia Negro, Mª do Carme (dir.) (1998): *Avaliación dos danos provocados pola maré negra do Aegean Sea. Informe 1997*, Equipo de Investigación de Economia Pesqueira e Recursos Naturais, Universidade de Santiago de Compostela.

Source: García Negro, Mª do Carme (dir.) (1998): *Valuation of the damages caused by the Aegean Sea oil slick. Report 1997*. Research Team on Fishery Economics and Natural Resources of the University of Santiago de Compostela.

Pesca de baixura: restantes portos 1988 - 1994 (kg)
Inshore fishing: other ports 1988 - 1994 (kg.)

	1988	1989	1990	1991	1992	1993	1994
SUBGRUPO PEIXES FISH SUBGROUP							
Total peixes Total fish	12.504.669	9.761.856	7.378.826	8.609.952	7.715.464	7.683.401	9.052.254
SUBGRUPO MOLUSCOS MOLLUSC SUBGROUP							
Total moluscos Total molluscs	496.018	399.577	452.026	372.215	360.605	241.966	224.145
SUBGRUPO CRUSTÁCEOS CRUSTACEAN SUBGROUP							
Total crustáceos Total curstaceans	31.680	20.273	28.515	31.023	23.927	37.726	17.306
Total xeral General total	13.032.367	10.181.706	7.859.367	9.013.190	8.099.996	7.963.093	9.293.705

Fonte: Garcia Negro, Mª do Carme (dir.) (1998): *Avaliación dos danos provocados pola maré negra do Aegean Sea. Informe 1997*, Equipo de Investigación de Economia Pesqueira e Recursos Naturais, Universidade de Santiago de Compostela.

Source: García Negro, Mª do Carme (dir.) (1998): V*aluation of the damages caused by the Aegean Sea oil slick. Report 1997*. Research Team on Fishery Economics and Natural Resources of the University of Santiago de Compostela.

Pesca de baixura: restantes portos 1995 - 1997

Inshore fishing: other ports 1995-1997

SUBGRUPO PEIXES SUBGRUP FISH	1995 1995 KG KG	 VALOR VALUE	1996 1996 KG KG	 VALOR VALUE	1997 1997 KG KG	 VALOR VALUE
AGULLA GARFISH	208	6.864	15.623	487.718	17.900	541.133
BADEXO POLLACK	94.785	72.627.938	138.746	65.117.786	73.705	63.364.080
BARBADA FORK BEARD	3.183	702.312	9.348	808.945	2.246	457.421
BOCARTE ANCHOVY	185.863	57.504.040	50.473	21.337.580	2	2.808
BOLO SAND EEL	0	0	20.864	1.352.287	749	80.908
BOGA BOGUE	115.571	3.312.965	132.939	3.549.676	202.894	5.259.621
CABRA BLUE MOUTH	52.070	10.697.717	9.406	1.474.888	7.877	1.748.406
CÓNGRIO CONGER	192.184	44.076.130	250.207	29.621.773	187.495	38.268.140
DONCELLA RAINBOW WRASSE	4.965	2.332.148	15.664	5.332.425	6.824	2.891.809
DORADA GILTHEAD SEA BREAM	47	77.168	191	301.001	148	223.677
ESCACHO GURNARD TUB	43.799	19.586.951	47.181	16.943.177	48.250	16.315.141
FANECA POUTING	106.294	30.839.052	96.479	31.010.799	67.866	25.111.932
LENGUADO COMMON SOLE	11.835	16.353.234	5.210	6.019.815	10.571	14.080.496

SUBGRUPO PEIXES SUBGRUP FISH	1995 1995 KG KG	 VALOR VALUE	1996 1996 KG KG	 VALOR VALUE	1997 1997 KG KG	 VALOR VALUE
LÍRIO BLUE WHITING	8.657	1.021.060	1.254	289.110	1.283	212.695
MARAGOTA BALAN WRASSE	41.866	17.279.509	34.295	10.523.198	30.023	8.886.638
MERO DUSKY GROUPER	855	1.199.796	424	763.972	83	205.764
MUXE MULLET	3.717	196.767	174.920	618.122	14.631	507.177
OLLOMOL RED SEA BREAM	1.212	1.462.799	1.277	1.194.450	4.919	4.482.040
PANCHO AXILLARY SEA BREAM	16.189	11.012.716	0	0	0	0
PARROCHA SARDINE	71.173	6.261.521	90.863	14.231.077	187.803	16.374.993
PARGO COMMON SEA BREAM	1.168	1.504.397	3.738	3.610.393	2.155	2.916.680
PERRILA *PERRILLA*	181.418	6.749.600	1.841.848	71.342.502	1.013.399	33.106.649
PESCADA EUROPEAN HAKE	58.771	57.136.203	155.330	82.081.033	113.726	96.938.350
PESCADIÑA WHITING	93.175	55.752.076	113.809	46.464.240	100.547	61.685.932
PINTO SPOTTED CAT SHARK	1.294	1.032.102	5.672	4.503.722	4.836	4.173.108

SUBGRUPO PEIXES SUBGRUP FISH	1995 1995 KG KG	 VALOR VALUE	1996 1996 KG KG	 VALOR VALUE	1997 1997 KG KG	 VALOR VALUE
RAPE BLACK BELLIED ANGER	1.572	1.584.068	913	967.210	624	605.028
RAIA THORNBACK RAY	72.288	15.975.549	80.392	16.344.677	59.428	13.924.431
ROBALIZA SEA BASS	33.711	57.207.571	33.039	54.307.211	41.839	58.159.015
RODABALLO TURBOT	6.363	14.622.819	5.947	12.936.213	4.715	12.798.411
SABOGA SALERNA	54	8.463	2.219	383.200	4.087	161.233
SALMONETE GOATFISH	13.151	15.677.986	13.435	15.432.710	12.802	16.132.775
SAMARTIÑO ATLANTIC JOHN DORY	138	181.337	3.696	3.760.484	5.075	5.936.682
SARDIÑA EUROPEAN PILCHARD	5.005.905	332.191.029	4.410.551	330.726.155	2.428.336	230.357.377
SARGO WHITE SEA BREAM	22.577	17.594.228	22.755	14.789.803	22.385	14.792.467
SOLLO FLOUNDER	6.152	6.746.218	3.842	3.830.599	3.763	4.163.368
VELLO PAINTED COMBER	1.162	80.826	8.174	659.119	5.552	393.058
XARDA ATLANTIC MACKEREL	491.702	24.907.691	448.833	26.881.011	760.220	43.980.335

SUBGRUPO PEIXES SUBGRUP FISH	1995 1995 KG KG	 VALOR VALUE	1996 1996 KG KG	 VALOR VALUE	1997 1997 KG KG	 VALOR VALUE
XULIANA MONKFISH	25.020	14.016.845	38.284	14.588.563	41.448	16.625.384
XURELO HORSE MACKEREL	8.173.534	580.697.338	4.648.588	426.198.835	7.575.067	573.583.467
ZURDO BULLET TUNA	1.236	224.820	630	255.782	1.454	565.213
MISTURA MISTURA	222.207	14.215.706	492.708	49.475.733	304.813	13.365.537
TOTAL PEIXES TOTAL FISH	15.367.069	1.514.657.566	13.429.770	1.390.516.995	13.066.727	1.390.013.841

Fonte: Garcia Negro, Mª do Carme (dir.) (1998): *Avaliación dos danos provocados pola maré negra do Aegean Sea. Informe 1997*, Equipo de Investigación de Economia Pesqueira e Recursos Naturais, Universidade de Santiago de Compostela.

Source: García Negro, Mª do Carme (dir.) (1998): *Valuation of the damages caused by the Aegean Sea oil slick. Report 1997*. Research Team on Fishery Economics and Natural Resources of the University of Santiago de Compostela.

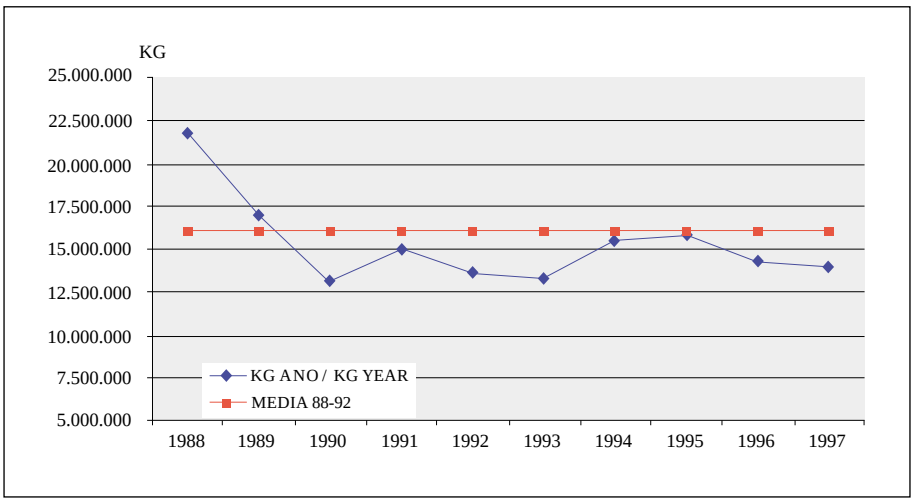
SUBGRUPO CRUSTÁCEOS SUBGRUP CRUSTACEANS	1995 1995 KG KG		1996 1996 TM TM		1997 1997 TM TM	
		VALOR VALUE		VALOR VALUE		VALOR VALUE
BOGAVANTE EUROPEAN LOBSTER	1	3.224	37	79.352	60	177.632
BOI OX CRAB	626	102.716	229	216.428	489	450.031
CAMARÓN SHRIMP	98	347.672	208	727.505	210	1.130.322
CENTOLA SPIDER CRAB	1.543	2.104.835	19.134	19.780.925	35.992	44.500.315
LANGOSTA COMMON LOBSTER	0	0	6	15.226	8	34.008
NÉCORA VELVET CRAB	1.798	1.342.090	3.135	3.050.694	5.722	6.009.765
PERCEBE BARNACLE	13.320	28.122.602	61.508	107.758.321	55.969	106.288.393
SANTIAGUIÑO LOCUST LOBSTER	53	80.678	77	147.688	204	517.086
TOTAL CRUSTÁCEOS TOTAL CRUSTACEANS	17.440	32.103.817	84.332	131.734.539	98.654	159.107.551

SUBGRUPO MOLUSCOS SUBGRUP MOLLUSCS	1995 1995 KG KG	 VALOR VALUE	1996 1996 KG KG	 VALOR VALUE	1997 1997 KG KG	 VALOR VALUE
AMEIXÓN CLAMS	0	0	2.080	101.920	0	0
CALAMAR SQUID HORNED	322	323.206	339	348.623	2.521	2.582.147
CHEPA OCTOPUS	11.166	3.911.858	19.648	5.453.0920	0	0
CHOPO CUTTLEFISH	608	336.019	3.444	1.670.993	3.420	1.544.279
POTA FLYING SQUID	22	7.472	98	38.526	3.187	1.200.765
POLBO OCTOPUS	408.314	221.818.309	708.488	325.001.023	749.237	451.449.617
TOTAIS TOTALS	420.433	226.396.864	734.094	332.614.343	758.364	456.776.809

Fonte: Garcia Negro, Mª do Carme (dir.) (1998): *Avaliación dos danos provocados pola maré negra do Aegean Sea. Informe 1997*, Equipo de Investigación de Economia Pesqueira e Recursos Naturais, Universidade de Santiago de Compostela.

Source: García Negro, Mª do Carme (dir.) (1998): *Valuation of the damages caused by the Aegean Sea oil slick. Report 1997*. Research Team on Fishery Economics and Natural Resources of the University of Santiago de Compostela.

Figura / Figure 2
Pesca de baixura: restantes portos 1988-1997
Inshore fishing: other ports 1988 - 1997



Fonte: Elaboración própria a partir de Garcia Negro, Mª do Carme (dir.) (1998): *Avaliación dos danos provocados pola maré negra do Aegean Sea. Informe 1997*, Equipo de Investigación de Economia Pesqueira e Recursos Naturais, Universidade de Santiago de Compostela.

Source: Our own data based on García Negro, Mª do Carme (dir.) (1998): *Valuation of the damages caused by the Aegean Sea oil slick. Report 1997*. Research Team on Fishery Economics and Natural Resources of the University of Santiago de Compostela.

Pesca de baixura: restantes portos 1988 - 1997

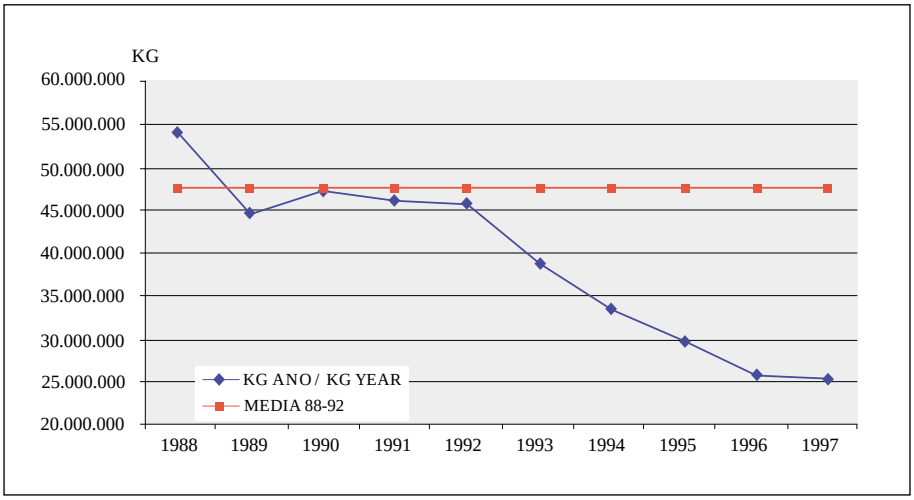
Inshore fishing: other ports 1988 - 1997

ANO / YEAR	VALOR / VALUE	KG	P. UNIT.
1988	2.146.088.311	21.720.611	98,80
1989	1.922.569.239	16.969.510	113,30
1990	1.907.685.836	13.098.944	145,64
1991	2.046.519.070	15.021.983	136,23
1992	1.900.830.334	13.499.994	140,80
1993	1.432.842.041	13.271.822	107,96
1994	1.721.649.580	15.489.508	111,15
1995	2.031.658.930	15.804.942	128,54
1996	2.319.214.755	14.248.180	162,77
1997	2.005.898.201	13.923.745	144,06
MÉDIA Kg 88-92 / AVERAGE Kg 88-92		16.062.209	

Fonte: Garcia Negro, Mª do Carme (dir.) (1998): *Avaliación dos danos provocados pola maré negra do Aegean Sea. Informe 1997*, Equipo de Investigación de Economia Pesqueira e Recursos Naturais, Universidade de Santiago de Compostela.

Source: García Negro, Mª do Carme (dir.) (1998): *Valuation of the damages caused by the Aegean Sea oil slick. Report 1997*. Research Team on Fishery Economics and Natural Resources of the University of Santiago de Compostela.

Figura / Figure 3
Pesca de baixura: total zona afectada 1988-1997
Inshore fishing: total affected zone 1988 - 1997



Fonte: Elaboración própria a partir de Garcia Negro, Mª do Carme (dir.) (1998): *Avaliación dos danos provocados pola maré negra do Aegean Sea. Informe 1997*, Equipo de Investigación de Economia Pesqueira e Recursos Naturais, Universidade de Santiago de Compostela.

Source: Our own data based on García Negro, Mª do Carme (dir.) (1998): *Valuation of the damages caused by the Aegean Sea oil slick. Report 1997*. Research Team on Fishery Economics and Natural Resources of the University of Santiago de Compostela.

Pesca de baixura: total zona afectada 1988 - 1997

Inshore fishing: total affected zone 1988 - 1997

ANO / YEAR	VALOR / VALUE	KG	P. UNIT.
1988	7.741.984.414	53.820.290	143,85
1989	8.668.866.705	44.497.300	194,82
1990	10.056.369.856	47.136.437	213,35
1991	10.249.066.566	46.139.685	222,13
1992	10.844.121.387	45.735.833	237,10
1993	8.154.082.795	38.836.719	209,96
1994	6.672.491.142	33.494.281	199,21
1995	6.040.902.640	29.747.014	203,07
1996	6.109.664.665	25.804.588	236,76
1997	6.807.428.638	25.343.048	268,61
MÉDIA Kg 88-92 / AVERAGE Kg 88-92		47.465.909	

Fonte: Garcia Negro, Mª do Carme (dir.) (1998): *Avaliación dos danos provocados pola maré negra do Aegean Sea. Informe 1997*, Equipo de Investigación de Economia Pesqueira e Recursos Naturais, Universidade de Santiago de Compostela.

Source: García Negro, Mª do Carme (dir.) (1998): Valuation of the damages caused by the Aegean Sea oil slick. Report 1997. Research Team on Fishery Economics and Natural Resources of the University of Santiago de Compostela.

3.3 Cuantificación das perdas en pesca extractiva

É evidente que a maré negra do *Aegean Sea* afectou grave e notoriamente ao volume total de desembarcos producidos na zona:

- O monto total das capturas (tomando para o ano 98 o dado do ano anterior ante a ausencia de dados fiables sobor dos desembarcos no porto da Coruña) diminueu de maneira farto visíbel: non pode ser achacado a circunstáncias do ciclo habitual un descenso de 76,53 millóns de kg en 5 anos no porto da Coruña, o que representa un valor de 21.232 millóns de pesetas* (ptas. constantes do ano 1992).
- A importáncia relativa desta cantidade –de por sí mui significativa– é relevante: eses 76,53 millóns de kg equivalen a 2,44 veces a produción dun ano medio.
- Unha caída desta magnitude sitúa a posíbel recuperación nun nível mui alto. A volta á normalidade resultará mais serodia do desexábel, e máis ainda se temos conta

* O cálculo final do valor en pesetas efectuouse utilizando os prezos medios do ano 1992. Estes prezos por ser anteriores ás modificacións sufridas nos desembarcos foron tomados como os máis representativos. Por unha banda antes da maré negra a composición interna-estrutura dos desembaros por espécies era *unha* determinada que se modifica con posterioridade por razóns da propria nova composición, esto afecta aos prezos e polo tanto ao prezo medio. En segundo lugar é un bó acordo considerar o punto cero no mes de Decembro do 92 a efeitos do cálculo económico.

3.3 Quantification of losses in extractive fishing

It is evident that the *Aegean Sea* oil slick seriously and notoriously affected the total volume of landings taking place in the zone:

- The total amount of the catch (taking for the year 1998 the data for the previous year, given the absence of reliable data on landings in the port of A Coruña) dropped in a striking fashion: a drop of 76.53 million kg. in 5 years in the port of A Coruña, representing a value of 21,232 million pesetas* (constant pesetas of 1992) cannot be attributed to circumstances of a normal cycle.
- The relative importance of this quantity – significant in itself – is relevant: those 76.53 million kg. are the equivalent of 2.44 times the production of an average year.
- A fall of this extent places possible recovery at a very high level. The return to normalcy will be much slower than desirable, and even more so if we take into account

* The final calculation of the value in pesetas was done using average prices from the year 1992. These prices, being prior to the modifications undergone in the landings, were taken as most representative. On one hand, previous to the oil slick the internal composition-structure of the landings by species was a determinate that was subsequently modified due to its own new composition, which affects prices and hence average price. In the second place it is a good solution to consider point zero in the month of December, '92 for purposes of economic calculation.

dos efeitos negativos sobre a frota ou a cuota de mercado.

- A distribución relativa desa diminución agrava ainda máis o seu significado: máis que proporcionalmente decrecen algunhas espécies que acadan un elevado valor unitário, como é o caso da pescada.
- Compre engadir unha outra cifra ás magnitudes da caída: aquela que corresponde ao mes de Decembro do 92, estimada en 2,06 millóns de kg, equivalentes a 571 millóns de pesetas (en correspondéncia co comportamento dos desembarcos de anos anteriores).
- A perda de recurso medida en desembarcos nos restantes portos é de 7,57 millóns de kg para os anos 93, 94, 95, 96 e 97, que representa un valor de 1.066 millóns de pesetas.
- A non comercialización do recurso no mes de Decembro de 1992 acada un volume de 862.000 kg e un valor duns 121 millóns de pesetas.

O monto global da perda atribuíbel, nesta data, do recurso desembarcado e negociado nas lonxas antecitadas podemos cifra-lo en 87,022 millóns de kg e 22.990 millóns de pesetas.

Aplicando a taxa de variación interanual (Dcbro.-Dcbro.) 93-94-95-96-97 dos prezos ao consumo, a cantidade anterior incrementa-se en 4.731 millóns, polo que a perda final atribuíbel para o recurso peixe, crustáceos e moluscos desembarcados é de 27.721,27 millóns de pesetas (valor en Decembro de 1997).

negative effects on the fleet or the market share.

- The relative distribution of this decrease makes its significance even more serious: some species that acquire a high unit value, as is the case with hake, decrease more than proportionately.
- It is necessary to add another figure to the measurements of the fall: that which corresponds to the month of December, '92, estimated at 2.06 million kg., equivalent to 571 million pesetas (corresponding to behaviour of landings in previous years).
- The loss of the resource measured in landings in other ports is 7.57 million kg. for the years '93, '94, '95, '96 and '97, which represents a value of 1,066 million pesetas.
- The non-marketing of the resource in the month of December, 1992, reached a volume of 862,000 kg and a value of about 121 million pesetas.

The overall quantity of the attributable loss, at this date, of the resource landed and marketed in the markets cited above can be put at 87.022 million kg and 22,990 million pesetas.

Applying the rate of inter-annual variation (Dec-Dec) 93-94-95-96-97 of consumer prices the previous quantity increases by 4,731 million, so that the loss attributable for the resource of fish, crustaceans and molluscs landed is 27,721,270,000 pesetas (value as of December, 1997).

3.4 Moluscos bivalvos

A diferenza do cálculo de perdas efectuado no apartado de pesca, onde, ainda con alguns problemas coas estatísticas, é posíbel facer unha reconstrución das mesmas que conleva un alto grau de fiabilidade, non acontece o mesmo cos dados de marisqueo de moluscos de praia. Debe-se a que á altura de 1992 a información do C.I.P.E.M. (Centro de Información Pesqueira e Marisqueira) sobre vendas estaba en fase de consolidación, especialmente na zona afectada, o que subestima fortemente as cifras reais, omitindo mesmo dados relativos a algunhas das confrarias afectadas. Optou-se por un método de valoración onde a información fose máis fidedigna.

Para o exame do significado económico das perdas ocasionadas pola maré nas espécies sedentárias de moluscos compreendidos na zona afectada, tomou-se como base os exaustivos mostreos efectuados no meses de Decembro 1992 - Febreiro 1993, imediatos á catástrofe, polas equipas da Conselleria de Pesca, Marisqueo e Acuicultura.

Deses mostreos extraiu-se información sobre dous aspectos que nos permitiron establecer a cuantia do valor da perda neste apartado: o volume de kg que, nas distintas espécies, tiñan talla comercial e a cantidade da povoación total destas espécies nos distintos bancos marisqueiros, que nos permite coñecer a biomasa.

3.4 Bivalve molluscs

In contrast with the calculation of losses incurred under the heading of fishing, where, even with some problems with the statistics, it is possible to make a reconstruction of the losses that offers a high level of reliability, the same does not occur with data for harvesting of beach molluscs. This is due to the fact that in 1992 information from the C.I.P.E.M. (Centre for Fisheries and Shellfish Harvesting Information) on sales was still in the consolidation phase, particularly in the affected zone, which caused a serious underestimation of real figures and even omitted data corresponding to some affected associations. We opted for a valuation method in which the information would be more reliable.

For the examination of the economic significance of the losses incurred due to the spill in sedentary species of molluscs in the affected zone, we took as a basis the comprehensive samplings made over the months of December, 1992, to February, 1993, immediately after the catastrophe, by teams from the Department of Fishing, Shellfish Harvesting and Aquaculture.

From these samplings information was taken on two aspects that permit us to establish the amount of the value of the loss under this heading: the volume of kg. that were of commercial size in the different species and the quantity of total population of these species in the different shellfish banks that allow us to determine the biomass.

Con esta información estabeleceron-se os supostos seguintes que determinarian o valor total do dano:

- Os moluscos de praia con talla comercial no momento do desastre consideran-se perdidos na sua totalidade en términos económicos. Isto é así porque existe proibición de captura e imposibilidade de venda mesmo clandestina.
- A recuperación da normalidade económica para os axentes individuais só se conseguirá cando as condicións do mercado sexan iguais ás do momento anterior á catástrofe. Isto supón acumulación de perdas en períodos sucesivos.
- Os tempos de recuperación varían segundo as distintas espécies. Valemo-nos para este cálculo dos utilizados en estudos económicos dos efeitos do *Amoco Cadiz*.
- Da biomasa coñecida só se computa a parte que representan os moluscos con talla comercializábel.
- Ergo, a parte de biomasa perdida con talla no comercializábel que poderia constituir un recurso potencial non é valorada.

Con todo isto, chegou-se aos seguintes resultados:

With this information the following premises were established with which to determine the total value of the damage:

- The beach molluscs of commercial size at the moment of the disaster were considered as a total loss in economic terms. This is because there is a ban on harvesting and even its illicit sale is impossible.
- Recovery of economic normalcy for individuals affected will only be achieved when market conditions are the same as those in effect at the time immediately prior to the catastrophe. This supposes the accumulation of losses over successive periods.
- Recovery times vary depending on the different species. For this calculation we use the times employed for economic effects of the *Amoco-Cadiz* incident.
- Of the known biomass only the part representing molluscs of commercial size is computed.
- Hence the non-marketable part of the biomass lost, which could constitute a potential resource, is not evaluated.

With all this, we arrive at the following results:

Valor das perdas imediatas nos bancos de moluscos

Value of losses in mollusc banks

Espécies Species	Kilogramos Kilograms	Prezo kg Price Kg	Valor (ptas.) Value (ptas)
Ameixa fina Grooved carpet shell	160.542	1.651,31	265.104.610
Ameixa babosa Carpet shell	350.057	882,04	308.764.270
Berberecho Common edible cockle	212.409	133,58	28.798.412
Coquina Wedge clam	19.619	1.032,00	20.246.808
Vieira * Common Scallop *	11.500	300,00	3.450.000
TOTAL			626.364.100

*Os valores para a vieira están expresados en pezas e prezo por peza.

*Values for scallops are expressed in pieces and prices per piece.

Fonte: Garcia Negro, Mª do Carme (dir.) (1998): *Avaliación dos danos provocados pola maré negra do Aegean Sea. Informe 1997*, Equipo de Investigación de Economia Pesqueira e Recursos Naturais, Universidade de Santiago de Compostela.

Source: García Negro, Mª do Carme (dir.) (1998): *Valuation of the damages caused by the Aegean Sea oil slick. Report 1997*. Research Team on Fishery Economics and Natural Resources of the University of Santiago de Compostela

Valor das perdas na recuperación dos bancos de moluscos
Value of losses in the recovery of the mollusc banks.

Espécies Species	Kilogramos Kilograms	Prezo kg Price Kg	Valor (ptas.) Value (ptas)
Ameixa fina Grooved carpet shell	722.414,62	1.651,31	1.192.930.400
Ameixa babosa Carpet shell	1.749.708,80	882,04	1.543.313.100
Berberecho Common edible cockle	637.213,35	133,58	86.393.385
Coquina Wedge clam	71.606,37	1.032,00	73.897.775
Vieira * Common scallop *	20.700	300,00	6.210.000
TOTAL			2.902.744.660

*Os valores para a vieira están expresados en pezas e prezo por peza.

*Values for scallops are expressed in pieces and prices per piece.

Fonte: Garcia Negro, Mª do Carme (dir.) (1998): *Avaliación dos danos provocados pola maré negra do Aegean Sea. Informe 1997*, Equipo de Investigación de Economia Pesqueira e Recursos Naturais, Universidade de Santiago de Compostela.

Source: García Negro, Mª do Carme (dir.) (1998): Valuation of the damages caused by the Aegean Sea oil slick. Report 1997. Research Team on Fishery Economics and Natural Resources of the University of Santiago de Compostela.

Logo, o valor das perdas nos bancos de moluscos, atribuíbeis ao *Aegean Sea* acada un monto total de: 3.529.108.760 ptas.

Pero este é o valor segundo os prezos do ano 1992, polo que á altura de decembro de 1997 teremos que sumar-lle a cuantia do resultante pola actualización dos prezos, calculada en función da taxa de variación interanual (decembro sobre decembro) do Índice

Thus the value of the losses in mollusc banks attributable to the *Aegean Sea* incident reach a total of 3,529,108,760 ptas.

But this is the value according to prices for the year 1992, so that by December, 1997 we must add the amount that is the result of an updating of prices calculated on the basis of the rate of inter-annual variation (December to December) of the general

de Prezos ao Consumo xeral para 1993, 1994, 1995, 1996 e 1997. Deste xeito, o valor da perda ciframo-la en: 4.336.240.857 ptas.

Os estudos realizados tras o embarracamento do *Amoco Cadiz* na Bretaña francesa son unha boa análise dos tempos de recuperación por espécies, despois dun impacto destas características[11]. Nestes estudos fai-se muito fincapé en que, ainda máis que o cálculo de mortos e enfermos, o que importa para os axentes económicos do litoral é o futuro, o tempo de *recuperación*, non só o efeito imediato senón sobre todo o momento en que a situación se atope como antes da catás-

Retail Prices Indexes for 1993, 1994, 1995, 1996 and 1997. In this way we put the value of the loss at 4,336,240,857 ptas.

Studies done following the running aground of the *Amoco-Cadiz* in Brittany show a good analysis of recovery by species following an impact of these characteristics[11]. In these studies much emphasis is put on the idea that more than a calculation of dead and diseased in the population, what is important for the economic agents of the coast is the future, the time necessary for *recovery*, not only from the immediate event but most of all in the sense of the moment

11. En Bonnieux, F.; Dauce, P. e Rainelli, P., *Impact socio-économique de la marée noire provenant de l´Amoco-Cadiz*, U.V.L.O.E.-I.N.R.A., 1980, encontramos unha excelente síntese baseada noutros estudos dos efeitos deste sinistro, polo que utilizaremos basicamente este. De todos os xeitos compre non esquencer aqui estudos prévios como o de Topinka J. A.; Tucker L. R., *Long term oil contamination of fucoid macroalgae following the Amoco Cadiz*, Oil spill. Cool. Int. Amoco-Cadiz CNEXO, COB, Brest, 19-22 nov. 1979; ou os de Chasse, C.; Morvan, D., *Six mois après la marée noire de l´Amoco-Cadiz, bilan provisoire de l´Amoco-Cadiz de l´impact écologique*, Penn ar *batea*, P.V., n.º 93, pp. 311-338; Lamrini, A., *Contribution à l´étude de l´impact de la marée noire de l´Amoco-Cadiz sur les populations de Mulets (Chelone Labrosus, Mugil auratus, Mugil ramada*), mémoire DEA, Océanogr. biol., Brest, 1980; Miossec, L., *Effects de la pollution de l´Amoco-Cadiz sur la morphologie et sur la reproduction des Plies (Pleuronectes plstena) dans l´Aber Wrac´h et l´Aber Benoit*, Coll. Int. Amoco-Cadiz, CNEXO, COB, Brest, 19-22 nov. 1979; e López, E. et al., *Modifications histopathologiques et stress chez des anguilles soumises à une exposition prolongée aux hydrocarbures*, Coll. Int. Amoco-Cadiz, CNEXO, COB, Brest 19-22 nov. 1979.

11. In Bonnieux, F.; Dauce, P.; Rainelli, P., *Impact socio-économique de la marée noire provenant de l´Amoco-Cadiz*, U.V.L.O.E.- I.N.R.A., 1980, we find an excellent synthesis based on other studies of the effects of the accident, so we will use basically this one. In any case, however, we should not forget here prior studies such as that of Topinka J. A.; Tucker L.R., *Long term oil contamination of fucoid macroalgae following the Amoco Cadiz*, Oil spill. Cool. Int. Amoco-Cadiz CNEXO, COB, Brest, 19-22 Nov. 1979; or those of Chasse, C.; Morvan, D., *Six mois après la marée noire de l´Amoco-Cadiz, bilan provisoire de l´Amoco-Cadiz de l´impact écologique*, Penn ar *batea*, P.V., nº 93, pp. 311-338; Lamrini, A., *Contribution à l´étude de l´impact de la marée noire de l´Amoco-Cadiz sur les populations de Mulets (Chelone Lbrosus, Mugil auratus, Mugil ramada*), mémoire DEA, Océanogr. biol., Brest, 1980; Miossec, L., *Effects de la pollution de l´Amoco-Cadiz sur la morphologie et sur la reproduction des Plies (Pleuronectes plstena) dans l´Aber Wrac´h et l´Aber Benoit*, Coll. Int. Amoco-Cadiz, CNEXO, COB Brest, 19-22 Nov. 1979; and Lopez E. et al., *Modifications histopathologiques et stress chez des anguilles soumises à une exposition prolongée aux hydrocarbures*, Coll. Int. Amoco-Cadiz, CNEXO, COB, Brest 19-22 Nov. 1979.

trofe. Esta será a medida esencial do sinistro. Aqui deben-se ter en conta os seguintes elementos:

- Os degraus e as duracións das contaminacións prévias á restauración.
- As etapas transitórias e as características de povoacións e das espécies en xogo.
- Comenzo do retorno das espécies normais e os tempos requeridos para que estas recuperen a sua importáncia anterior.

Cómpre lembrar que os procesos de descontaminación teñen unha duración variábel segundo se trate da masa de auga, dos organismos filtradores, dos sedimentos nas zonas expostas, dos sedimentos nas zonas semiabertas ou dos sedimentos nas zonas abrigadas.

Mentres os meios físicos sigan a estar contaminados e contaminantes, as povoacións normais tenden a ser reemprazadas por outras espécies que habitan en zonas habitualmente contaminadas como os fondos dos portos ou as saídas de sumidoiros.

O retorno das espécies normais comenza dun xeito variábel segundo que se trate de recolonización a partir de larva (caso dos moluscos, dos poliquetos) ou de adultos que tiveran emigrado. Ao igual que para as algas, os animais sedentários ou cuase-sedentários non terian outra posibilidade máis que se mover pola zona e a miúdo de morrer ou ser esterilizado pola contaminación; para a fauna non sedentária –os peixes, os crustáceos

in which the situation reverts to what it was before the catastrophe. This will be the essential measure of the accident. Here the following elements must be taken into account:

- The extent and duration of pollution prior to recovery.
- Transitory stages and characteristics of the species in question.
- Beginning of the return of normal species and the time required for them to recover their previous importance.

It is necessary to remember that decontamination processes have a duration that varies depending on if we are dealing with the mass of water, with filter organisms, with sediments in exposed zones, sediments in semi-open areas or sediments in protected zones.

While the physical environments continue to be both polluted and pollutant, normal populations tend to be replaced by other species that are accustomed to inhabiting typically polluted areas, such as the sea floor in ports or drain outlets.

The return of normal species commences in different ways depending on whether it is a case of re-colonization by larvae (in the case of molluscs, of the polychaetes) or of adults that have emigrated. As with algae, sedentary or almost sedentary animals will not have any possibility beyond moving in the zone and often dying or being sterilised due to the pollution; non-sedentary fauna like fish and crustaceans will have the possibility of escaping from the

–haberia a posibilidade de fuxir diante dos eflúvios nocivos, eventualmente regresar e, para alguns, concentrar-se, por veces multiplicar-se no espazo deixado vacante, onde as algas enfebelecidas polo petróleo se viron arrincadas e se foron acumulando, onde o petróleo cos anos vaia perdendo muita da sua toxicidade e tenda a ser unha matéria orgánica entre outras en curso de metabolización.

Dun xeito xeral, o tempo de recuperación dunha povoación T_R está comprendido necesariamente entre a duración dunha xeración T_g próxima da idade média na povoación normal entre T e a idade máxima média ou lonxevidade Tmax que é 3 veces máis elevada. O vello equilíbrio demográfico non se terá acadado antes de Tmax = 3 T_g, pero a produción logo a biomasa da povoación serán restabelecidas a un valor intermediário de T_g, T e Tmax, decidindo chamar T_R a este valor tal que

$$T_R = (Tmax + T_g) / 2 = 2\ T_g$$

Para a povoación dunha espécie dada, cunha taxa de produción P para a biomasa B, a relación P / B é inversamente proporcional á idade média T. O indivíduo de peso médio W que ten praticamente a mesma taxa de produción P / W que o conxunto da povoación nas povoacións normais de animais de sangue frio e un crescimento contínuo, pesa case un tércio do peso máximo da espécie, Wmax. A sua taxa de produción é dobre do que o é para a metade do peso máximo:

$$(P / W)_{1/3\ Wmax} = 2\ (P/ W)_{0,5\ Wmax}$$

harmful effluvia and eventually returning, while some can gather and multiply in the space that is left free, where algae debilitated by the oil were uprooted and accumulated, where the oil over the years loses much of its toxicity and tends to become another organic material in the process of metabolising.

In general terms recovery time of a population T_R necessarily lies between the duration of a generation T_g close to the average age of a normal population between T and the maximum average age or Tmax longevity, which is 3 times higher. The old demographic balance will not have been attained until Tmax = 3 T_g, but the population and hence the biomass of the population will be re-established at a value midway between T_g, T and Tmax, so we decide to call this value T_R so that

$$T_R = (Tmax + T_g) / 2 = 2\ T_g$$

For the population of given species, with a rate of production P for the biomass B, the relation P / B is inversely proportionate to the average age T. The individual of average weight W that has practically the same rate of production P / W as the whole of the population in normal populations of cold-blooded animals and continuous growth, weighs almost a third of the maximum weight of the species, Wmax. Their rate of production is double what it is for half the maximum weight:

$$(P / W)_{1/3\ Wmax} = 2\ (P/ W)_{0,5\ Wmax}$$

xa que:

$$P / Wx = K (Wmax – Wx) / Wv$$

Recollendo as diversas relacións mencionadas:

$$P / W_{0,5} = {}^{1}/_{2}\ P / W = 2\ T^{-1} = 2\ T_g^{-1} = T_R^{-1} = {}^{2}/_{3}\ Tmax^{-1}$$

O tempo de recuperación do equílíbrio cualitativo das povoacións é necesariamente o das espécies máis lentas.

3.5 Mexillón

O sector mexilloeiro é, entre os afectados directos pola maré negra, un dos máis importantes polo volume dos danos sofridos.

Dentro da zona afectada o cultivo de mexillón realiza-se nos polígonos Sada-A e Sada-B, situados en Lorbé e Carnoedo respectivamente. O número real de bateas instaladas nesta ria ascende a 127 segundo mostreo realizado por técnicos da Conselleria de Pesca en dias posteriores ao desastre.

Nesta zona constatan-se diferenzas notábeis a respeito do resto do sector mexilloeiro galego, con peculiaridades específicas no tipo de explotación, produtividade e destino das vendas, como sinalamos a continuación.

since:

$$P / Wx = K (Wmax – Wx) / Wv$$

Bringing together the various relations cited:

$$P / W_{0,5} = {}^{1}/_{2}\ P / W = 2\ T^{-1} = 2\ T_g^{-1} = T_R^{-1} = {}^{2}/_{3}\ Tmax^{-1}$$

The time for recovery of the quantitative balance of the populations is necessarily that of the slowest species.

3.5 Mussels

The mussel harvesting sector, among the sectors most directly affected by the oil slick, is one of the most important in terms of the volume of damage suffered.

Within the affected zone mussel culture is carried on in the polygons Sada-A and Sada-B, located in Lorbé and Carnoedo respectively. The real number of *bateas* installed in this ria is 127 according to a sampling done by technicians from the Department of Fisheries in the days following the disaster.

In this zone notable differences were registered with respect to the rest of the Galician mussel culture sector, with specific peculiarities in type of installation, productivity, and sales destination, as we indicate below.

3.5.1 Tipo de explotación

O tamaño médio dunha explotación nesta zona é de 14,1 bateas mentres que para o conxunto de Galiza está en torno a 2,1, é dicer, na zona o tamaño médio e case 7 veces superior á média galega. De todos os xeitos debemos salientar a forte concentración da propriedade: o 59,1% das bateas están en maos dunha soa empresa, e as tres empresas máis grandes concentran o 84,3% do total de bateas, polo que na prática estamos ante empresas produtoras cuxa organización da produción é perfectamente homologábel á dun sector típicamente industrial coas especificidades próprias da actividade.

3.5.1 Type of installation

The average size of an installation in this zone is 14.1 *bateas* while for Galicia as a whole it is around 2.1. In other words, in this zone the average size is 7 times larger than the Galician average. we should also point to the striking concentration of ownership: 59.1% of the *bateas* are in the hands of a single company, and the three largest companies concentrate 84.3% of all the *bateas*, so that in practice we are faced with production companies whose productive organisation is perfectly comparable to that of an industrial sector, with the specific characteristics typical of the activity.

Distribuición do número de bateas por explotación
Distribution of the number of *bateas* per installation

Concesionário / Concessionaire	N.º Bateas / Nº *Bateas*	Porcentaxe / Percentage
Empresa 1 / Company 1	75	59,06%
Empresa 2 / Company 2	19	14,96%
Empresa 3 / Company 3	13	10,24 %
Empresa 4 / Company 4	8	6,30 %
Empresa 5 / Company 5	3	2,36 %
Empresa 6 / Company 6	3	2,36 %
Empresa 7 / Company 7	2	1,57 %
Empresa 8 / Company 8	2	1,57 %
Empresa 9 / Company 9	2	1,57 %
TOTAL	127	100 %

Fonte: Garcia Negro, Mª do Carme (dir.) (1998): *Avaliación dos danos provocados pola maré negra do Aegean Sea. Informe 1997*, Equipo de Investigación de Economia Pesqueira e Recursos Naturais, Universidade de Santiago de Compostela.

Source: García Negro, Mª do Carme (dir.) (1998): *Valuation of the damages caused by the Aegean Sea oil slick. Report 1997*. Research Team on Fishery Economics and Natural Resources of the University of Santiago de Compostela.

3.5.2 A produción

O cultivo de mexillón é unha actividade relativamente recente na Ria de Sada-Lorbé mais, contodo, a produtividade é máis elevada que noutras zonas. O que se explica por unha menor densidade de bateas e pola forte concentración da propriedade que permite unha organización técnica da produción máis racional. Por isto, ainda que o número de bateas só representa o 3,6 % do total galego, a cota acadada no total da produción é significativamente máis elevada.

Outra característica que se vén sumar ás anteriores é o elevado degrau de integración vertical da produción. Desde o cultivo até as fases de depuración, transporte e comercialización están integrados nun mesmo holding que controla un 60% da produción mitícola da zona.

3.5.3 Destino da produción

O destino da produción, e tamén a diferenza do resto de Galiza, é case exclusivamente para fresco. Dado que o prezo para fresco é máis do dobre que para fábrica, a participación que vai ter a produción desta zona, medida en valor, será ainda muito máis importante do que supón a produción en termos físicos.

Trata-se, logo, de explotacións con capacidade de producir máis e con muito máis valor que no resto do sector galego.

3.5.2 Production

Mussel culture is a relatively recent activity in the Ria of Sada-Lorbé, but even so productivity here is higher than in other zones. Which can find its explanation in the lower density of *bateas* and the concentration of ownership, which permits a more rational technical organisation of production. For this reason, although the number of *bateas* only represents the 3.6% of the total in Galician, the percentage of total production is significantly higher.

Another characteristic that should be added to the above is the high level of vertical integration of production. Cultivation, purification, transport and marketing are integrated in one single holding that controls 60% of the mussel production of the zone.

3.5.3 Destination of the production

The destination of the production is also different from the rest of Galicia since it is almost exclusively for the fresh seafood market. Given that the price for fresh seafood is double the factory price, the participation of the zone, measured in value, would be much more important than what production in physical terms would seem to indicate.

Thus these are installations with a capacity to produce more, and at a much higher value than the rest of the Galician sector.

3.5.4 Proxección da produción mexilloeira na zona

Na táboa seguinte aprecia-se a estrutura da produción a 3 de Decembro de 1992, segundo se desprende do mostreo realizado por técnicos da Xunta de Galicia nos primeiros momentos do desastre. Con base nestes dados elaboramos un modelo que nos permitiu coñecer cal seria a evolución temporal da produción na auséncia de maré negra.

3.5.4 Projection of mussel production in the zone

In the following table we can see the production structure in December, 1992, as derived from the sampling done by staff from the Xunta de Galicia in the earliest days of the disaster. On the basis of these data we prepared a model that permitted us to discover the pattern of production in the absence of the oil slick.

Estrutura da produción de mexillón. Decembro 1992
Structure of mussel production. December, 1992

EMPRESA COMPANY		TIPO 1 TYPE 1	TIPO 2 TYPE 2	TIPO 3 TYPE 3	TIPO 4 TYPE 4	TOTAL TOTAL
Empresa 1	Cordas	122	2.169	2.547	720	5.558
Company 1	Lines					
	Kg	21.350	325.350	254.700	36.000	637.400
	Ptas.	2.604.700	29.932.200	15.536.700	1.800.000	49.873.600
Empresa 2	Cordas	2.531	457	129	85	3.202
Company 2	Lines					
	Kg	442.925	68.550	12.900	4.250	528.625
	Ptas.	54.036.850	6.306.600	786.900	212.500	61.342.850
Empresa 3	Cordas	0	500	0	0	500
Company 3	Lines					
	Kg	0	75.000	0	0	75.000
	Ptas.	0	6.900.000	0	0	6.900.000
Empresa 4	Cordas	886	0	1.242	246	2.374
Company 4	Lines					
	Kg	155.050	0	124.200	12.300	291.550
	Ptas.	18.916.100	0	7.576.200	615.000	27.107.300

Empresa 5	Cordas	0	430	281	0	711
Company 5	Lines					
	Kg	0	64.500	28.100	0	92.600
	Ptas.	0	5.934.000	1.714.100	0	7.648.100
Empresa 6	Cordas	8.381	4.968	4.291	6.071	23.711
Company 6	Lines					
	Kg	1.466.675	745.200	429.100	303.550	2.944.525
	Ptas.	178.934.350	68.558.400	26.175.100	15.177.500	288.845.350
Empresa 7	Cordas	500	245	344	0	1.089
Company 7	Lines					
	Kg	87.500	36.750	34.400	0	158.650
	Ptas.	10.675.000	3.381.000	2.098.400	0	16.154.400
TOTAL	Cordas	12.420	8.769	8.834	7.122	37.145
EMPRESAS	Lines					
TOTAL	Kg	2.173.500	1.315.350	883.400	356.100	4.728.350
COMPANIES	Ptas.	265.167.000	121.012.200	53.887.400	17.805.500	457.871.600

Fonte: Garcia Negro, Mª do Carme (dir.) (1998): *Avaliación dos danos provocados pola maré negra do Aegean Sea. Informe 1997*, Equipo de Investigación de Economia Pesqueira e Recursos Naturais, Universidade de Santiago de Compostela.

Source: García Negro, Mª do Carme (dir.) (1998): *Valuation of the damages caused by the Aegean Sea oil slick. Report 1997*. Research Team on Fishery Economics and Natural Resources of the University of Santiago de Compostela.

Estes son os dados de base que permitiron a elaboración dun modelo de produción.

O ponto de partida consistiu en considerar como teria evoluído a produción de mexillón de Lorbé no suposto de que o dia 3 de Decembro de 1992 non acontecera a catástrofe do *Aegean Sea*, é dicer, levou-se a cabo unha proxección teórica da produción no tempo.

Isto permitiu coñecer a corrente de ingresos que seria xerada por este sector e tamén coñecer, aproximadamente, en que momento do tempo seria realizada. A actualización das

These are the basic data that made possible the preparation of a production model.

The starting point consisted in considering how the mussel production of Lorbé would have developed if the *Aegean Sea* catastrophe had not taken place on 3 December, 1992. In other words a theoretical projection was made for production in time.

This permitted us to know the current of income that would be produced by this sector and also to know approximately at what points in time this income would be produced. The updating of income on the basis of the

rendas a partir dos momentos en que efectivamente se producirian veu facilitada polo coñecimento da corrente de ingresos.

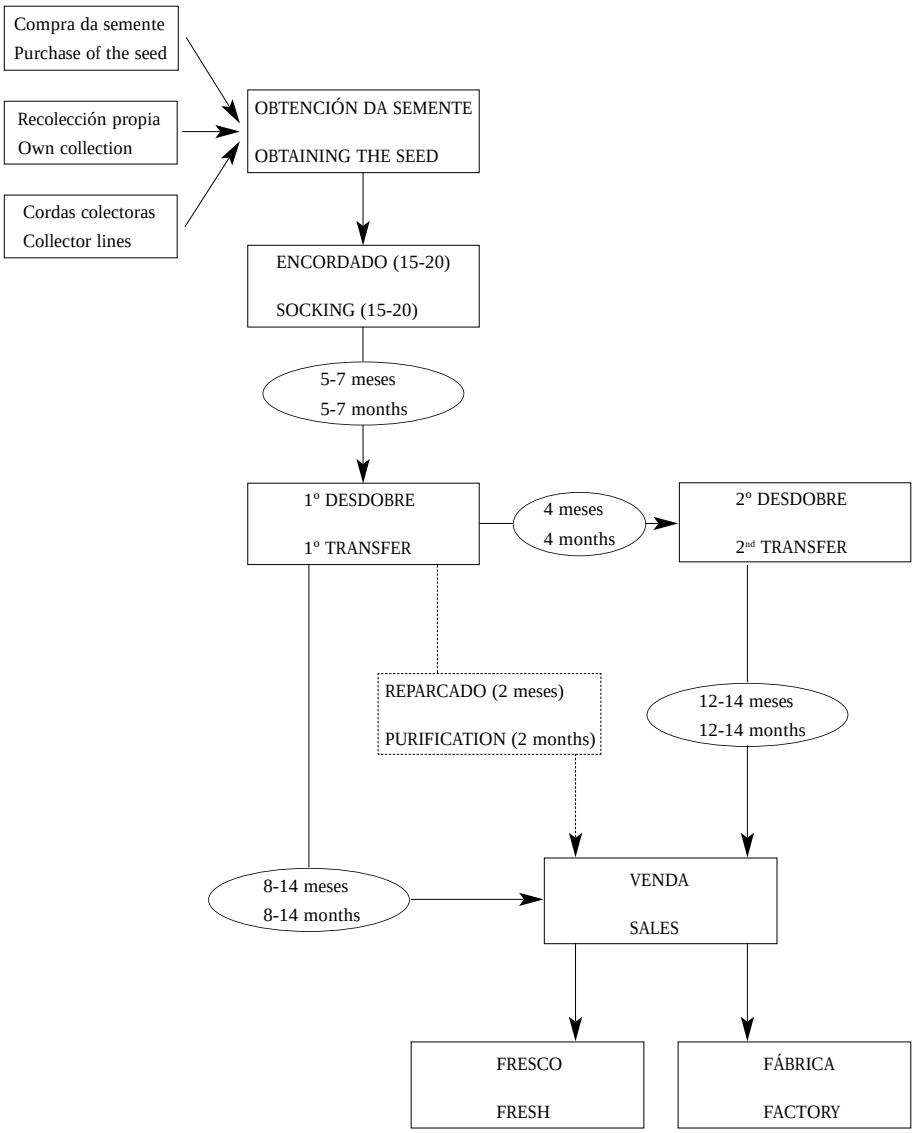
Dentro deste modelo non se incluiron os gastos extraordinários nos que tiveron que incurrir as empresas mexilloeiras por mor da maré negra: limpeza, reparacións, reposición, ... que en calquera caso serán considerados na valoración global dos danos.

Os supostos nos que descansa este modelo son derivados da própria actividade produtiva, que esquematicamente se representa no seguinte cadro:

moments when it is produced was facilitated by knowing the current of income.

Not included in this model are extraordinary expenses incurred by the mussel companies due to the oil slick: cleaning, repairs, replacements… which in any case will be considered in the overall valuation of the damages.

The assumptions on which this model is based are derived from the productive activity itself, which is graphically represented in the table below:



Fonte: Garcia Negro, Mª do Carme (dir.) (1998): *Avaliación dos danos provocados pola maré negra do Aegean Sea. Informe 1997*, Equipo de Investigación de Economia Pesqueira e Recursos Naturais, Universidade de Santiago de Compostela.

Source: García Negro, Mª do Carme (dir.) (1998): *Valuation of the damages caused by the Aegean Sea oil slick. Report 1997*. Research Team on Fishery Economics and Natural Resources of the University of Santiago de Compostela.

Asi, partimos dos seguintes dados:

- Número de bateas: 127.
- Cada batea dispón de 500 cordas.
- Longo de cada corda: 12 metros.
- Cada corda produce ao final do período de maduración 175 quilos (mexillón tipo I).
- Período médio de maduración: 15 meses, composto polas seguintes fases:
  a.- Fase de cria, 5 meses.
  b.- Fase de desdobre, 10 meses a partir da fase de cria. Nesta fase obtemos 3 cordas de desdobre por cada unha de cria.
  c.- Fase de recollida e venda. Transcorridos os 15 meses de cultivo considerase que toda a produción se recolle e se vende.

En cada momento do tempo plantan-se o 30% do total de cordas libres.

Todas as vendas se realizan o dia 30 do mes en curso e as plantacións de cria o dia 1 do mes seguinte á venda.

Para evitar distorsións inecesárias, minúsculas sobre a magnitude do valor da produción ao final do período, eliminaron-se as flutuacións atribuíbeis ao comportamento estacional do mercado e as limitacións específicas para realizar a plantación en determinadas épocas debido a factores naturais.

Thus we start with the following data:

- Number of *bateas*: 127.
- Each *batea* has 500 lines.
- Length of each line: 12 metres.
- Each line produces 175 kg. (type 1 mussel) at the end of the maturation process.
- Average maturing period: 15 months, composed of the following phases:
  a.- Seeding phase, 5 months.
  b.- Transfer phase, 10 months following the seeding phase. In this phase we obtain 3 transfer lines for each seeding line.
  c.- Harvesting and sales phase. After the 15 months of cultivation all the production is considered to have been harvested and sold.

In each moment 30% of the total available lines are in use.

All sales are done of the 30th of the current month and the planting of the seeds on the first day of the month following the sale.

To avoid unnecessary minor distortions of the magnitude of the value of production at the end of the period, fluctuations attributable to seasonal behaviour of the market and specific limitations to planting during certain periods due to natural factors are eliminated.

Proxección da produción de mexillón 1992 - 1993

Ano	Mes	Mexillón tipo 1		Mexillón existéncias		Mexillón tipo 1 acumulado	Mexillón tipo 1 acumulado	Total tipo 1 + exist. acumulado
		kg	ptas.	kg	ptas.	kg	ptas.	ptas.
1992	Decembro	2.873.675	350.588.350	3.295.650	253.614.100	2.873.675	350.588.350	604.202.450
1993	Xaneiro	0	0	3.541.965	265.929.850	2.873.675	350.588.350	616.518.200
	Febreiro	2.113.650	257.865.300	1.730.265	99.253.450	4.987.325	608.453.650	787.707.100
	Marzo	0	0	1.911.435	108.311.950	4.987.325	608.453.650	716.765.600
	Abril	0	0	1.911.435	108.311.950	4.987.325	608.453.650	716.765.600
	Maio	0	0	1.911.435	108.311.950	4.987.325	608.453.650	716.765.600
	Xuño	0	0	5.350.860	378.265.890	4.987.325	608.453.650	986.719.540
	Xullo	0	0	5.350.860	378.265.890	4.987.325	608.453.650	986.719.540
	Agosto	0	0	6.256.710	435.515.610	4.987.325	608.453.650	1.043.969.260
	Setembro	0	0	6.256.710	435.515.610	4.987.325	608.453.650	1.043.969.260
	Outubro	0	0	4.519.410	275.684.010	4.987.325	608.453.650	884.137.660
	Novembro	2.026.850	247.275.700	6.409.335	548.664.540	7.014.175	855.729.350	1.404.393.890
	Decembro	0	0	6.409.335	548.664.540	7.014.175	855.729.350	1.404.393.890

Fonte: Fonte: Garcia Negro, Mª do Carme (dir.) (1998): *Avaliación dos danos provocados pola maré negra do Aegean Sea. Informe 1997*, Equipo de Investigación de Economia Pesqueira e Recursos Naturais, Universidade de Santiago de Compostela.

Projection of mussel production 1992-1993

Year	Month	Mussel type 1		Mussel stock		Mussel type 1 accumulated	Mussel type 1 accumulated	Total type 1 + stock accumulated
		kg	ptas.	kg	ptas.	kg	ptas.	ptas.
1992	December	2,873,675	350,588,350	3,295,650	253,614,100	2,873,675	350,588,350	604,202,450
1993	January	0	0	3,541,965	265,929,850	2,873,675	350,588,350	616,518,200
	February	2,113,650	257,865,300	1,730,265	99,253,450	4,987,325	608,453,650	787,707,100
	March	0	0	1,911,435	108,311,950	4,987,325	608,453,650	716,765,600
	April	0	0	1,911,435	108,311,950	4,987,325	608,453,650	716,765,600
	May	0	0	1,911,435	108,311,950	4,987,325	608,453,650	716,765,600
	June	0	0	5,350,860	378,265,890	4,987,325	608,453,650	986,719,540
	July	0	0	5,350,860	378,265,890	4,987,325	608,453,650	986,719,540
	August	0	0	6,256,710	435,515,610	4,987,325	608,453,650	1,043,969,260
	September	0	0	6,256,710	435,515,610	4,987,325	608,453,650	1,043,969,260
	October	0	0	4,519,410	275,684,010	4,987,325	608,453,650	884,137,660
	November	2,026,850	247,275,700	6,409,335	548,664,540	7,014,175	855,729,350	1,404,393,890
	December	0	0	6,409,335	548,664,540	7,014,175	855,729,350	1,404,393,890

Source: García Negro, Mª do Carme (dir.) (1998): *Valuation of the damages caused by the Aegean Sea oil slick. Report 1997*. Research Team on Fishery Economics and Natural Resources of the University of Santiago de Compostela.

Proxección da produción de mexillón 1997

Ano	Mes	Mexillón tipo 1		Mexillón existéncias		Mexillón tipo 1 acumulado kg	Mexillón tipo 1 acumulado ptas.	Total tipo 1 + exist. acumulado ptas.
		kg	ptas.	kg	ptas.			
1997	Xaneiro			1.393.436	78.959.412		3.893.433.681	3.972.393.093
	Febreiro			1.393.436	78.959.412		3.893.433.681	3.972.393.093
	Marzo			3.900.777	275.755.834		3.893.433.681	4.169.189.466
	Abril			3.900.777	275.755.834		3.893.433.681	4.169.189.466
	Maio			4.561.142	317.490.880		3.893.433.681	4.210.924.512
	Xuño			4.561.142	317.490.880		3.893.433.681	4.210.924.512
	Xullo	1.477.574	180.273.985	3.294.650	200.973.643		4.073.697.617	4.274.671.260
	Agosto			4.672.405	399.976.450		4.073.697.617	4.473.674.067
	Setembro			4.672.405	399.976.450		4.073.697.617	4.473.674.067
	Outubro			5.068.624	460.994.143		4.073.697.617	4.534.691.760
	Novembro			5.068.624	460.994.143		4.073.697.617	4.534.691.760
	Decembro	4.378.872	534.222.328	1.315.306	115.688.845		4.073.697.617	4.723.608.790

Fonte: Fonte: Garcia Negro, Mª do Carme (dir.) (1998): *Avaliación dos danos provocados pola maré negra do Aegean Sea. Informe 1997*, Equipo de Investigación de Economia Pesqueira e Recursos Naturais, Universidade de Santiago de Compostela.

Projection of mussel production 1997

Year	Month	Mussel type 1		Mussel stock		Mussel type 1 accumulated	Mussel type 1 accumulated	Total type 1 + stock accumulated
		kg	ptas.	kg	ptas.	kg	ptas.	ptas.
1997	January			1,393,436	78,959,412		3,893,433,681	3,972,393,093
	February			1,393,436	78,959,412		3,893,433,681	3,972,393,093
	March			3,900,777	275,755,834		3,893,433,681	4,169,189,466
	April			3,900,777	275,755,834		3,893,433,681	4,169,189,466
	May			4,561,142	317,490,880		3,893,433,681	4,210,924,512
	June			4,561,142	317,490,880		3,893,433,681	4,210,924,512
	July	1,477,574	180,273,985	3,294,650	200,973,643		4,073,697,617	4,274,671,260
	August			4,672,405	399,976,450		4,073,697,617	4,473,674,067
	September			4,672,405	399,976,450		4,073,697,617	4,473,674,067
	October			5,068,624	460,994,143		4,073,697,617	4,534,691,760
	November			5,068,624	460,994,143		4,073,697,617	4,534,691,760
	December	4,378,872	534,222,328	1,315,306	115,688,845		4,073,697,617	4,723,608,790

Source: García Negro, Mª do Carme (dir.) (1998): *Valuation of the damages caused by the Aegean Sea oil slick. Report 1997*. Research Team on Fishery Economics and Natural Resources of the University of Santiago de Compostela.

Desta táboa obtemos o valor das perdas nos cultivos de mexillón a 31 de Decembro de 1997, que acadan un monto total de: 5.299.321.760 ptas.

Pero desta cifra habería que descontar as vendas efectivamente realizadas antes de dito ano, correspondentes á produción reiniciada en Maio de 1995. Ante a negativa das empresas productoras a facilitar este dato, optamos por utilizar o noso modelo, do que obtemos unhas vendas por valor de 1.827.483.540 ptas.

Descontando das perdas totais o valor das vendas así calculado, obten-se unha nova cifra de perdas a 31 de Decembro de 1997 por un total de: 3.471.838.220.

Por último, a este valor hai que sumar-lle a cuantia do resultante pola actualización financeira, xa que está calculado a prezos do ano 1992. Utilizando a taxa de variación interanual (Decembro sobre Decembro) do Índice de Prezos ao Consumo xeral para 1993, 1994, 1995, 1996 e 1997 obtemos o valor da perda, que ciframos en: 4.186,331 millóns de ptas.

As cifras que a continuación se ofrecen teñen carácter definitivo. Non obstante, e dado que o coñecemento científico disponíbel indica que os efeitos sobre o medio ambiente, en particular sobre a flora e a fauna mariña, e, polo tanto, sobre as especies que forman parte dese medio, deixan-se sentir ate un prazo que, segundo a especie, pode acadar ate os 25 anos, o cálculo dos danos imputábeis á maré negra do *Aegean Sea* poden efectivamente ver-se incrementados no futuro en función da verificación deses danos.

From this table we obtain the value of losses in mussel cultures as of 31 December, 1997, arriving at a total amount of 5,299,321,760 Ptas.

However, from this figure we would have to discount sales made before the year in question, corresponding to production that was reinitiated in May, 1995. Given the refusal of the producer companies to provide this information, we have opted for using our model, which gives us sales with a value of 1,827,483,540 Ptas.

Discounting from the total losses the value of sales calculated in this way a new figure for losses as of 31 December, 1997, is obtained, for a total of 3,471,838,220.

Finally, to this value we must add the result of a financial updating, since calculations have been done using prices for the year 1992. Employing the rate of inter-annual variation (December to December) of the Retail Prices Indexes for 1993, 1994, 1995, 1996 and 1997 we obtain a value for losses that we set at 4,186,331,000 ptas.

The figures offered below have a definitive character. Nonetheless, given that available scientific knowledge indicates that the effects on the environment, particularly on marine flora and fauna, and thus on the species that form a part of this environment, will be felt over periods which, depending on the species, can be of as much as 25 years, the calculation of the damages attributable to the *Aegean Sea* oil slick may be seen to effectively increase in the future, subject to the verification of those damages.

Máis ainda, a reincidencia en accións desequilibradoras incrementaria o prazo para a recuperación do medio.

En definitiva, ciframos que a avaliación dos danos que afectaron ao recurso obtido na zona e constatábeis a 31 de Decembro de 1997 é de:

36.243,843 millóns de ptas*.

resultado da suma do cálculo de perdas efectuado para a pesca de baixura, marisqueo a pé e cultivos de mexillón da zona.

* Aprox. 217 millóns euros.

Furthermore, the recurrence of actions causing imbalance would increase the period of time requisite for the recovery of the environment.

In short, we set the valuation of the damages affecting the resource obtained in the zone and evident as of 31 December, 1997 at:

36,243.843.000 ptas*.

the result of the sum of the calculation of losses sustained for inshore fishing, shellfish harvesting on foot and mussel culture in the zone.

* Aprox. 217 million euros.

CONCLUSIÓNS DO SEMINARIO
CONCLUSIONS OF THE SEMINAR

Manuel M. Varela Lafuente
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> ... as organizacións turísticas de todos os países mediterráneos moi pronto se van ver obrigadas a imprimir e distribuír un mapa de todos os fermosos areais estragados polas mareas negras.
>
> L. Durrell (1978): *As illas gregas*

Ó longo do seminario tratamos de avanzar en varias direccións ó responder algunhas preguntas:

1. ¿Por que falamos dunha factura social dos danos?, ¿por que non centrarse só no hoxe indemnizable?
2. ¿Cales son os principais conceptos da factura e o seu método de estimación?, ¿cal é o escenario base e os datos de primeira man necesarios?
3. ¿Cal foi ata agora o tratamento destas cuestións na normativa europea? ¿E cales son as reflexións que abre a estratexia norteamericana neste aspecto?
4. ¿Que podemos planear dende a Economía dos Recursos Naturais e Ambientais sobre prevención, responsabilidade ambiental e cuantificación de danos? (En particular en AERNA e para o caso galego).

Throughout the seminar we attempted to advance in various directions by seeking the answers to certain questions:

1. Why do we talk about a social cost of the damage? Why not focus solely on what can be compensated today?
2. What are the principal concepts involved in this cost and how is it to be calculated? What is the basic situation and firsthand data necessary to so?
3. What has been the treatment for these questions in European regulations? What are the considerations that inform American strategy in this respect?
4. What can we propose from the point of view of the Economy of Natural and Environmental Resources as to prevention, environmental responsibility and quantification of damage (in particular in AERNA and in the case of Galicia)?

1. Neste seminario atopamos datos e argumentos para contestar a primeira pregunta en sentido afirmativo, pero tamén nos sucesivos borradores do Programa de Intervención Científica (MCyT 2002:7 e 2003:8) de entre 10 preguntas básicas formuladas hai catro que teñen relación directa coa nosa función:

- ¿Que danos causou e causará á pesca do banco de Galicia e zonas próximas?
- ¿Que perdas causou no marisqueo e pesca litoral das zonas afectadas?
- ¿Canto tempo tardará en recuperarse a biodiversidade e as poboacións de especies comerciais de interese comercial?
- ¿Durante canto tempo non se poderán consumir os productos da zona?

Preguntas que logo dun panel permanente de impactos biofísicos teñen a súa resposta cabal en senllas valoracións económicas. Tamén dende o Goberno Autónomo o Plan Galicia (Xunta 2003:34) asumía facer a "... axeitada e homoxénea avaliación de danos ambientais ocasionados polo accidente do *Prestige*, *incluíndo a súa valoración económica*" (cursivas nosas).

Convén antes de seguir reiterar aquí unha obviedade que, por selo, pode chegar a pasar desapercibida: o producto vertido en cantidade, duración e composición converte esta marea negra en algo diferente ó coñecido ata o de agora. Con máis de tres meses de sucesivas mareas negras sobre unha fronte litoral de máis de 1000 km, con preto xa de

1. In this seminar we find data and arguments with which to answer the first of these questions in the affirmative. In addition, in successive drafts of the Programme for Scientific Intervention (Ministry of Science and Technology 2002:7 and 2003:8), of the 10 basic questions posed four have directly to do with our task:

- What damage was caused and will be caused to fishing on the Galician bank and nearby areas?
- What damage was caused to shellfish production and coastal fishing in the affected areas?
- How long will it take for biodiversity and species of commercial interest to recover?
- How long will it be impossible to consume the products of the area?

Questions that following the work of a permanent panel on biophysical impact find complete and precise answers in corresponding economic assessments. Also, in the Autonomous Government, the Galicia Plan (Xunta 2003:34) assumes responsibility for carrying out an "adequate and homogeneous valuation of the environmental damage caused by the accident of the *Prestige*, including economic evaluation" (our italics).

Before going on it is advisable to repeat here something that is obvious, but which for that very reason may go unnoticed: the product spilled, in terms of quantity, duration and composition makes this oil slick different from anything known up to this time. With more than three months of successive oil slick over a coastline more than 1000 km

40.000 t de fuel no mar e unha incógnita sobre outras 30.000... nada anterior[1] pode asemellarse. O propio documento Ministerial dicía: "El vertido es una mezcla compleja de hidrocarburos cuya remediación por vía biológica puede ser muy lenta... la cantidad vertida hace prever que la permanencia de éste en el ambiente puede ser muy larga, décadas" (MCyT 2002:46) pois é ben sabido que na destilación dos crus obtense:

1º a fracción gasosa: butano, propano, ...
2º os productos brancos: queroseno, gasolina, ...
3º os productos negros: betume, fuel, ...

sendo estes últimos os máis contaminantes e resistentes á biodegradación, mentres os primeiros poden evaporarse en boa medida nun vertido. No caso do *Erika* e para unha cifra vertida que non chega á metade do *Prestige* o seu Ministerio de Ecoloxía e Desenvolvemento Sostible afirma: "... la toxicidad de 10.000 tm de una carga de fuel –FO– puede ser comparable a una carga de 200.000 tm de crudo bruto".

Todo o anterior sitúanos diante de impactos ambientais e económicos de gran dimensión e que, obviamente, fan imprescindible unha avaliación *ad hoc* e non –como puidera ser en catástrofes menores– unha derivada de

1. Un cadro resumo de mareas negras na UE pode verse en Comisión 2000b:42, con datos básicos.

long, with more than 40,000 metric tons of fuel oil already in the sea and another 30,000 an open question, nothing before[1] can compare with it. The report of the Ministry itself says: "The spillage is a complex mixture of hydrocarbons the remedying of which by biological means may be very slow… the quantity of the spill makes it foreseeable that its permanence in the environment may be very long, perhaps decades" (Ministry of Science and Technology 2002:46) since it is well known that from the refining of crude oils we obtain:

1º gaseous fraction: butane, propane, ...
2º white products: kerosene, gasoline, ...
3º black products: bitumen, fuel oil, ...

and that the latter are the most pollutant and most resistant to biodegradation, while the former can at a great extent evaporate during a spill. In the case of the *Erika* and for a quantity of oil spilled that was not even half of that of the *Prestige*, the Ministry for Ecology and Sustainable Development stated: "... the toxicity of 10,000 metric tons of a cargo of fuel oil –FO– can be comparable to a cargo of 200,000 metric tons of crude oil".

All of the above places us before environmental and economic consequences on a grand scale which obviously make absolutely essential an ad hoc valuation and not – as might be

1. A table summarising oil slicks in the EU can be seen in Commission 2000b:42 with basic data.

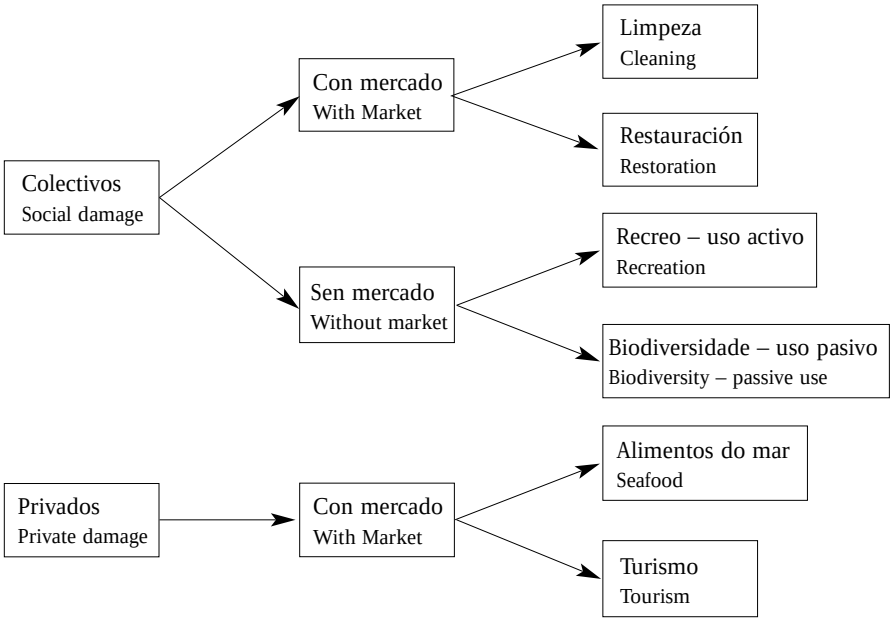
transferencias de danos estimados noutras mareas (Grigalunas *et al.* 1998:74).

Para facelo no concepto de "custo social dunha marea negra" queremos incluír nunha mesma "factura" unha avaliación económica global dos danos que sexa útil[2] non só –nin principalmente– para efectos de indemnizacións efectivas senón, sobre todo, útil no que atinxe á prevención. É dicir, ás modificacións que se fan inaprazables xa sobre o ámbito,

done in the case of catastrophes of lesser impact – a valuation based on tranfering estimations of damages in other oil slicks (Grigalunas et al. 1998:74).

To do this with regard to the concept of "social cost of an oil slick" we wished to include in the same cost estimate an overall economic valuation of damages that would be useful[2] not just – or even principally – for purposes of effective compensation but would rather be most of all of use in terms of

Danos ós recursos naturais e ambientais nunha marea negra
Damage to natural and environmental resources in an oil slick



Elaboración propia / Own elaboration.

2. Hay e Thébaud 2002:3.

2. Hay & Thébaud 2002:3.

contías e procedementos de responsabilidade ambiental nos vertidos por hidrocarburos nas augas da UE.

2. Estamos, daquela, entrando xa na segunda pregunta. Ó falar de avaliación global e de todos os danos, temos que incluír[3] os valores perdidos tanto de mercado como sen mercado, os gastos de limpeza, os programas de restauración e todos os custos de oportunidade relevantes.

En xeral os danos privados dispoñen de mercados para a súa avaliación pois afectan a actividades económicas (pesca, marisqueo, hostalería, restauración, etc.) a través do impacto directo ó recurso natural danado polo vertido: o mar como recurso alimentario e o litoral como recurso para atraer visitantes. Non adoitan presentarse aquí problemas insuperables para a súa inclusión no marco[4] FIDAC-OMI aplicable na UE aínda que si para a súa concreta cuantificación e total pago.

Polo contrario os danos colectivos poden (ás veces si, ás veces non) ser avaliados a través de indicadores de mercado e engloban os prexuízos directos producidos en recursos naturais e ambientais. Danos e prexuízos que teñen un marcado carácter social e/ou público. Xa nun acordo xudicial[5] de referencia nos EE.UU. con motivo do *Exxon Valdez* recoñecíanse estes danos directos ós recursos naturais nesta enu-

prevention. In other words, in terms of the modifications that cannot now be postponed with regard to the scope, amounts and procedures for establishing environmental liability for spills of hydrocarbons in the waters of the EU.

2. We thus now approach the second question. When speaking of overall evaluation and of all the damage, we must include[3] the losses in terms of both market and non-market costs, the costs of cleaning, restoration programmes and all relevant opportunity costs.

In general, private damages have markets for their evaluation, since they affect economic activities (fishing, shellfish harvesting, hotels, restaurants, etc.) through direct impact on the natural resource damaged by the spill: the sea as a food source and the coast as a resource that attracts visitors. Insurmountable problems do not tend to appear against their inclusion in the IOPC Funds-IMO framework[4] applicable in the EU, but they do appear with regard to their specific quantification and total payment.

On the other hand, collective damages can (sometimes yes and sometimes no) be evaluated through market indicators and include direct damage done to natural and environmental resources. Damages and prejudicial consequences that have a marked social and/or public nature. In the judicial decision[5] taken in the U.S. on the case of the *Exxon Valdez*, direct damages to natural resources

3. Grigalunas *et al*. 1986:257.

4. Serían as perdas reclamables de beneficios (FIDAC 2002:7).

5. USDC 1991:5-6.

3. Grigalunas et al. 1986:257.

4. These would be losses claimable for IOPC Funds 2002:7 benefits.

5. USDC 1991:5-6.

meración textual: "... perdas en valores de uso, de non-uso, opción, recreo, herdanza, existencia, excedente do consumidor, rendas económicas, e outras semellantes...", conceptos que, ó longo deste seminario, foron obxecto de consideración e precisión.

3. Na mesma liña e máis recentemente[6] a Comisión Europea planeaba avaliar os danos para coñecer o valor dos recursos naturais e dos servicios perdidos incluíndo: "... recursos vivos e non vivos como a terra, os hábitats, a fauna, o medio natural, o medio biótico, o aire, as augas soterradas e superficiais, e os ecosistemas"; consecuentemente, na proposta de Directiva (COD 2002/0021) de Responsabilidade Ambiental na UE (art. 2.1.19) o valor total do dano incluirá:

i) "... o valor que as persoas consigan como consecuencia da utilización directa do recurso natural";
ii) "... o valor que as persoas atribúan ós hábitats e ás especies con independencia da súa utilización directa".

O grave problema vai ser aquí que o tráfico marítimo de hidrocarburos, e a responsabilidade ambiental derivada dos seus vertidos, exclúese explicitamente polo de agora no borrador da dita directiva (art. 3.3).

Así as cousas, neste segundo caso dos danos directos ós recursos naturais e ambientais por unha marea negra, no marco actual da UE esta-

6. Comisión 2000:51-52.

were recognised and enumerated in the text: "… losses in use and non-use values, option values, recreation, heritage, existence, consumer surplus, income and other similar values…" concepts that throughout this seminar were the object of consideration and specification.

3. Along the same line, and more recently[6], the European Commission proposed evaluating damages in order to establish the value of natural resources and services lost by including: "... living and non-living resources, such as the earth, habitats, fauna, the natural environment, the biotic environment, subterranean and surface waters and ecosystems"; consequently, in the proposal for the EU Directive (COD 2002/0021) on Environmental Liability (Art. 2.1.19) the total value of the damage will include:

i) "... the value that people obtain as a consequence of the direct use of the natural resource";
ii) "... the value that people attribute to habitats and species regardless of their direct use".

The serious problem here is going to be that maritime hydrocarbon traffic and the environmental responsibility deriving from its spillage is explicitly excluded from the directive cited above (Art. 3.3.).

As things stand, in this second instance of direct damage to natural and environmental resources caused by an oil slick, within the framework of the

6. Commission 2000:51-52.

mos diante dunha clara primacía do enfoque de mercado, enfoque que exclúe a avaliación e reparación dos danos sociais que poidan exceder dos custos dos programas de limpeza e restauración[7]. Pois deixando a un lado os danos directos que implican uns maiores ou menores desembolsos na retirada, limpeza e xestión do hidrocarburo de mar e terra (e nos que o único que se discute é a súa adecuación, contía e custos de oportunidade) que adoitan ser aceptados polo FIDAC-OMI, as perdas en usos recreativos non se aceptan e as ecolóxicas só, se acaso, na contía estricta dos custos de restauración (Hay e Thébaud 2002:23).

Estes danos directos sen mercado (de uso / recreo) (de non uso / ecosistemas), dado o seu carácter público e colectivo, provocan que só poida reclamalos o Goberno –logo dunha superación das dificultades técnicas para avalialos– se o marco legal o permite... Cando, como sucede na UE, non é así, saliéntanse os meros custos de limpeza e restauración (Grigalunas *et al.* 1998:63).

Este marco de responsabilidade descansa nunha dobre e dubidosa suposición:

i) que as medidas de restauración -que si se sufragan- poden "situar el lugar dañado en el mismo estado ecológico" e que "un derrame importante de hidrocarburos no causará daños permanentes al medio marino" (FIDAC 2002:29);

7. Só medidas razoables de restauración (FIDAC 2002:7).

EU, priority is clearly given to a market approach that excludes evaluation and repair of social damage that might exceed the costs of cleaning and restoration programmes[7]. Thus, leaving aside the direct damages which imply greater or lesser outlays for the removal, cleaning and handling of the hydrocarbon from sea and land (in which the only question under discussion is their adaptation, amount and opportunity costs) and which tend to be accepted by IOPC Funds-IMO, losses in terms of recreational uses are not accepted and ecological losses are only considered in the amount considered for restoration costs (Hay & Thébaud 2002:23).

These direct damages with non-market costs (use/recreation; non-use/ecosystems), given their public nature, can only be claimed by the Government – once surmounted the technical difficulties involved in evaluating them – when the legal framework so permits. When, as occurs in the EU, this is not the case, basic costs of cleaning and restoration are emphasised (Grigalunas et al. 1998:63).

This liability framework rests upon a double, doubtful supposition:

i) that restoration measures – if they are defrayed – can "restore the damaged area to the same ecological condition" and that "a significant spill of hydrocarbons will not do permanent damage to the marine environment" (IOPC Funds 2002:29);

7. Reasonable restoration measures (IOPC Funds 2002:7).

ii) que verbo de eventuais cuantificacións en termos monetarios dos danos ó medio natural "El Fondo no tendrá en cuenta reclamaciones por daños al medio ambiente tomando como base una cuantificación abstracta calculada conforme a modelos teóricos" (FIDAC 2002:30).

Dubidosa pois se, por unha banda, algúns danos se prolongan (como nos relatou M. MacCammon para Alasca máis de dez anos despois) moi a longo prazo no tempo, e a recuperación ambiental nunca será total, por outra, hoxe contamos xa con ferramentas[8] para avaliar as perdas "transitorias" sociais de benestar que se están a producir no longo prazo.

Non facelo así (é dicir, identificar os danos sociais sen mercado cos custos dos programas de restauración)[9] supón aceptar como real un virtual regreso ó día antes do vertido, supón renunciar a que se indemnicen os valores non comerciais danados e, ó cabo, eximir o causante do dano do pago total deste. Se a parte en cuestión é cuantiosa, daquela non só é unha estafa social senón –poida que máis importante– un estímulo perverso a que seguir contaminando sexa "barato".

ii) that with regard to incidental quantifications in financial terms of the damages to the environment, "The Fund will not take into account claims for damages to the environment taking as a basis an abstract quantification calculated according to theoretical models" (IOPC Funds 2002:30).

Doubtful since, on one hand, some damage is prolonged (as M. MacCammon described in Alaska more than ten years later) and of long-term effect and environmental recuperation will never be total, on the other hand because today we have tools[8] to evaluate "transitory" losses in social welfare that occur over long-term periods.

Not doing so (in other words, identifying non-market social damage with the costs of the restoration programmes)[9] signifies accepting as real a virtual return to the day before the spill, signifies renouncing the possible indemnification for damaged non-commercial values, and, finally, exempting the agent of the damage from total payment for it. If the part in question is a significant amount, this is not only a social fraud but also – perhaps more importantly – a perverse stimulus for continuing to pollute to continue to be "cheap".

8. Fronte ás demandas baseadas nos custos razoables da recuperación as demandas baseadas "en la utilización de técnicas de avaliación como los costes de transporte o evaluación contingente... no son aceptadas" (Thébaud 2002).

9. Ambos os dous son independentes (MacAlister 2001:47).

8. As opposed to claims based on reasonable restoration costs, demands based "on the use of valuation techniques such as transport costs or contingent valuation… are not accepted" (Thébaud 2002).

9. Both are independent (MacAlister 2001:47).

Este diagnóstico non é novo; tanto sobre a necesaria ampliación da actual definición de danos causados pola contaminación (Comisión 2000b:37), como sobre que o dano ecolóxico debe ser recoñecido e precisado (CESF 2000:111) e con que métodos de avaliación continxente pode ser medido (Ministère 2000) vaise abrindo, paseniñamente, na UE un amplo consenso.

4. Coa elaboración da devandita factura queremos contribuír a unha análise rigorosa para o caso do *Prestige* que, recoñecendo a estructura e limitacións do actual marco de responsabilidade ambiental, permita formular a súa necesaria modificación e actualización tanto no relativo ós danos directos –en boa medida sociais– das mareas negras, como ós comerciais. Pois, sen dúbida, se o *E. Valdez* supuxo un custo de limpeza e restauración de máis de 3000 millóns de dólares, algo insólito sucede cando o sistema FIDAC-OMI se gaba, pola súa banda, de liquidar 120 sinistros por 600 millóns de euros.

Xa foran estas as leccións do *Erika* "os responsables das mareas negras deben garantir a reparación dos danos de toda natureza, sexan económicos ou non" (CESRPL, 2000:77), o que implicaba xa entón "situar os importes de indemnización do FIPOL á medida dos danos causados" (CESRPL, 2000:79), dado que o límite actual (FIDAC-FIPOL) de aproximadamente 180 millóns de euros considerábase insuficiente (CESF 2000:18) e cunha metodoloxía e enfoque que dificulta en boa medida a cuantificación dos danos ó medio natural. Pouco pode-

This diagnosis is not new; a broad consensus is taking shape, step by step, in the EU with regard to the need to expand the current definition of damage caused by pollution (Commission 2000b:37) and in the conviction that ecological damages should be recognised and specified (CESF 2000:111) and that methods of contingent valuation make it possible to measure them (Ministère 2000).

4. With the preparation of our bill for social costs we wish to contribute to a serious analysis of the *Prestige* incident that, recognising the structure and limitations of the current legal framework of environmental liability, would make it possible to propose its necessary modification and up-dating both with regard to the direct damage – in large part social damage – due to oil slicks, as well as to the indirect or commercial damages. Since without a doubt if the *E. Valdez* signified a cost in cleaning and restoration of more than 3000 million dollars, something peculiar is occurring when the IOPC Funds-IMO system boasts on its part of settling 120 accidents with € 600 million.

The lessons of the *Erika* were "Those responsible for oils slicks must guarantee the repair of damages of all kinds, whether economic or not" (CESRPL, 2000:77), which already implied then, "Fixing the total amounts of FIPOL compensations in accordance with the damage caused" (CESRPL, 2000:79), given that the current limit (IOPC Funds-FIPOL) of approximately 180 million euros was considered insufficient (CESF 2000:18), with a methodology that made it difficult to quantify the damage

mos engadir no noso caso cando só os gastos de limpeza e mitigación do *Prestige* estímanse xa en máis de cinco veces[10] ese límite.

Seguimos aínda moi lonxe do que formula o Libro Branco sobre Responsabilidade Ambiental na UE (Comisión 2000:14) que "... o principio de responsabilidade ambiental fai posible a prevención dos danos e a internalización dos custos ambientais".

No que atinxe ó papel de AERNA, debemos subliñar o seguinte:

- Posto que o papel da Economía é amplo e importante, seméllanos que, ademais das iniciativas individuais ou de grupo de investigación –e ó fío destas– para estudiar e achegar algo sobre o problema, procede outra iniciativa de alcance distinto, máis amplo e de confluencia entre esas iniciativas.
- É dicir, consideramos positivo propoñer un marco para os posibles debates ou posta en común das ideas: AERNA ofrece un moi axeitado pola súa propia definición e dimensión.
- Consideramos tamén que podemos contribuír a abrir un eido para posibles colaboracións de carácter complementario ou coordinado: proxectos, etc. que favorezan a eficiencia e eviten duplicidades.

10. No *Amoco Cadiz* (Thébaud 2002) os danos triplicaron as indemnizacións (146 M euros) e para o *Erika* quintuplicarían o tope FIDAC.

to the environment. There is little that we can add in our case, when the costs of cleaning and relief in the *Prestige* affair are already estimated at more than five times[10] that limit.

We still continue to still be far from the recommendation of the White Paper on Environmental Liability in the EU (Commission 2000:14) that "... the principle of environmental liability makes possible the prevention of damage and internalisation of environmental costs".

With regard to the role of AERNA, we should emphasise the following:

- Given the extensive and important played by the economy, it seems to us, that, in addition to individual or research group initiatives – and in line with them – to study and contribute to the solution of the problem, it would be advisable to undertake another initiative that is different and broader in scope, acting to bring together those initiatives.
- In other words, we consider it would be positive to propose a framework for possible debates or interchanges of ideas: AERNA, due to its definition and scope, offers a fully adequate framework.
- We also consider that we can contribute to open up a forum for possible cooperation of a complementary or coordinated nature – projects, etc. – that promote efficiency and avoid duplications.

10. With *Amoco Cadiz* (Thébaud 2002) damages tripled the compensations (146 M euros) and for the *Erika* they quintupled the IOPC Funds limit.

- E, así mesmo, a dispor de garantías de calidade científica. AERNA non só integra profesionais españois e portugueses de prestixio senón que está en condicións de conseguir a colaboración e a avaliación doutros profesionais europeos e americanos.

Con este espírito, AERNA acordou:

1. Constituír no seu seo un Grupo de Investigación sobre o *Prestige*.

2. Emitir, no seu momento, un informe sobre os efectos económicos, sociais e ambientais da marea negra do *Prestige*.

Para o caso de Galicia, estas liñas de estudio, e estes principios ou ideas, han ser o punto de partida dun traballo de investigación de ámbito galego sobre os efectos económicos e os custos relativos á marea negra do *Prestige*. Este estudio está a ser promovido polo Consello Económico e Social de Galicia.

Este proxecto responderá ás necesidades temporais dun estudio deste tipo, expresadas neste seminario. Nel participaremos investigadores galegos de diferentes equipos e contaremos coa colaboración e asesoramento científico de economistas ambientais de recoñecido prestixio, membros de AERNA e participantes neste seminario, así como algúns outros expertos internacionais neste ámbito de estudio.

- and at the same time look for guarantees of scientific quality. AERNA is not only made up of prestigious Spanish and Portuguese professionals but is also in a position to obtain the cooperation and evaluation of other European and American professionals.

In this spirit, AERNA has agreed:

1. To form within its organisation a Research Group on the *Prestige*.

2. To issue, at the appropriate moment, a report on the economic, social and environmental effects of the *Prestige* incident.

For the case of Galicia these lines of study and these principles or ideas are going to be the starting point for research work on a Galician scope on the economic effects and costs relating to the *Prestige* oil slick. This study is promoted by the "Consello Económico y Social de Galicia" (Economic and Social Council of Galicia).

This project will correspond to the requirements in terms of time of a study of this type, as expressed in this seminar. Participating in it will be Galician researchers from different teams, and we will also have the benefit of the cooperation and scientific advice of prestigious environmental economists, AERNA members and participants in this seminar, as well as other international experts in the fields touched upon in the study.

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COLECCIÓN B A S E

Evitar un novo *Prestige*. ¿Pode a Economía Ambiental axudar a conseguilo? Se o lector deste libro compara os efectos das avaliacións de danos sobre os responsables das mareas negras nos EE.UU. (*Exxon Valdez*) e Europa (*Erika, A. Sea, ...*) caerá na conta de onde temos grandes eivas que corrixir.
Os autores dos distintos capítulos –voluntariado internacional dunha análise de urxencia– sinalan as luces e sombras coas que especulan os que converten aforros privados en catástrofes públicas.

To avoid another *Prestige*. Can Environmental Economics help to achieve this? If the reader of this book compares the effects of natural resource damage assessments on liability regarding oil spills in the U.S.A (*Exxon Valdez*) and Europe (*Erika, A. Sea, ...*), she will realize of the serious weaknesses that need to be urgently corrected.
The authors of the different chapters – international volunteers for an urgent analysis – point out to the lights and shadows of the business that turn private savings into public catastrophes.

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SECCIÓN DE CIENCIA, TÉCNICA E SOCIEDADE