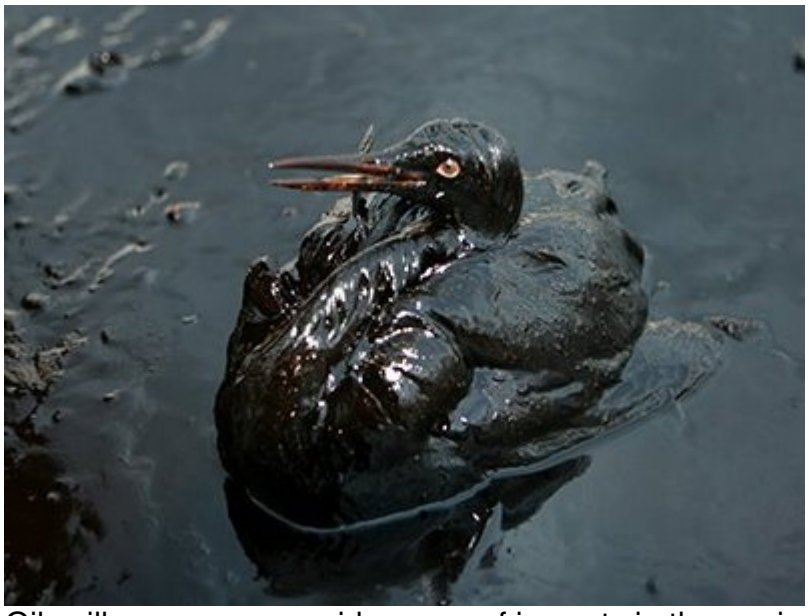
THE MISSION

Oil spills can seriously affect the marine environment both as a result of physical smothering and toxic effects. The severity of impact typically depends on the quantity and type of oil spilt the ambient conditions and the sensitivity of the affected organisms and their habitats to the oil.

EFFECTS OF OIL POLLUTION ON THE MARINE ENVIRONMENT



Oil spills can cause a wide range of impacts in the marine environment and are often portrayed by the media as ‘environmental disasters’ with dire consequences predicted for the survival of marine flora and fauna.

In a major incident the short-term environmental impact can be severe, causing serious distress to ecosystems and to the people living near the contaminated coastline, affecting their livelihoods and impairing their quality of life.

Images of oiled birds following a spill encourage the perception of widespread and permanent environmental damage with the inevitable loss of marine resources. Given the highly charged and emotional reaction usually associated with oil spills, it can be difficult to obtain a balanced view of the realities of spill effects and subsequent recovery.

The impacts of spills have been studied and documented in the scientific and technical literature over several decades. Consequently, the effects of oil pollution are sufficiently well understood to allow for broad indications of the scale and duration of damage for a given incident. A scientific appraisal of typical oil spill effects reveals that, while damage occurs and can be profound at the level of individual organisms, populations are more resilient. In time, natural recovery processes are capable of repairing damage and returning the system to its normal functions. The recovery process can be assisted by removal of the oil through well-conducted clean-up operations, and may sometimes be accelerated with carefully managed restoration measures. Long term damage has been recorded in a few instances. However, in most cases, even after the largest oil spills, the affected habitats and associated marine life can be expected to have broadly recovered within a few seasons.

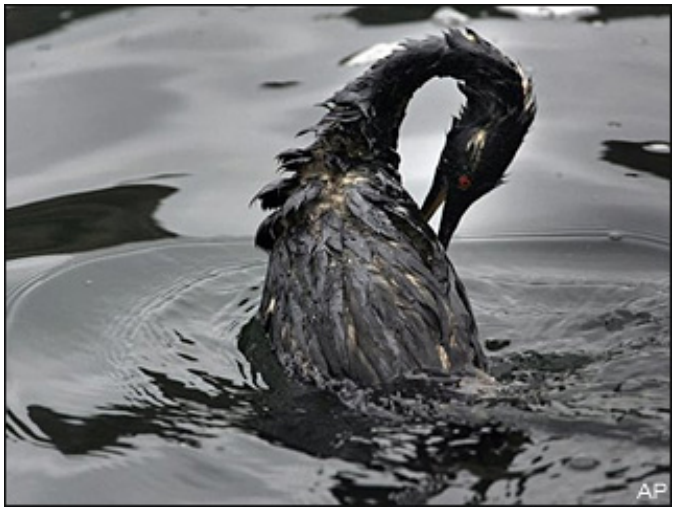
Mechanisms for oil spill damage
Oil may impact an environment by one or more of the following mechanisms:

• Physical smothering with an impact on physiological functions;
• Chemical toxicity giving rise to lethal or sub-lethal effects or causing impairment of cellular functions;
• Ecological changes, primarily the loss of key organisms from a community and the takeover of habitats by opportunistic species;
• Indirect effects, such as the loss of habitat or shelter and the consequent elimination of ecologically important species.

The nature and duration of the effects of an oil spill depend on a wide range of factors. These include: the quantity and type of oil spilt; its behaviour in the marine environment; the location of the spill in terms of ambient conditions and physical characteristics; and the timing, especially in relation to the season and prevalent weather conditions. Other key factors are the biological composition of the affected environment, the ecological importance of the component species and their sensitivity to oil pollution. The selection of appropriate clean-up techniques and the effectiveness with which operations are conducted can also have a significant bearing on the effects of a spill.

The potential effects of a spill are also dependent upon the speed with which the pollutant is diluted or dissipated by natural processes. This determines the geographical extent of the affected area and whether or not sensitive environment resources are exposed to elevated concentrations of oil, or its toxic components, for a significant period of time. Of similar importance is the extent to which organisms are vulnerable and sensitive to oil pollution. Vulnerable organisms are those which, because of their positioning in the marine environment, typically at the sea surface or the water's edge, are more likely to come into contact with oil. Sensitive organisms are those that would be acutely affected by exposure to oil or its component chemicals. Less sensitive organisms are more likely to withstand short-term exposure. In a number of countries, shorelines have been mapped and indices attributed to different habitats according to sensitivity. For example, the resultant maps or sensitivity atlases accord mangrove forests or saltmarshes a high index, while sandy beaches generally feature at a low index.

The characteristics of the spilt oil are important in determining the extent of any damage. A spill of a large quantity of highly persistent oil, such as a heavy fuel oil (HFO), has the potential to cause widespread damage in the intertidal zones of shorelines through smothering. However, toxic effects are less likely for HFO, or other highly viscous oil that has low water solubility, as the chemical components of the oil have a low biological availability. Oil incorporated within 'asphalt pavement' (a conglomerate of highly weathered oil and shingle) is similarly less bio-available, irrespective of its duration on the shoreline, although indirect damage may occur due to habitat modification.



In contrast, the chemical components of kerosene or other light oils have a higher biological availability and damage through toxicity is more likely. However, rapid dissipation, through

evaporation and dispersion, means light oils may be less damaging overall, as long as sensitive resources are sufficiently distant from the spill location. On the other hand, effects can be expected to be greatest and longer lasting in situations where dilution is slowed, such as when the pollutant becomes trapped in muddy sediments or in enclosed areas, for example shallow lagoons with poor water exchange. At exposure levels lower than those sufficient to cause mortality, the presence of toxic components may lead to sub-lethal effects such as impaired feeding or reproduction.

The marine environment is highly complex and natural fluctuations in species composition, abundance and distribution over space and time are a fundamental feature of its normal functioning. Within this environment, marine animals and plants have varying degrees of natural resilience to changes within their habitats. The natural adaptations of organisms to environmental stress, combined with their breeding strategies, provide important mechanisms for coping with the daily and seasonal fluctuations in ambient conditions. This in-built resilience means that some plants and animals are able to withstand a certain level of contamination by oil. Nevertheless, spills are not the only anthropogenic pressure on marine habitats. Widespread over-exploitation of natural resources and chronic urban and industrial pollution also contribute significantly to the degree of variability within marine ecosystems. Against a background of high natural variability, more subtle damage inflicted by an oil spill, such as a downturn in breeding success, productivity or biodiversity, can be difficult to detect.