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Illegal Oil Discharge in European Seas

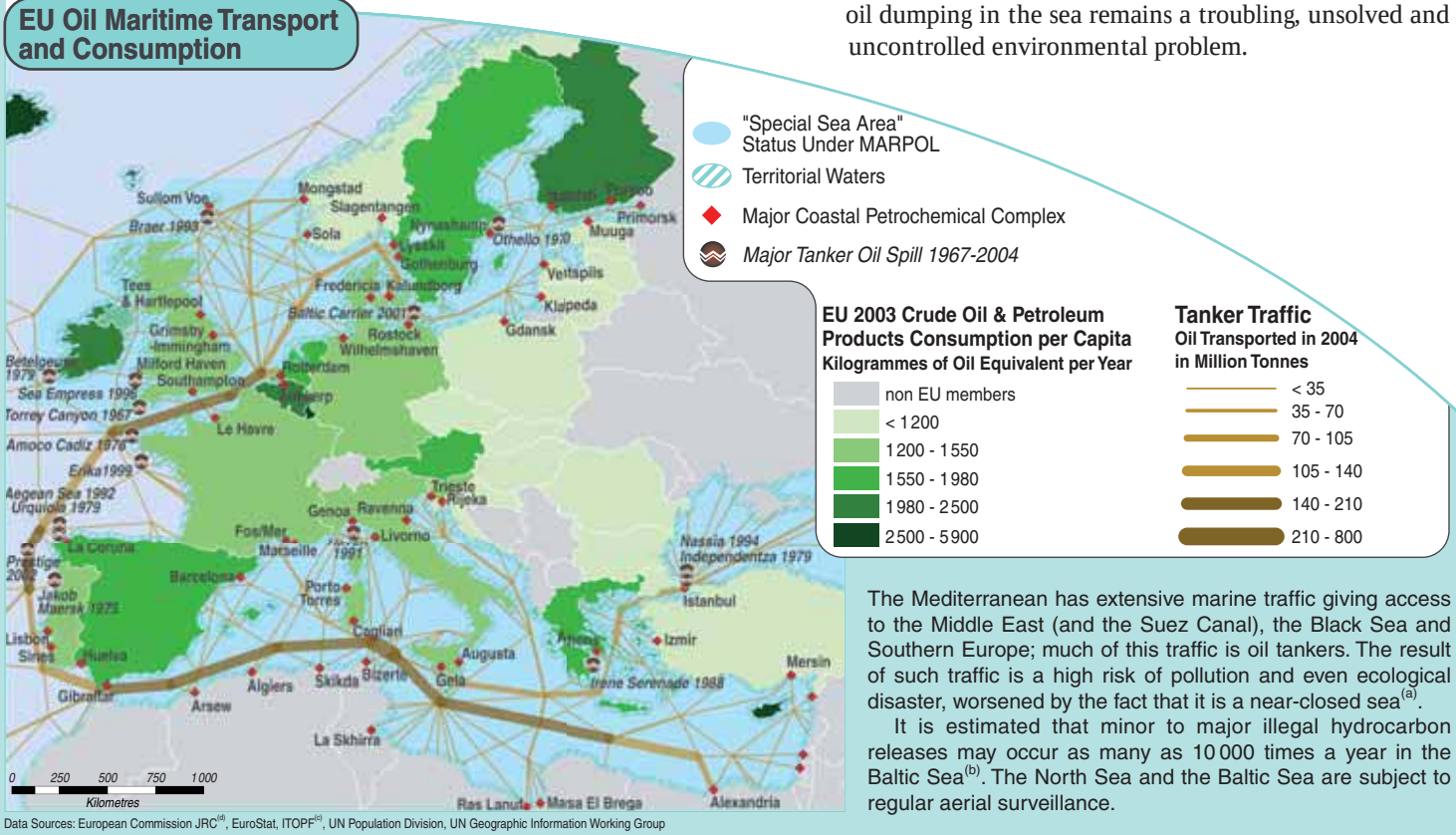
One-third of global marine oil transportation passes through European waters. Not only oil tankers, but various other cargo ships pose a constant threat of small to medium-scale oil pollution from illegal dumping of oily wastes with at least 3000 major events per year around Europe[1]. The devastating consequences of occasional "newsworthy" accidents are outmatched by constant small, but still harmful, releases from oil industry transport.

Ninety per cent of oil and refined products are transported by the sea. Accidents resulting in massive oil spills, with their images of soiled beaches and dying birds are newsworthy, accessible to the mass media, affect public opinion and mobilise policy-makers. However, such dramatic accidents occur only infrequently and represent only a small fraction of the pollution problem at sea. Routine tanker operations lead to the release of noxious ballast water and tank washing residues. Furthermore, fuel oil sludge, engine room wastes and foul bilge water, produced by all types of ships, also end up in the sea.

Out of the 1.5 to 1.8 billion tonnes of crude oil transported worldwide yearly - 35% of total marine transportation - Europe is the main recipient with nearly 500 million tonnes of crude oil and 250 to 300 million tonnes of refined products per year. These ratios still are rising due to increased consumption. Moreover, many oil tankers transport their cargo to other destinations through European waters, meaning that the total amount of crude oil passing through EU waters could well be over 1 billion tonnes[1]. The Mediterranean alone sees 360 million tonnes of oil and refined products per year transported on its waters, approximately 22% of global total[2].

Without efficient and strict controls as a deterent, and to lower costs, oil tanker crews release noxious residuals at sea. It is estimated that at least 3000 major illegal hydrocarbon dumping incidents take place in European waters yearly, amounting to total amounts of between 1750 and 5000 tonnes in the Baltic Sea, 15000 to 60000 tonnes in the North Sea, and more than 400000 tonnes in the Mediterranean[1]. Oil released into European seas as a result of operational discharges greatly exceeds the amount released during accidental spills: yearly, in the Mediterranean, they can add up to nearly 20 times the amount that was spilled by the "Prestige" off northern Spanish coasts in 2002. Despite international and domestic conventions and legislation, oil dumping in the sea remains a troubling, unsolved and uncontrolled environmental problem.

EU Oil Maritime Transport and Consumption



Data Sources: European Commission JRC[d], EuroStat, ITOPF[c], UN Population Division, UN Geographic Information Working Group

The Mediterranean has extensive marine traffic giving access to the Middle East (and the Suez Canal), the Black Sea and Southern Europe; much of this traffic is oil tankers. The result of such traffic is a high risk of pollution and even ecological disaster, worsened by the fact that it is a near-closed sea[a].

It is estimated that minor to major illegal hydrocarbon releases may occur as many as 10000 times a year in the Baltic Sea[b]. The North Sea and the Baltic Sea are subject to regular aerial surveillance.

What is Released and Why ?

Oil pollution from routine tanker operations includes ballast water, tank washing residues and other oil mixtures from the engine room and bilge waters. Such pollution is also known as slops. When old tankers offload cargo and prepare to travel empty, they must take on large quantities of ballast water to maintain the proper balance of the ship. When the ballast water is discharged, oil residues are released as well. Releasing ballast water should be done in special receiving facilities in ports, but is generally done at sea to avoid extra costs (~0.15 € per m^3). When switching cargoes, hulls are washed to remove oil residue on hull walls (about 0.5% of the total load). Tank washing must be done at sea, as the vapours and fumes emitted during the process violate air quality standards in the urban areas where ports are located. Such washings may be done by spraying pure oil or water into the tanks in order to remove oil residues. The remainings from a tank washing should typically be stored in slop tanks, discharged at a reception facility and tanks inspected at each port of call. But this is rarely done, and cleaning residues are also left at sea. For the reception facilities, the value of the oil may be small relative to the cost that it takes to treat and refine it. There are also regulatory concerns, as laws may classify any unwanted water associated with the slops as toxic waste, thus subjecting the port facility to unwanted requirements. Simply put, the port facilities do not want to handle the waste oil.

Sludges include engine room wastes and foul bilge water from all types of ships. Due to the low quality of ship fuel, only part of it is effective for propulsion. Before being burnt, fuel can be centrifuged, generating residues (~2% of total fuel load) which are stocked in bilges. Ships also use a large amount of engine lubricants that often leak and end up in bilges. Generally, sludges are stocked in a separate specific tank. Various lubrication and other oils spilled during ship operations may also be stored in such tanks, which need to be emptied regularly. Quantities are to be recorded in the "Oil Record Book" required by the *MARPOL Convention* and noxious residues unloaded in adapted facilities in ports. The certificate delivered by the collecting company is also stored in the Oil Record Book.

In practice, boats rarely unload in ports for various reasons:

- Cost: highly variable, can reach 200 euros per m^3.
- Increased dock time. Unlike slops, sludges cannot be unloaded simultaneously with other ship operations, making the dock time longer and more expensive.
- Lack of proper facilities to accept and treat sludges in harbours. Facilities' availability varies depending on country, region and activity level, which may or may not economically merit a private collection system.
- Existing regulations are not applied: for example, in France, the current number of boat inspections is lower than 10%, whereas European legislation calls for 25%[3]. Since there are no existing measures forcing ships to unload their waste in harbour facilities, these costs are considered "avoidable".
- Lack of sanctions: the chances of being “caught in-the-act” while illegally unloading fuel or sludges are very low today. Without sufficient incentives for port facilities to receive or for vessels to off-load slops and sludges, and without regulatory requirements and enforcement to mandate their off-loading, the shipping industry must nevertheless discharge residues somewhere. Thus, it is often done illegally at sea, along regular shipping routes or in the area of recent oil accidents, so that these wastes might mix with accident residues and go unnoticed.

Accidental Oil Spills - The Prestige Case Study

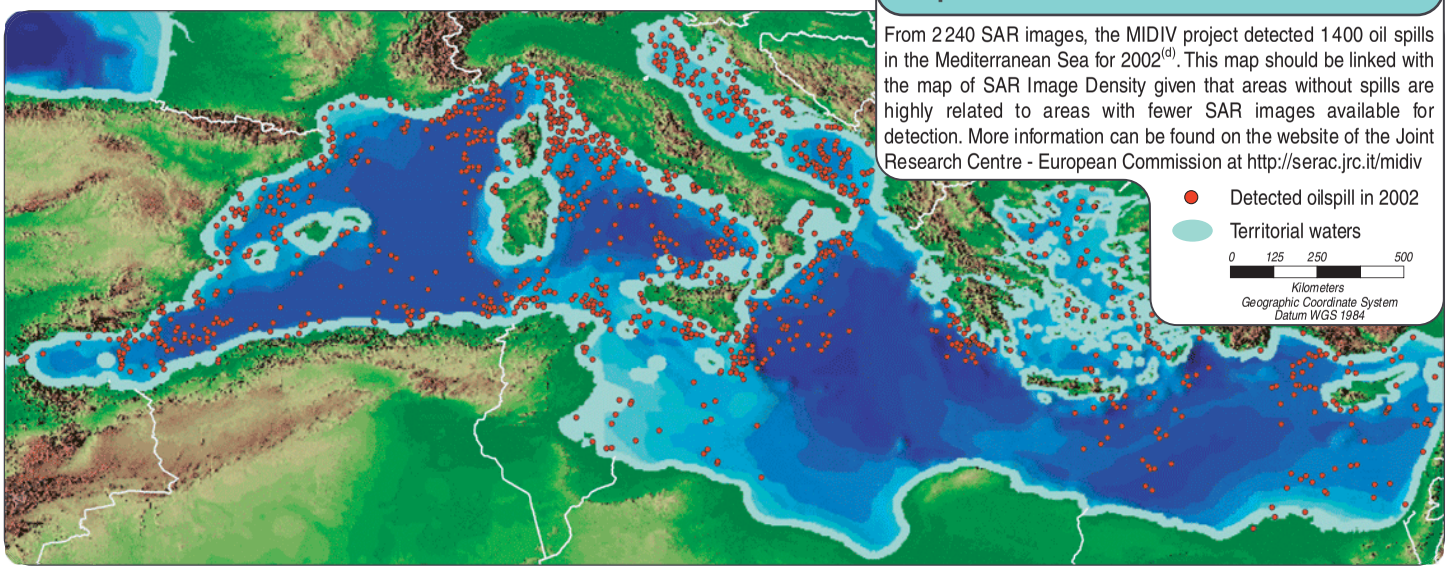
Fortunately, the number of marine accidents and the volume of oil released is on the decline (see graph, blue line, right scale). The average number of oil accidents of more than 700 tonnes dropped from 25 in the 1970s and nine in the 1980s, to 3.8 between 2000 and 2004 acording to International Tanker Owners Pollution Federation Limited[c].

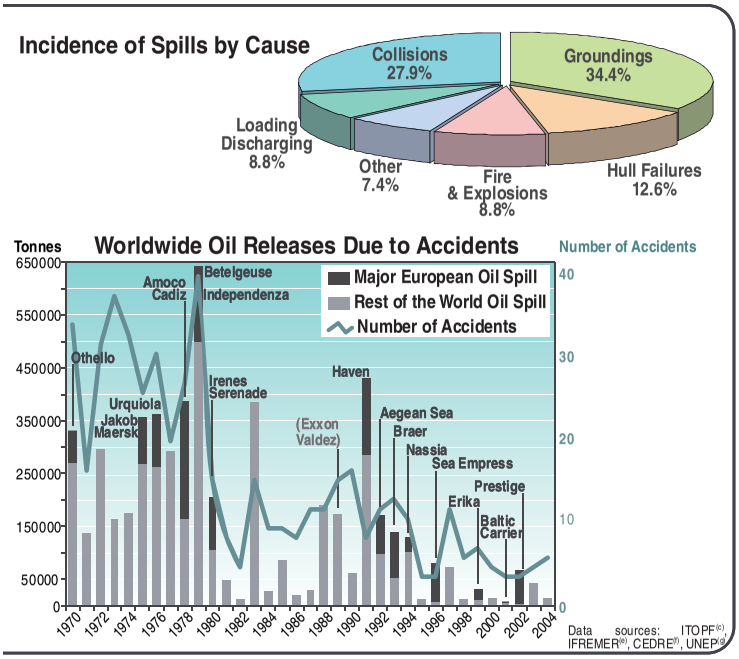
On 13 November 2002, the Prestige tanker, carrying 77 000 tonnes of crude oil, was damaged off the Spanish coast of Galicia. Six days after the first troubles, it broke up and sank in water 3 000 metres deep. The first oil slicks reached the coast starting on 22 November. Various missions to pump oil from the wreck removed 13 600 tonnes by 30 September 2004. The total spill was estimated at 64 000 tonnes. Aerial surveillance missions have been monitoring the site and reporting that minimal leakage is still visible.

This tanker was registered and flying the Bahamian flag, owned by a Liberian company based in Athens, and the oil was owned by a Swiss subsidiary of a Russian company that was immediately sold after the wreck. The crew was from the Philippines and Romania led by Greek officers. This is a typical strategy used by the maritime industry to lower costs and to mask responsibility in case of accidents. The Spanish government has sued the insurance company, based in London, in order to receive damage compensation. The International Oil Pollution Compensation Funds (IOPC) has put an upper limit on its compensation of 171,5 million euros, covering close to 15% of current damages. 1900 km of beaches were affected by tar balls, and around 160 000 tonnes of oil residues were collected.

Oilspills detected in the Mediterranean Sea

From 2 240 SAR images, the MIDIV project detected 1 400 oil spills in the Mediterranean Sea for 2002[d]. This map should be linked with the map of SAR Image Density given that areas without spills are highly related to areas with fewer SAR images available for detection. More information can be found on the website of the Joint Research Centre - European Commission at http://serac.jrc.it/midiv





Oil from tanker accidents (see "Accidental Oil Spills" box above).

Urban and industrial sewage. According to UNEP[4], hydrocarbons in the oceans are mostly due to industrial and urban runoff. Much oil is released into the sea as a result of leakage from refineries, oil terminals and oil not being properly disposed of.

Oil drilling operations, pollution from offshore platforms and pipeline leaks release some oil into the sea, including oil mixed into the briny waters that escape from the oil reservoirs. These inputs remain the smallest source of oil.

Natural sea floor seeps produce between one-third and one-half of the oil in the ocean. These are seafloor springs where oil and natural gas leak and rise buoyantly from oil-laden, sub-seafloor sediments.

Impacts on the Environment !

The impact depends on the type of oil, amount spilled, weather conditions and dynamics of the area or the ecosystem. When crude oil reaches water, 16% is diluted, 22% is biodegraded into simpler substances by either sunlight or bacteria, and the remaining amount has negative impacts on the environment. The less dense components (~15%) eventually evaporate into the atmosphere. This petroleum then reacts to form greenhouse and acid gases similar to those from the combustion of oil. The heavier portions of crude oil coagulate into tar patties, a sticky oil and water mixture, and may either wash up on shore or sink to the bottom. The 28% that sinks to the bottom of the sea mixes with sediments, and can turn into a thick tar-like mass that destroys the habitat of many bottom-dwelling organisms and valuable spawning sites for fauna. Especially vulnerable are slow-moving shellfish such as clams, oysters and mussels. These creatures can't escape from an oil slick. The tar-like clumps can also drift with tides and currents and pile up in high seas (~3%), or wash up on shores (~15%). If a spill occurs near a coastline, beached oil can leak into fresh groundwater reservoirs that often extend under beaches, contaminating local wells[5].

In many spills involving tankers or offshore oil wells, some of the oil spilled initially catches fire, resulting in atmospheric emissions of gases that contribute to global warming and acid rain, as well as large quantities of toxic ash. The fate of sludges is more complex to determine, since synthetic oil has a longer life span in the natural environment, accumulates in the food chain and contains toxics such as dioxins and heavy metals that have dramatic effects on wildlife.

Oil can harm the marine environment in three different ways: by poisoning after ingestion, by direct contact and by destroying habitats. Its impacts are deadlier on coasts than in open ocean, as more living organisms are affected. Marine mammals and birds can ingest a great deal of oil while attempting to clean themselves. Carnivorous animals and birds which eat the carcasses of other oiled creatures also end up ingesting potentially toxic amounts. Birds and marine mammals can also be killed by direct exposure to oil[6]. It can cover a bird's feathers, making it impossible for it to fly, and so heavy it may simply sink rather than float. Oil also eliminates the ability of a bird's feathers and mammals' fur to keep them warm, leading to death by hypothermia[7].

Fish ingest large amounts of oil through their gills. If this does not kill them directly, it can inhibit their ability to reproduce, cause deterioration in their DNA and result in offspring which are deformed. Fish and shellfish metabolisms often degrades oil components into other substances even more toxic for them.

What Can Be Done ?

Powerful tools are available under international conventions to better control or avoid marine pollution from oil[h,i]. The ultimate goal of the 1973 Convention for the Prevention of Pollution from Ships and the related 1978 Protocol (MARPOL) is "the complete elimination of intentional pollution of the marine environment by oil and other harmful substances". Under the 1992 amendments to MARPOL, vessels may discharge oil into the ocean at a rate of 30 litres per nautical mile (16 liters per km), as long as they are further than 80 km from shore. The evidence suggests that it is common practice for vessels to exceed this limit[7].

This protocol also introduced the concept known as protective location of Segregated Ballast Tanks (SBT). SBTs are empty on the cargo-carrying leg of the voyage and only loaded with water ballast for the return leg. Ballast water then doesn't mix with foul slop or sludges as it is contained in these specific tanks. Ships with SBT are also likely to result in smaller oil spills in case of accidents, as the oil is contained in smaller multiple tanks, and water SBTs are positioned where the impact of a collision or grounding is likely to be greatest. As such, the amount of cargo spilled after such an accident will be greatly reduced. In its Annex 1, the *MARPOL Convention* defines Special Areas considered to be so vulnerable to pollution that discharges from ships within them have been completely prohibited: nearly all seas

Cartoon extracted from "Vive les Vacances" - © Reiser

around Europe have been designated Special Areas except the Norwegian Sea, the Bay of Biscay and the Iberian Coast. The European Community is also urging marine companies to stop illegal dumping, and often brings to justice the ones that still do. European Directive 2000 59 calls for harbours to have a proper waste collecting facility. Including waste collection cost directly in harbour taxes (package price) is being tried in Sweden and Germany, resulting in much lower illegal discharges in the North Sea. The EC is also reinforcing aerial and satellite observation, ARGOS markers and widespread use of "black boxes", as well as an appropriate legal system with trained inspectors and judges. It is in the process of harmonising financial sanctions among member states. Today they vary by a factor of 30, leaving the ship a choice where to discharge depending on the risk.

On the national level, it remains very difficult to carry out effective sanctions, other than against illegal actions that take place in national waters and specific protected areas. Coastal states have limited jurisdiction over passing ships flagged by other states. Beyond territorial waters and the Exclusive Economic ones (EE , or similar areas), the role of coastal states is restricted to monitoring and collecting "sufficient evidence" of pollution offences, for reporting to the administrative state of the culprit ship (flag state). While the flag states are bound by international law to investigate such reports and punish polluters, what constitutes "sufficient evidence" is their own decision. Thus the vast number of pollution incidents takes place just beyond territorial waters and the EE [(2)].

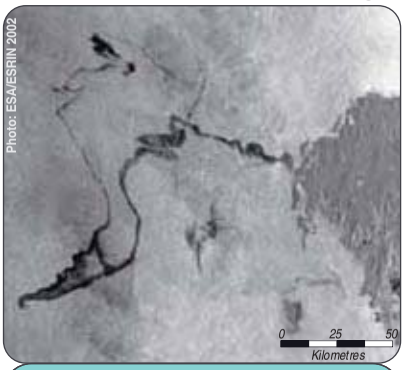
The most effective method for reducing the amount of oil in our seas would be to use less oil. As long as oil remains our primary energy source, hydrocarbon pollution from illegal discharge and accidents and their impacts on marine and coastal biodiversity will continue to occur. Crude oil provides about 40% of all present global energy demand, the largest single energy source. Oil exploration is projected to grow by another 60% in the next 30 years, while keeping a high share of world energy use[(a)]. Oil is used in power plants and for heating in some countries however, the main consumer of oil products is the transport sector. Increased energy efficiency and renewable forms of energy such as solar and wind are clean alternatives that could reduce our dependence on oil.

Satellite Imagery for Oil Spill Detection

- Provide early warning of possible threats to coastal areas in time to take counter-measures, and allow rapid mobilization of airborne and/or shipborne platforms for verification.
- Continuous surveillance of illegal discharges. Detect and deter illegal discharges from sea-based sources. Monitor the extent of compliance with regulations, through periodic statistical assessments of discharge/spill events.
- Conduct oil pollution containment in case of vessel damage. Support response operations in case of such accidents.
- Archive information on releases and compile statistics on oil discharge/spills.

Visible satellite systems are susceptible to false alarms of oil dumping due to sun glint, wind sheen, bottom features, cloud shadows, and biogenic material such as surface weeds and sunken kelp beds. Therefore, there are certain times when visual techniques and optical satellite images are unsuitable for mapping oil spills. It is in these cases where radar remote sensing is required. With Synthetic Aperture Radar (SAR) data, the signature of oil can be used to detect minute concentrations of hydrocarbon on the sea and distinguish between different types of oil thickness[(9)].

The possibility of detecting an oil spill in a SAR image depends on the fact that the oil film decreases the backscattering of the sea surface, resulting in a dark feature which contrasts with the brightness of the surrounding sea. A minimum wind field of 2-3 m/s (~5 knots) creates sufficient brightness in the image and makes the oil film visible. When the wind field is too high (more than 15m/s, ~35 knots) it causes the spill to disappear (break, sink...). SAR images are unable to identify the ship which caused the pollution, but can identify the position of the probable pollution culprit[(10)].



Oil from the Prestige tanker, off the northwest coast of Spain, had already reached the Spanish coast when ESA's Envisat satellite acquired this radar image of the oil slick, stretching more than 150 km, on Sunday, 17 November 2002.

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[b] The Finnish Environment Insitute at www.environment.fi
[c] The International Tanker Owners Pollution Federation Limited (ITOPF) at www.itopf.com
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[e] Institut Français de Recherche pour l'Exploitation de la Mer at www.ifremer.fr
[f] Centre de Documentation, de Recherche et d'Expérimentations sur les Pollutions Accidentelles des Eaux at www.le-cedre.fr
[g] The Global Marine Oil Pollution Information Gateway at http://oils.gpa.unep.org
[h] The Bonn Agreement at www.bonnagreement.org
[i] The Helsinki Commission at www.helcom.fi

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