

ANALYSIS

Estimating the short-term economic damages from the *Prestige* oil spill in the Galician fisheries and tourism

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Abstract

The *Prestige* oil spill may be considered as one of the worst in the last years because of the amount of oil spilled (59,000 tons at the moment) and the wide zone affected: almost all the coastline in Galicia (Spanish region with a very important coast fishing and tourist activity) and some points in North Spain and in Southwest France. In this paper, we estimate the short-term economic damages from the *Prestige* oil spills in the Galician fishing and tourist activities. The economic losses arising from the *Prestige* oil spill exceed those items that can be indemnified under the IOPC system. Their magnitude could reach 5 times more than the applicable limit of compensations in the *Prestige* case. The consequence is net losses from repeated oil spills and internationally accepted incentives to risky strategies in the marine transport of hydrocarbons.

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1. Introduction

Over ten events of oil tankers with important wastes have occurred in Europe since 1967. The Atlantic coast is in one of the main routes of the oil tankers and is the most affected zone with nine events (Table 1). And the oil tanker *Prestige*, loaded with a cargo of 77,000 tons of heavy bunker oil, ran into problems off the Galician coast (NW Spain) on November 13, 2002. After several days following an

erratic path and spilling 19,000 tons, the tanker finally sank 130 miles west off the Southern coast. In the following months, 40,000 tons of oil leaked into the sea with large slicks drifting towards the Galician coast, and later to the Cantabrian and French coasts. This oil spill may be considered as one of the worst in the last years because of the amount of oil spilled and the zone affected: almost all the coastline in Galicia, some points in North Spain and in Southwest France. Galicia can be considered the *region or ground zero* in relation to the damage caused by the black tides from the *Prestige*.

Galicia, located in the Spanish North West, is a region with a very important coastal fishing and tour-

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Table 1
Principal events of oil tankers in Europe

Vessel	Date event	Place event	Waste (tons)
Torrey Canyon	1967	UK/France	11,900
Urquiola	1976	Spain	100,000
Amocco Cadiz	1978	France	223,000
Betelgeuse	1979	Ireland	44,000
Haven	1991	Italy	144,000
Aegean Sea	1992	Spain	74,000
Braer	1993	UK	85,000
Sea Empress	1996	UK	72,000
Erika	1999	France	20,000
Prestige	2002	Spain	77,000

Source: European Commission, (2000): COM (2000) 142/2, 22.6.2000, Brussels.

ist activities. In 2001, the fishing and aquaculture activities contributed 2.23% of the Galician gross value added and this sector employs around 33,000 people directly (see Table 2). Regarding tourism for the regional economy of the Galicia, the tourist expenses are significant (Consellería, 2004; Exceltur, 2003), which reach 5.73% of the gross added value of the economy and a percentage of something lower in employment terms (see Table 2). The official statistical sources (www.iet.tourspain) on the sector directly associate half of the tourist-recreational uses registered in Galicia to the enjoyment of the coast (beaches, landscapes, gastronomy, etc.).

The economic effects caused by pollution events have been examined in a number of studies, and progress has been made in our understanding of the magnitude of the costs associated with the release of toxic or hazardous substances into the fish habitats, both from theoretical and applied point of view (Bonnieux and Rainelli, 1993, 2004; Carson et al., 1992, 1996; CESRPL, 2000; Cohen, 1995; Collins et al., 1998; Grigalunas and Opaluch, 1993; Grigalunas et al., 1986, 1998, 2001; Hanemann and Strand, 1993; Prada, 2001).

The aim of this article is to present a short-term economic assessment of damages from the *Prestige* oil spill in the Galician fishing and tourist sectors. The social cost approach has been adopted to show the limitations of the current institutional framework of liability. The paper is structured as follows. In Section 2, the different components of social costs of an oil spill are discussed. Section 3 deals with the estimation of short-term economic damages in fisheries. In Section 4, an estimation of damages to tourism is presented. The cleaning and restoration costs are showed in Section 5. The paper closes with a final reflection.

2. The social costs of an oil spill

The assessment of the social cost of an oil spill deals with a more comprehensive set of damages than the usual assessments carried out for compensation purposes. In the more general approach, private costs and collective or public damages are included (see Fig. 1). Private costs are those related to the fisheries and seafood sector (extractive, transport, processing and marketing firms) and to tourism on coastal areas. These are private costs because a limited group of individuals is affected and they are associated to economic activities for which market values are available. The liability framework of the International Oil Pollution Compensation (IOPC) Fund, a convention adopted under the auspices of the International Maritime Organization (IMO), compensates for these losses, once quantification and proof are provided. When the oil tanker *Prestige* sank, the compensation limits were established in 180 million euros. After this event, the IOPC system introduced the Supplementary Fund and the compensation limits were increased until 940 millions.

Collective or public losses are usually identified with cleaning and restoration costs. Direct expenses

Table 2
The Galician fishing and tourist sectors in 2001 (current prices)

	Total in Galicia	Fishing and aquaculture	%	Tourism	%
Production (1000 euros)	68,235,608	1,193,475	1.75	3,811,188	5.59
Gross value added (1000 euros)	32,460,588	722,310	2.23	1,859,603	5.73
Employment	1,107,907	34,851	3.15	51,899	4.68

Source: Instituto Galego de Estatística, Cuentas económicas.

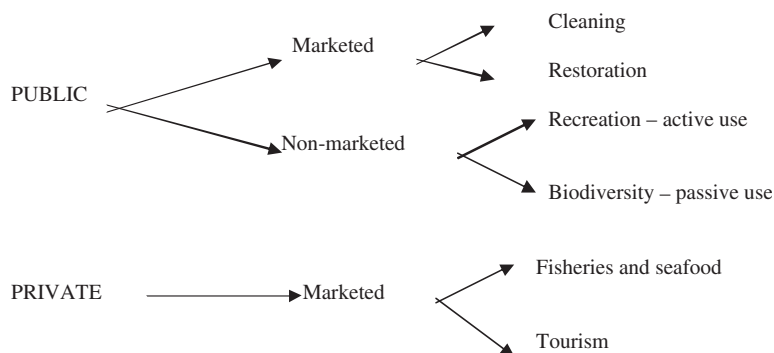


Fig. 1. Components of social costs of an oil spill.

on these issues are easily available because they are related to services and goods also bought and sold in markets. The IOPC/IMO system compensates for these expenses under the assumption that natural resources and the environment do recover the same state they had before the spill once restoration has been undertaken. Then the costs that can be indemnified by IOPC include the losses on fisheries, seafood sector and tourism only on coastal areas, and the cleaning and restoration costs.

However, lost recreation opportunities for residents (use of beaches, landscape, etc.) and passive use losses (cultural, existence and heritage values) are social damages not suitable for compensations because they have no markets to be interchanged and, consequently, market prices were not available. Nevertheless, there are non-market valuation methods available and accepted as reliable to estimate collective non-marketed losses. In the current international liability framework these claims are still not allowed, which implies that risky strategies of maritime transport are still profitable.

3. Economic damages in the fishing sector

We should distinguish the short-term effects valuation of those effects that will be felt in a medium/long-term period. In a short-term period, the valuation consists of calculating the economic losses in the fishing income derived from the variations in the

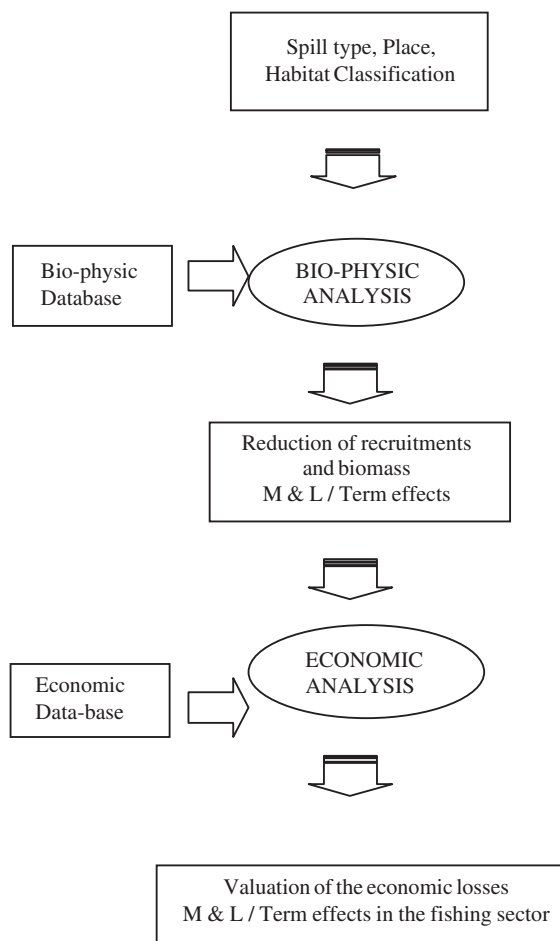


Fig. 2. Analysis of valuation of damages.

Table 3
Fishing production in coastal fish markets (first sale) in Galicia

		Reference Period (1998–2002) ^a		After <i>Prestige</i> situation (2003)		Difference	
		Tons	1000 € –03	tons	1000 € –03	tons	1000 € –03
2002	N	6551.03	15,554.53	3451.10	12,237.26	– 3099.93	– 3317.27
	D	4726.28	18,597.57	525.96	3375.23	– 4200.32	– 15,222.34
2003	J	4269.32	11,488.47	453.47	1340.43	– 3815.86	– 10,148.04
	F	4922.32	12,149.19	1389.06	4128.26	– 3533.26	– 8020.93
	M	4770.52	11,646.53	2181.53	6842.33	– 2588.99	– 4804.20
	A	5178.39	10,981.48	2478.41	7814.49	– 2699.98	– 3166.99
	M	6166.98	12,823.27	3088.36	9859.50	– 3078.63	– 2963.77
	Jn	6517.98	13,201.87	3749.86	9169.11	– 2768.12	– 4032.76
	J	6281.84	14,649.41	5752.29	13,067.21	– 529.55	– 1582.20
	A	7391.74	16,050.32	5446.34	12,636.22	– 1945.40	– 3414.11
	S	7169.84	13,163.86	7226.29	13,939.53	56.44	775.67
	O	6651.60	14,654.07	6787.06	16,788.96	135.46	2134.90
	N	6551.03	15,554.53	4927.73	12,950.40	– 1623.30	– 2604.13
	D	4726.28	18,597.57	3707.74	19,034.49	– 1018.54	436.92
	2002	11,277.31	34,152.10	3977.06	15,612.50	– 7300.25	– 18,539.61
	2003	70,597.85	164,960.58	47,188.13	127,570.93	– 23,409.72	– 37,389.65
	Total	81,875.16	199,112.68	51,165.19	143,183.43	– 30,709.97	– 55,929.26

Source: Own compilation from: [Consellería de Pesca e Asuntos Marítimos de la Xunta de Galicia \(2003\)](#): Estadísticas de Producción Pesqueira. Plantaforma Tecnológica da Pesca: [www.pescadegalicia.com](#).

^a The reference period is 1997–2001 for the November and December months.

captures of the affected species.¹ Thus, for fishing, strictly, the captures will be considered, monthly preferably, by species (*i*) and they will be compared with the equivalent ones in the previous year that the pollution took place:

$$V_{it}^{SC} - V_{it}^C = [p_{it}^{SC} h_{it}^{SC}] - [p_{it}^C h_{it}^C] \quad \forall i, t \quad (1)$$

where the superscript *SC* and *C* indicate, respectively, the situations without pollution and with pollution due to the spill and *p* denotes the unitary price of the captures (*h*).

With regard to medium/long-term valuations, the Economy depends on Biology to be able to proceed to this valuation (see Fig. 2). So it is necessary to know the situation and evolution of the affected marine resources. In particular, it is necessary to know the losses of adults and juveniles for the different groups of species. They will be bigger in the sedentary spe-

cies, the loss of larvae², the possible genetic and behaviour alterations, etc.

Expression (1) is transformed now in:

$$\sum_i \int_{tc}^T [V_i^{sc}(t) - V_i^c(t)] e^{-\rho t} dt, \quad \forall i \quad (2)$$

where *tc* indicates the instant when the contamination takes place; *T* is the instant when *i* species recovers; ρ denotes the social rate of discount. The results will depend anyway on the future captures that in turn depend of the stock level. The usual thing is to consider such an effect a relationship of the type $h_i(t) = q_i x_i^\alpha(t) e_i^\beta(t)$ where h_i is the captures of the species *i*, x_i is stock size, *e* is the fishing effort, q_i is the species capturability coefficient *i*; and α and β are parameters that represent the stock elasticities and effort, respectively.

Regarding the short-term results, given the wide extension of the area affected by the *Prestige*, and that in the near coast 80% of the Galician coastal fleet is located (Rias of Vigo, Pontevedra, Arousa and the western area of the county of A Coruña), including

¹ We are only including the differences in income but not in costs. In the compilation process the response from the fishermen was very low, and the final sample was not significant from statistical point of view, especially in the more artisanal or traditional segments. The figures on income used in this section were obtained from official sources.

² As well as in the case of marketed species as if it forms part of the foodchain through the predator–prey relationship, and rebounding on future recruitments and on the biomass in a medium-term.

Table 4
Aquaculture production in Galicia

	Mussel		Turbot		Total	
	tons	1000 € –03	tons	1000 € –03	tons	1000 € –03
Reference P. (1998–02)	249,729.85	146,330.00	3231.70	28,781.10	252,961.55	175,111.10
2003	246,956.10	138,834.30	3141.20	27,299.70	250,097.30	166,134.00
Difference	– 2773.75	– 7495.70	– 90.50	– 1481.40	– 2864.25	– 8977.10

Source: Own compilation from Ministerio de Agricultura, Pesca y Alimentación: www.mapya.es/jacumar; Organización de Productores Mexilloeiros de Galicia (OPMEGA), and Consellería de Pesca e Asuntos Marítimos da Xunta de Galicia (2003).

shellfish-gathering areas as well as most of aquaculture facilities (specially mussels cultivated on rafts), we should estimate a high rate of incidences. The data of landings and income by month for whole species from coastal Galician fleets are showed in Table 3. And the annual aquaculture production, mussel and turbot, is showed in Table 4 (in the turbot case, there are no monthly figures).

Because of the spawning crisis in some species (e.g. sardine and hake), storms and rainy weather, and the red tides (in the mussel case) in the last 3 years (Pazos, 2004), we will use average data for the period 1998–2002 as the reference situation, instead of 2001–2002. So for the fishing activity, we will compare the monthly data of 2003 with the equivalent ones in period 1998–2002; and the data corresponding to November and December 2002 will be compared with the average data for 1997–2001. For the aquaculture activity, we will use the annual data for period 1998–2002 as a reference situation.

From these estimations we obtain a decrease about 34,000 of tons and 65 millions euros between both periods for the aquaculture and coastal fishing production as a whole.³ This decrease represents a loss of 10.00% in the produced tons and 17.34% in the corresponding sale incomes. Since the fall in incomes is greater than in the physical production, it means the prices too went down probably because of a lost in the consumer's trust.

³ On other hand, the affected fishermen and other people closely connected with the fishing activity (sellers, traders personal from producer organizations, etc., approximately 19,000 persons, fishermen included) received subsidies from the regional and central governments during the closed season. This amount was estimated in 52 million euros for 2003 (Consellería da Presidencia, Xunta de Galicia www.xunta.es). It probably helped to reduce the individual effects from oil spill.

The most significant loss corresponds to the fishing production with 31,000 tons and 56 million euros. This sharp fall is produced basically in November and December in 2002 and in the first 6 months in 2003, when many fisheries (into Rias specially) were closed for fishing. In the aquaculture sector the economic losses are lower than in the fishing (3000 tons and 9 million euros, respectively). The mussel production (in tons and value) goes down notably in comparison with the turbot production. On other hand, taking into account that the fishing costs are not included and the fishermen saved same running costs (e.g. fuel) after spill since vessels were idle during several weeks, probably the figure obtained in this section are overestimating the damages. However, these figures can indicate the magnitude of the effects from the oil spill.

4. Losses in the Galician tourist sector

For the tourist-recreational uses that now we will analyse, it can be useful specially to observe that the majority of the Galician beaches received in more or smaller degree fuel-oil stains during the weeks and months following the shipwreck (CES, 2003). For our purposes, we will distinguish three main types in those uses depending on the number of overnight staying: excursions (visits without spending nights; then these visits correspond to Galician residents and from North Portugal), weekend trips (visits spending less of four nights) and trips (visits with more of three nights).⁴ At the same time, these tourism flows can come from Spanish regions or other countries. The number of

⁴ There are 1599 establishments (hotels, camp sites, inns and rural tourism) that offer something less than 85,000 lodgings according to www.turgalicia.es.

Table 5
Tourism flows in Galicia

Type of visit	Reference Period (2002)		After <i>prestige</i> situation (2003)		Difference	
	Overnight staying (million)	Million € –03	Overnight staying (million)	Million € –03	Overnight staying (million)	Million € –03
Domestic excursions	16.90	211.25	14.43	170.25	– 2.47	– 41.00
Rest excursions ^a	3.60	149.40	3.11	128.97	– 0.49	– 20.43
Trips from Spain	21.70	883.19	22.35	911.47	0.65	28.28
Trips from other countries	10.30	477.92	8.16	384.62	– 2.14	– 93.30
Weekend visits	8.60	107.50	8.16	100.20	– 0.44	– 7.3
Total	61.10	1829.26	56.21	1695.51	– 4.89	– 133.75

Source: Own compilation from: Ministerio de Economía-Instituto de Estudios Turísticos (2003a,b): “Movimientos turísticos de los españoles”, www.iet.tourspain.es/paginas.

^a From North Portugal.

overnight staying and the tourism incomes for Galicia in 2002 and 2003 are showed in Table 5. The year 2002 will be the reference situation in the tourist case.

After *Prestige* oil spills, the number of overnight staying and incomes decrease in 5 millions and 134 million euros, respectively; these figures represent a fall close to 8% in both of them. Basically, it is due to the domestic excursions and trips from other countries. The number of overnight staying corresponding to these visits fell over 15% and 21%, respectively. However, the visits came from Spain increase lightly (3%), but it is not enough to compensate for the sharp fall in the other concepts. Regarding on the losses in tourism incomes, again the domestic excursions and visits that came from other countries go down notably by 19% and 20%, respectively.

5. Cleaning and restoration costs

In the case of Galicia, the coastal natural heritage affected has been very important. Great part of the

coast is integrated by Rias, rich ecosystems in biodiversity but extremely sensitive, that gives place to wetlands, sandbanks and diverse formations of great ecological interest. In February of 2003, approximately 1000 km of Galician coast had been affected in a higher or lower degree by the oil-spill, among which were 745 beaches. However, the impact is more persistent and it has been much worse estimated in rocks, cliffs, swamps, dunes and seabed, in which it is also more difficult the natural cleaning, and more harmful the human intervention. Great part of these coastal ecosystems is protected officially, as for example the Atlantic Islands National Park (the only Galician national park and one of the 13 Spaniards) and 38 protected species, in danger of extinction.

The current regime of compensations in the IOPC system compensates the environmental losses “until the reasonable costs of cleaning and restoration”, under the supposition that the environment may fully recover the state prior to the incident. In Spain it has been considered the costs of cleaning and restoration in, at the moment, 559 million Euros,

Table 6
Cleaning and restoration in some oil spills

Black tide	Type	1000 tons	KM	Cost (\$M or euros)	Cost per tons (\$ or euros)	I	II
A. Cadiz (1978)	crude	223	350	134	650	50%	37%
E. Valdez (1989)	crude	35	700	3100	70,454	100%	35%
ERIKA (1999)	fuel	20	400	124	6200	–	15%
PRESTIGE (2002)	fuel	77	1900	559 ^a	10,666	15% ^b	–

I. Percentage of the compensation finally paid compared with total cleaning and restoration costs.

II. Cleaning and restoration costs as a percentage over the total estimated damages.

^a Result of the sum of the following costs: 184 million euros of cleaning at sea, 315 million euros of cleaning in the coast, 60 million euros to extract the fuel that remains in the vessel.

^b Percentage estimated by IOPC (92FUND/EXC.22/8/1), in Executive Committee meeting of May, 2003.

something which should be carefully thought of because this quantity could only be reimbursed by the insurance of the polluter in hardly a small part. That amount is including the expenses of retirement, transport and storage of oil from the sea, islands and the coastal line, regeneration of the littoral and regeneration of the Natural Parks.

The amount of cleaning and restoration costs of some of the most recent and known black tides are presented in Table 6. The Amocco Cadiz produced many economic studies (Bonnieux and Rainelli, 1993), including even the valuation of the work of volunteers and soldiers. The unitary mitigation costs obtained by these authors was about \$650 per ton (of 1978). In this black tide, 85% of final payments by IFOP were related to cleaning and restoration costs, despite these costs were less than 40% of the estimated damages.

The Exxon Valdez is the unavoidable reference due to several motives. The main one being the direct payment by Exxon of all mitigation costs (2.1 billion dollars), and the agreement to provide a restoration fund (of 1 billion dollars). Consequently, the cost of this event was the highest in Table 6.

The figure per ton of fuel in the Erika oil spill was higher than in the Amocco Cadiz, because it was fuel instead of crude and that is more polluting. The black tide of the *Prestige* is, in several aspects, similar to the Erika: in the type of hydrocarbon spilt; in the work of volunteers (not paid); and in the difficult task of extracting the fuel remaining in the vessel and giving the correct treatment to the fuel recovered in the coast and at sea.

6. Final reflections

If we observe the whole of the obtained estimations and summarized in Table 7, the accumulated amount (762 million euros) multiplied almost 5 times the limits of applicable environmental responsibility in the *Prestige* case (180 million euros).

The magnitude of the losses at the moment outside of the current system of compensation is, in consequence, considerable. To obviate these items constitutes a social irresponsibility and an incentive to risky strategies in the marine transport of hydrocarbons. Even with the new limit, agreed on May 16 of 2003

Table 7

Estimation of losses for Galicia (million euros) 2003

Concept	Loss (Million euros)
Cleaning and restoration	559.0
Coastal fisheries and aquaculture	64.9
Tourism	133.8
Total	761.7

(940 million euros), if the economic effects on North Spain and Southwest France coasts would be included in the estimation, the total amount could be higher than that limit.

Finally, this estimation must be made more precise because the costs associated to the tourist-recreational use and in the fishing activity have only been calculated for the year 2003; the expenses of cleaning and restoration probably exceed this year and prolonged some years more, and on the other hand, the losses in values of passive use were not estimated in this paper. As an example, in the case of Alaska, still nowadays, 14 years later, the effects persist on the natural environment. Nevertheless, the data here obtained can be indicative of the magnitude that the estimations based on real data may reach.

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