

ACTIONS TAKEN IN THE NATIONAL PARK ISLAS ATLÁNTICAS DE GALICIA DUE TO PRESTIGE SHIPWRECK

Emilio Esteban Rodríguez Merino. Former acting Manager Curator of the maritime-terrestrial National Park Islas Atlánticas de Galicia (Organismo Autónomo Parques Nacionales, Ministry of Environment).

Currently, Technical Advisor at the Studies and Planification Division in the Center for Prevention and Fight against Marine and Litoral Pollution (CEPRECO), Ministry of Presidency.

Starting situation.

Due to the spill caused by *Prestige* oil tanker and its sinking 150 nautical miles away from Cíes Islands (maritime-terrestrial National Park *Islas Atlánticas de Galicia*), the National Parks Autonomous Organism set up a special plan in order to alleviate the effects on the Park. With that aim, on 18th November 2002, an internal protocol, "Actuations programme to prevent the effects of a possible incidence of *Prestige's* shipwreck in the National Park *Islas Atlánticas de Galicia*, was written. Afterwards, the protocol was confirmed by the Managing Comission of the Park in the following meeting held on 5th December at Xunta de Galicia's Consejería de Medio Ambiente in Santiago de Compostela.



Oil plates arriving to Ons island

According to the evolution of the fuel plates, on December 1st, an specific surveillance programme was launched in the maritime zone of the National Park, specially in the occidental side of Sálvora archipelago because, according to the information provided by Xunta de Galicia Consejería de Pesca y Asuntos Marítimos, the State Society of Maritime Rescue and the Coordination Bureau for the derived actions due to *Prestige* oil spill, this was the area with a bigger risk at the beginning of these actions. As a result of this inspection, the first set of stains was found on December 2nd two miles away the west of Sálvora, plates which reached Sálvora island on December 3rd, specifically the beaches of Bois and Almacén. These first stains were cleaned immediately by two teams hired by the National Park. From December 4th on, oil stains were arriving to the rest of the National Park archipelagos, except Cortegada island, placed at the end of Ría de Arousa.

1. Actions to take out the wastes from the hydrocarbon pollution.

After the damage, the National Parks Autonomous Organism developed different actions according to the special circumstances of the different residues. In brief we can talk of four kinds of different actions:

1.1 Cleaning of sandy beaches and continuous surfaces

From the beginning of December until the end of February, the fundamental work in the National Park consisted in taking away the oil residues accumulated on the coasts, specially in sandy zones. Currently the beaches in the islands which form the National Park are clean of oil residues.

The cleaning in sandy zones was done by hand, with the aim of avoiding further impacts on the ecosystems which form the systems of beaches in the National Park, avoiding excessive compactations of sands' horizons and burying the oil because of using heavy machinery. This work was done with the only support of shovels, rakes, buckets and sacks. After cleaning a zone, it was delimited in order to avoid that the movement of people could transport oil residues to clean zones without noticing (in the EPI, boots, etc.) or actively (taking buckets full of oil).

The workers and volunteers were daily assigned to beaches, according to the work to do, organised by the technical staff of Parques Nacionales (National Parks) and collaborators from Xunta de Galicia. We also had the help of the coordinators of the different groups of volunteers who, since the embarkment, were under the effective coordination of the persons in charge, designed by the works management in each of the archipelagos which form the National Park. At the end of each working day, the personnel from Parques Nacionales-Xunta de Galicia carried to the harbour all the waste recovered in order to transport it by boat to the active harbours for *Prestige's* activities where, through the company Tragsa, were shipped to the authorised company.



*Volunteers gathering fuel
in Figueiras beach
(Monteagudo island-Cíes)*

In zones where there was an accumulation of containers on sandy substrate, it was necessary to sift the sand manually with the use of sieves to gather the rests that were buried or half-buried as a consequence of the cleaning works. Also in those beaches where half-buried little balls of fuel were located, it was also come to its sifting. With the purpose of detecting possible buried oil, campaigns of soil sampling were made in a regular sampling. These samples have not detected buried fuel accumulations.



Sifting at Figueiras Beach

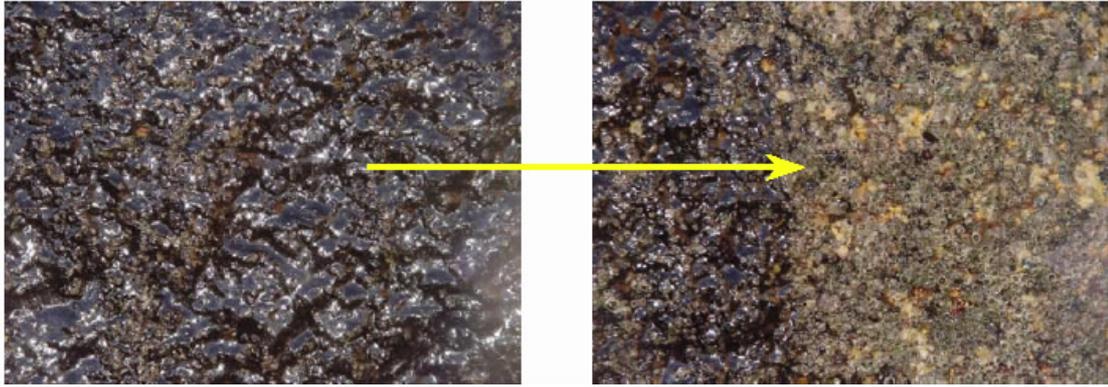
Only in the intertidal zone of Area dos cans (Ons) was found a buried fuel plate (about 12,000 kg.) in the zone corresponding to the equinoctial low tide, and when discovered afterwards, it was cleaned up by manual means.

Until the beginning of August, small "biscuits" of liquid fuel of very small size were detected arriving at the beaches of Figueiras and Canexol, in a sporadic and irregular way, and they were immediately cleaned up by the groups who remain on duty on the islands. This arrival was decreasing regularly, being mainly associated to high tides and the cleaning works of rests of oil in the infracoast in front of the beach of Figueiras (Monte Agudo island, Cíes) and Canexol (Ons). Later on the arrival of small "biscuits" was very sporadic, and due to spills or cleaning of boats afterwards



1.2. Hydrocleaning of rocky intertidal zones and supralitoral stretches.

The cleaning of these zones meant the implementation of a specific methodology by using of hydrocleaning machines. This technique was applied by specialized personnel of National Parks and the Xunta of Galicia. The method has proven its effectiveness in all the zones where it was possible to be applied. It consists on applying pressured seawater to room temperature, without adding any additive, by using hydrocleaners. In order to gather "chapapote" pulled out from rocks, waterproof absorbent blankets were used in the cleaning fluids (chapapote + seawater) run-off zones, which ended up soaked in them. In addition, absorbing floating barriers were used to retain the oil that, despite the blankets, slipped to the sea in the falling zone to the sea of the water flow.



This technique was used in a total surface of 33,305 sq. ft., in the zones where the method was applicable since it was possible to gather the waste that this cleaning process generates. However, there were remaining oil stained surfaces in which it is not possible to apply the hydrocleaning method, as it is not feasible to recover efficiently the generated waste: where it was not possible to collect the cleaning waste fluids (zones of open and beaten sea where an efficient barrier cannot be placed), where there were important concentrations of vagile fauna (non-sessile), like sea fleas - amphipodes, isopodes, poliquetes, etc. -, in places where there were important concentrations of sedentary fauna (limpets - *Patella* spp, winkles - *Littorina* spp. *Gibbula* spp., *Monodonta lineata* -, and others), and finally where there were important concentrations of seaweed (waists of *Pelvetia canaliculata*, *Fucus* spp..., and sessile fauna (sponges, anemones, briozoos... In these zones bioremediation techniques were applied (based on the results derived from the bioremediation experiment (to harness the action of oil-lithic bacteria) that was carried out in Sálvora - on 1.000 sq. ft.- with the collaboration of researchers from the Instituto de Investigaciones Marinas, CSIC).



1.3. Removal of hydrocarbons from seabeds

The inspections made by professional divers detected the accumulation of fuel residues coming from *Prestige* spill in different zones of the seabed in the National Park, fundamentally in infralitoral sedimentary zones. The samplings showed that the deposition of these remainders affected to shellfish banks traditionally operated by brotherhoods of the surroundings, as well as to diverse typical ecosystems of seabeds in Atlantic waters, whose degree of conservation had motivated, among other aspects, the declaration of the maritime-terrestrial National Park. Being aware of the problem a decision was taken, agreed by the Xunta de Galicia and the General Administration of the State, coordinated by the Commission of the Government for the actions derived from *Prestige*'s shipwreck, to proceed to remove these residues, evaluating always that the impact of the removal techniques did not surpass the impact already produced by the own deposition of the remainders. It has always been used techniques that minimized the impact of removal and guaranteed the security of the divers who worked in those tasks. Working together with the Consellería de Pesca e Asuntos Marítimos and the Navy, as well as other bodies of divers (Civil Guard, Firemen, the Red Cross, professionals of the brotherhoods), until the end of September all the wastes located and accessible

were removed, up to a total amount of 1,611.535 tones. This waste is a mixture of sand-fuel residues-biological rests (seaweed, bioclastical rests, etc.) and water.



With the collaboration of the Navy ship BSR Neptuno, which contributed with two to six couples of divers and robots, the exploration and sampling were made in the archipelagos that form the National Park, in depths higher to 15 metres (with divers between 15 and 30 mts. and with sampling using submarine robot between 25 and 60 mts.). As well, a Technical Attendance of National Parks, by using other submarine robots, complemented this prospection in other zones. In none of the explorations appreciable fuel remainders were found. In the spring of 2004, as a consequence of the inspection made, in the month of June it could be observed how in the South zone of the infralitoral beach some of these stains were found, together with rests of bags and tools used in the cleaning works of 2003. The working hypothesis of the cause by which in this spring the fuel appears in the open is that the sands which covered it were mobilized by the coastal dynamics of this time of the year but they were retained in the depression caused by the dredging labours that affected the infralitoral North part of this beach. So it seems that this trial to rebalance the arids was the causating of this situation. The zone occupied about 21,960 sq. ft. The amount of visible fuel at the bottom of Figueiras beach in that zone was: south zone, 9,560 sq. ft. of sedimentary infralitoral and north side (Cantareiras) with plates which occupied around 20,000 sq. ft. of sedimentary infralitoral. They were removed by professional divers during the summer of 2004, with an extraction of approximately 8,000 kg.

1.4. Bioremediation in rocky coastal zones (intertidal and supralitoral)

The biorecovery or boosting the natural processes of oil biodegradation has a very clear utility once the mechanical methods of collecting the pollutant lose efficacy. Basically, it consists in adding in the affected areas the auxiliary nutrients (N, P, Fe, etc.) and other bacterial growth boosters that help the development of autochthonous oil-lithic species or strengthening by sowing the affected areas with oil-lithic bacteria of wild, autochthonous or allochthonous origin. Since the middle of the last century, around five million tones of oil per year have been spilled in the sea from different pollution sources, amount which may have caused a situation impossible to ignore if the hydrocarbon were as little biodegradable as for instance, some chlorine insecticides or the biphenyls, triphenyls or polychloride naphthalenes. This proves that the biosphere metabolizes the different components of the crude.

In the maritime-terrestrial National Park Islas Atlánticas de Galicia several spaces were found whose physical configuration (stony beaches, anfractuositities and rocky cracks) made them practically inaccessible to the mechanical methods of cleaning, so the more reasonable alternative seems, in these cases, the biorecovery. When the application of this procedure, which admits several modalities, is done under the proper security restrictions, its biological risk can be considered null.

In collaboration with the CSIC, it was implemented a first experimental project which consisted on comparing, in an isolated stony beach, in Sálvora island. This project was coordinated by the National Parks Autonomous Organism and doctors Miguel Anxo Murado and Antonio Figueras, researchers at

the Instituto de Investigaciones Mariñas de Vigo (CSIC) that had the equipment and infrastructure necessary for the execution.

The results 80 days after starting the first applications indicated that it is a process that works, in case the selected product for the bioremediation (S-200) is an effective resource, which permits to recover the aspect of the rocks, without toxicological side-effect implications, in a period of about 7-9 months. The main problem is the high proportion of asphaltenes in the oil spilled by *Prestige* which are the products more difficult to degrade by the organisms, although it is a residue of scarce toxicity or biodisponibility. Concerning bacteria growth, in the beginning, it was higher with autochthonous bacteria but, afterwards, they levelled and reached about 20,000 organisms per sq. ft. in all cases. From the following application and scientific monitoring of this technique, the research team has concluded among other aspects:

- The effectiveness of bioremediation declines significantly when oil gets old, the resource shows –even not requiring urgent actions in case of accident- an optimal temporal window. The results reached with *Prestige's* oil show a period of 3-6 months as a tolerable delay for maximum effectiveness with S-200.
- In the natural substract the aging of the oil is added, whose persistency is increased due to two causes .Firstly, its adsorption to the granitic substract, having proved in the laboratory that the UV radiation contributes to elevate the components proportion that remain in the silica-gel.
- At least in rocky substracts, the bioremediation mechanism cannot be assimilated to a microbial culture, where the carbon source (here the oil) disappears with the kinetics of an autocathalitic consumption .The process is better explained with a model that captures oil-lithic units at random with short actuation time and low viability, where the only way of raising the effectiveness is to obtain fertilizing formulations that favour the gain and retention of microbiota. This explains the ineffectiveness of the aqueous fertilizing formulations and the results,comparatively much superior, of the oily formulations.
- The S-200 has a slow dispersing effect, very restricted spatially, that favours the bioaccessibility of the oil and does not present the contraindications derived from the massive use of dispersants and tensioactives with an environmental make-up aim.
- Finally, the microbiota captured by the surfaces treated with S-200 experiment a marked seasonal variation and contains an important proportion of DNA-detectable elements, but not culturable. This explains the absence of significant accelerations obtained in the laboratory with isolated bioreinforcement of experimental oiled surfaces and treated with S-200.



Product application in bioremediation

The detailed results will be presented by Dr. Murado at VERTIMAR-2005.

1.5. Installing containment booms

Absorbent and oceanic booms were placed with a length of about 200 meters in the zone of Almacén Beach (Sálvora), 300 meters in the North zone of Rodas Beach (Cíes), and 300 meters in the harbour zone and Area dos Cans (Ons), to build a protected zone free of fuel that acted as a refuge for birds.

During the month of December two booms were placed, in coordination with the Xunta de Galicia, in Cíes Archipelago; one in the South of San Martiño Island (in the surroundings of Cabo Bicos) and another one in the area of Penela dos Viños. These two latter, according to the agreement with scientists from the Faculty of Sea Sciences (University of Vigo), in order to protect marine communities which serve as recolonization centers for the affected zones. In general the booms have been effective until the force of the sea (storms, rough sea, etc.) ended to break most of them. In addition, the same Faculty, in coordination with National Parks Autonomous Organism, placed two experimental booms to protect the western area of O Lago dos Nenos (Children's Lake) between the Islands of Monteagudo and the lighthouse in Cíes.

Assessment

After a hard work, **49,000 working days** altogether volunteers, Army, TRAGSA staff, the Xunta of Galicia, and National Parks Autonomous Organism, **4,589.9 tons** of waste were extracted from hydrocarbon pollution in beaches and rocks of the National Park (to add to around 1,615 tones of residues from seabeds).

An amount of **11,992,926.38€** were invested in these works.

At the moment, excluding the surface being cleaned with bioremediation techniques, in the rest of the National Park all the affected zones have been cleaned, even though the monitoring remains, mainly in seabeds, where a team of professional divers continues watching in case any stain hidden until now may appear. Currently, the everyday activity of the National Park is normalised in the management of the singularity and natural richness of Galicia Atlantic Islands, which form a natural and cultural patrimony of doubtless scientific, aesthetic and educative value.

We must not forget the effects that this catastrophe may have caused in the ecosystems of the National Park, that is why in November 2003, the Ministry of Environment, through the National Parks Foundation, has given in an official announcement the technical consultancy to evaluate and follow the *Prestige's* oil spill damages in Islas Atlánticas de Galicia National Park and other protected areas of communitarian relevance, by an amount of 1,234,625 euros. This project will last for 3 years; after its conclusion, a technical-scientific report to evaluate the damages produced must be delivered, establishing the measures for its regeneration and a programme for surveilling and minimizing future hydrocarbon pollution episodes in waters of the National Park.

Effects on the ecosystems

From the arrival of the fuel stains to Islas Atlánticas National Park, National Parks Organism started up a procedure to collect and follow the birds throughout the archipelago.

Three premises were fitted out, one in Cíes, another one in Ons and the third one in Sálvora, with personnel specialized in birds' recovery in charge, under the coordination of a specialized in wild fauna veterinarian. The actions taken in the veterinary premises on each island consisted of a stabilization of the corporal constants according to the protocol decided between the administration and implied organizations. This process consisted in moisturizing and thermal stabilization of the bird, in order to be transferred later on to the Recovery Center in "O Campiño" (Pontevedra), where it was treated to his recovery.



Details of premises on the Islands

From the beginning of March 2003 and after a substantial downturn in the number of oiled birds found, these premises on the islands were closed. During the rest of year 2003 regular *in situ* recognition of the most inaccessible zones (coves and small barren islands) were done using shallow-draft vessels (*planeadoras* and *zodiac*).

In these premises a total of **196 oiled birds** between alive and died were treated to date. Later on 6 oiled birds were recovered and sent to Centers for Wild Fauna recovery of the Xunta of Galicia, affecting species as shag (*Phalacrocorax aristotelis*), guillemot (*Uria aalge*), razorbill (*Alca torda*), seagull (*Larus michahellis*), shady gull (*Larus fuscus*), puffin (*Fratercula arctica*), gannet (*Sula bassana*), cormorant (*Phalacrocorax carbo*), black-headed gull (*Larus ridibundus*), great black-backed gull (*Larus marinus*), common scoter (*Melanitta nigra*), and rock dove (*Columba livia* var. domestic).



On Sunday, 4th of April, in the morning, warnings of the arrival of oiled birds were received from our own day-care center. It was confirmed later on that it was due to an illegal cleaning of tanks in the sea corridor of Fisterra. 138 guillemots, 44 razorbills, 11 puffins and 1 shag, 194 oiled birds altogether, 30 of which were found dead, transferring the rest of them to the Fauna Recovery Center of Cotorredondo.

In a first advance of the technical consultancy for evaluating and monitoring the damages caused by the *Prestige's* oil spill in Islas Atlánticas de Galicia National Park, coordinated by *Centro de Investigaciones Submarinas S.L.* (Submarine Research Center Ltd) and that groups researchers from CSIC (Superior Council of Scientific Research), the Universities of Vigo, Oviedo, Cantabria, Basque Country and Cadiz, among others, as well as some environmental consultancies, without being a diagnosis of the conservation state, but only a set of preliminary observations on the basis of the results obtained until the first semester of 2004:

- 1) It was noticed that the upper intertidal communities were the most affected by the oil, although they usually have low densities of organisms and a low specific richness. They are dominated by limpets, cirripeds and *Verrucaria maura*.
- 2) In the intertidal zone the lack of the horizon of *Mastocarpus stellatus* (rhodophyceae seaweed), characteristic of middle intertidal in semiexposed coasts, was noticed. The horizon of *Chondrus crispus* (another rhodophyceae) typical of the inferior intertidal of exposed coasts, was not found either, but only isolated specimens in some zones.
- 3) Specific horizons with scarce amplitude of *Fucus* were found, lacking in several middle intertidal zones in protected-semiexposed coasts. Finally, the brown seaweed *Himantalia elongata* was not found, that forms horizons very well defined in the lower intertidal of semiexposed coasts.
- 4) In the subtidal zone, it was not found big specimens of brown seaweed, in particular of the species *Laminaria hyperborea*, *Laminaria ochroleuca*, that form together with *Saccorhiza polyschides* the mixed *Laminaria* forests fundamentally in the West side of the islands. There were solely species of small bearing of *Laminaria* sp., as well as rhizoids with the holdfast destroyed in the apex of *Laminaria hyperborea*.
- 5) *Falkenbergia rufolanosa*, allochthonous species with great capacity of nutrients absorption and fast growth, it developed to ample horizons in the underbrush of *Saccorhiza polyschides*. On the other hand, the lack of the red seaweed *Gelidium sesquipedale* was verified in walls of exposed coasts, that in some zones was replaced by *Falkenbergia rufolanosa*.
- 6) Some characteristic species only scarcely found were in 2004, such as the red seaweed *Sphaerococcus coronopifolius* or echinoderm (crinoid) *Antedon bifida*. Dead specimens of other species appeared, such as anthozoa *Alcyonium digitatum*. Some characteristic "seabeds", like those of ophiura (*Ophicomina nigra*) in the East margin of Cíes and Ons, were rarefied in 2004.
- 7) Finally, the sessile benthos (poriferous, anthozoa, ascidia, etc.) which presented an ample covering in the walls of the West margins of the islands, showed in 2004, a smaller density and specific richness.

It is still soon to make a global evaluation. It is necessary to wait until all the studies that have begun are finished to value the impact of the ship's spill and establish their conclusions to be able to make a diagnosis on the impact that this spill has had on the ecosystems of the National Park.

Final reflexions

The maritime-terrestrial National Park of the Atlantic Islands of Galicia owes a lot to the civil society, that articulated in groups of volunteers helped to that the image of the Park is the present one, and not the black of "chapapote". It also owes a lot to the colleagues from the other 12 National Parks, and the Centers managed by the National Parks Autonomous Organism, as well as to other colleagues from the Ministry of Environment, whose aid was huge and not payable. The National Park also counted with the help of workers of the Xunta of Galicia who collaborated at every moment, as well as the Armed Forces, who lent their effort to these works of cleaning. We cannot forget the colleagues from Tragsa company, on whose support we counted throughout these actions. Finally, we cannot forget the numerous members of the scientific community, who collaborated not only with their effort as volunteers, but also with their knowledge, with their critical spirit, to the works that were carried out in the National Park.

The current international legislation, that allows those unsafe and dangerous ships sailing near our coasts, is inadequate and puts in a danger the marine ecosystems of our coasts, as well as the source of income of an important fraction of the population who depends on the sea for their survival. It is to wish that in a near future, the international organisms and the nations become aware of this constant threat and cause a change in the legislation.

It would also be necessary an increase in the monitoring and inspection systems, that allow to detect these spills and to locate the offenders to be able to apply the current legislation to them, and to undo that feeling that invades of the impunity of ecological crimes in the sea.

The catastrophe of *Prestige* has shown the necessity of a good coordination when ecological disasters like this one happen. Every catastrophe is, by definition, unforeseeable and little controlable in its first stages, but a suitable collaboration among competent administrations, a flow of appropriate and sufficient information, as well as suitable contingency plans are necessary to face these events, and to transform that initial unpredictability into an organized, effective and efficient work.

This catastrophe has also shown the current degree of ignorance about the marine environment, even when it represents a high percentage of the natural and economic wealth of our country. It becomes evident that it is needed an increase in the research effort in oceanography and specifically in marine Biology, since from knowledge flows any attempt of regulation management in the marine environment, and from an appropriate management and regulation will emerge the measures that may allow to face events such as the catastrophe of *Prestige* ship.

Finally, the polluting spill of this oil tanker has waked up the ecological conscience of a sector of the society, which is a positive effect among so many negative ones. Let us hope that this conscience will not put to sleep and allows that the society maintains the Administrations in permanent alert against any impact on natural environment.