



Circular Economy Lab & Observatory

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WATER POLLUTION

I.f Oil spills in marine systems
Romania-1.2



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Introduction:

The catastrophic effects that marine oil spills have on economic, environmental, and ecological systems have made them a major source of worry. Although catastrophes involving tankers, barges, pipelines, refineries, drilling rigs, and storage facilities are the most common cause of oil spills in rivers, bays, and the ocean, they can also include recreational boats and marinas.

The majority of oils float on saltwater from the oceans or freshwater from rivers and lakes. A thin oil slick typically forms when oil spreads out quickly across the water's surface. Cleaning up after an oil spill is challenging and depends on a number of variables, including the type of oil that was spilled, the water's temperature, and the kinds of shorelines and beaches that were affected.

This is because oil spills have a devastating effect on marine life and those whose line of work depends on using the ocean's resources. Additionally, cleanup efforts can have an impact on marine life. Physical harm to the ecosystems that plants and animals call home may also have an indirect impact on it.

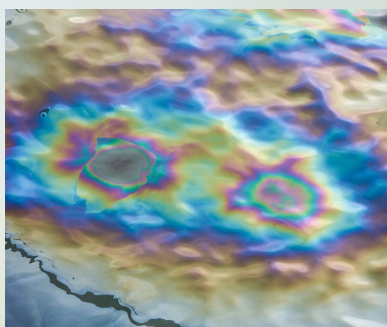
The oil slick gradually shrinks as it spreads, eventually reducing to a very thin sheen that frequently resembles a rainbow. (In exceptional instances, really heavy oil may occasionally sink.) The ice-free season is getting longer in high-latitude regions due to climate change, which means more oil is being extracted and more ships are traveling through the Arctic. There are more and more oil drilling and shipping operations in regions with severe weather and extensive sea ice that raises concerns about oil-related accidents.



<https://pixabay.com/photos/beach-ocean-oil-oil-spill-sand-4644063/>

Environmental damage caused by petroleum contamination affects both terrestrial and aquatic ecosystems. The contamination of marine environments, however, has received increased attention from the general public, regulatory agencies, and scholarly communities. This is due to the fact that marine oil spills can have a significant negative economic impact on coastal operations as well as people who use marine resources.

Communities that are vulnerable to oil disasters must thus plan for and anticipate their effects. Even though they move slowly, chemical and physical processes coexist with biological processes.



The crucial biological processes include intake by big organisms and subsequent metabolism, storage, and discharge, as well as breakdown by microbes to carbon dioxide or organic material in intermediate oxidation stages. On the surface of the water, evaporation alone will remove almost 50% of the hydrocarbons present in an “average” crude oil. Oil’s density and kinematic viscosity rise as a result of the loss of volatile hydrocarbons.

<https://pixabay.com/photos/oil-slick-uss-arizona-hawaii-1438862/>

Problem’s description:

Every year, more oil is transported by water. A billion tons of oil are either produced in or transported via European ports annually; of this amount, the North Sea and the Atlantic Ocean account for about 70%. Given how many accidents occur every day, this implies that oceans, coastlines, and beaches are all at risk of being impacted by oil spills. The effects on the sea and, consequently, the plant and animal species that live there are terrible.



<https://pixabay.com/photos/ship-oil-rig-sea-ocean-water-6135590/>

Since marine pollution is a serious issue that directly affects marine flora and fauna as well as indirectly impacts human health, it is imperative that we take good care of our oceans, coastlines, and beaches if we are to survive.

Because of this, it is important to understand the harm that these catastrophes produce and create effective plans of action to address the issue quickly when it arises, or to be ready with the finest oil-spill cleanup solution in advance of a disaster. Effects of oil spills on the environment First off, the instant an oil leak happens, an oily film forms on the water's surface that, if it is not contained and rapidly removed, will block off light under the surface for days, weeks, or even months at a time.

Due to the fact that maritime plants need sunlight to accomplish photosynthesis, they will swiftly die if they are not provided with it. The oil will then slowly descend into the ocean and cause under-water pollution. Multiple microorganisms may vanish as a result of its highly poisonous nature.

Additionally, over time, oil spills at sea harm all living species that make up the regional environment. Some species' life will be on the line as a result of severe harm to their reproductive systems and food supplies.

What kind of animals are most impacted by this environmental issue?

All marine mammals, fish, and crustaceans are generally impacted by oil spills, as are birds because they spend the majority of their time near the ocean. Dolphins, whales, and turtles are the marine creatures that are most impacted by oil spills.



This is because oil may enter their respiratory systems and obstruct them when they move to surface to breathe. Oil spills can also have a negative impact on birds. Unfortunately, harmful compounds in the oil cause many birds to become poisoned when cleaning themselves, and other birds lose their ability to fly when the feathers on their wings become covered with oil. These birds eventually succumb to hypothermia as a result of their inactivity. Crustaceans and fish are other animals that suffer from oil spills and become unfit for human food.

<https://pixabay.com/photos/oil-rig-sunset-sea-maritime-6522473/>

Even though a spill frequently does not have an immediate impact on these animals, marine currents can in a matter of days transport the oil to their homes.

How does oil impact marine life?

Fur-bearing species like sea otters and birds with water-repellent feathers lose their capacity to insulate against the elements when exposed to oil.

Birds and mammals will get hypothermia if they lack the ability to ward off water and protect themselves from the cold water. Additionally, young sea turtles may get caught in oil after mistaking it for food. Oil can be inhaled by dolphins and whales and can have negative effects on lungs, immune system, and reproduction.

When animals and birds try to clean themselves, they frequently consume oil, which is poisonous to them. Although they might not be exposed right away, fish, shellfish, and corals may come into touch with oil if it is diluted in the water column; shellfish may also be exposed in the intertidal zone.

Adult fish that have been exposed to oil may show growth retardation, enlarged livers, changed heart and respiration rates, fin erosion, and decreased reproductive function. Particularly susceptible to negative consequences, both deadly and nonfatal, are fish eggs and larvae.



Even in cases when no fatal effects are seen, oil can make fish and shellfish unfit for human consumption. What Kind of Oil Causes the Most Damage When It Spills?

The type of oil spilt is important since different types of oil behave differently in the environment and have varying effects on animals and birds.

It's difficult to determine which type is the worst, though. We need first to make a distinction between "light" and "heavy" oils. Fuel oils are very "light" oils, including gasoline and diesel fuel. Light oils normally don't last for very long in the aquatic or marine environment since they are quite volatile (they evaporate very quickly) (typically no longer than a few days). They will swiftly evaporate if they spread out on the water, as they do when they are unintentionally spilt.

However, light oils pose two important risks even when they are present. Some can first ignite or blow up. Second, several light oils are thought to be hazardous, including diesel and gasoline. They are dangerous to humans who breathe their fumes or come into contact with them because they can destroy plants or animals that they come into contact with.



In contrast, really “heavy” oils (such as bunker oils, which are used to fuel ships), look black and may initially be sticky, but even then, they can linger in the environment for months or even years if not removed.

While heavy oils have the potential to be quite persistent, they typically have a lower acute toxicity than lighter oils. Instead, the capacity of heavy oils to suffocate organisms poses a short-term threat, whereas over time, some species may develop tumors or other long-term chronic health consequences.

Additionally, if heavy oils get on bird feathers, the birds could die from cold (they lose the ability to keep themselves warm). If sea otters get greased, we see the same consequence. Some heavy oils will solidify over a few days or weeks and resemble an asphalt road surface greatly. Heavy oils in this solidified state are probably safe for interaction with both plants and animals.

Prevention and Methods of Cleanup:

Prevention For Oil Spill

Even minor ship oil spills can occasionally accumulate to a significant amount. Despite being relatively modest in size, these fishing boats, ferries, or leisure boats are a significant source of pollution.



Oil spills can be avoided by taking the following steps:

To prevent oil from trickling, the engine staff must make sure that engine nuts are suitably snug. This results in bolt vibration and loosening when an engine is running. A cookie sheet and dripping pan ought to be in the engine (or oil tray).



Oil absorbent pads should be available in enough to soak up greasy water outflow. Replace infected components and fittings before they completely fail. Excessive heat and water exposure can cause lines to fail. While filling the tank with fuel, precautions should be followed. There should be some clearance space allowed for gasoline expansion and the tank shouldn't be overfilled. After refueling, the bilge pump needs to be properly shut off.

<https://pixabay.com/photos/sea-ocean-water-shoreline-response-80766/>

The vessel master should clean up any spills if they occur. The spill should be contained inside the ship by being collected, and the affected area should be cleaned with absorbent pads. All legal post-spill formalities should be waived, and a record should be kept regarding the incident.

Cleaning Techniques for Sea After Oil Spill Oil is essential and a significant source of income for many nations with large oil reserves. Therefore, the practice of transporting oil from the sea cannot be stopped; rather, we must seek out safer trips. Any situation involving an oil leak or an oil cleanup from the water must be prepared for.

Following is a brief explanation of various methods for cleaning the sea after an oil spill:

1. Oil Booms:

Due to their more straightforward design and simpler implementation, oil booms are the most widely utilized and well-liked equipment in oil cleanup.

These, sometimes known as “Containment Booms,” contain the oil to a limited region and prevent further spreading. The freeboard, skirt, and cable or chain are the three components. The section that extends over the water’s surface to prevent oil from splashing above the top is known as the freeboard.



A cable or chain is provided for crossing, and the skirt, which is positioned along the water’s surface and squeezes the oil beneath the boom, prevents it from escaping, until it is filled, for the strengthening and stabilization of the boom.

The following are additional traits of oil booms:

- When the spill’s area is relatively small, this strategy is used.
- It is employed when containment booms are nearby because if the boom needs to be hauled from a distant location, the spill may spread to a broader region and become more challenging to control.
- Additionally, it is employed in waters with constant wave velocities since an oil boom cannot effectively clean up after itself when the tide is changing.

2. Skimmers:

With the aid of skimmers or oil scoops, the oil can be simply collected or skimmed once oil booms have bound it. These skimmers are mounted on boats and remove impurities that are sticky or oily in the air. Similar to how a vacuum cleaner operates, this mechanical apparatus does as well. It absorbs all of the oil that is spread out in oil booms across the restricted water’s surface.



These physically separate the oil from the water to make it usable for other purposes. These additional salient characteristics of skimmers include:

- Due to the relatively lower cost of the equipment used for skimming oil, it is a cost-effective way of oil cleanup.
- The use of a skimmer in oil decantation has a significant flaw in that it is readily choked or clogged by debris if it is present in the restricted area.

3. Sorbents:

Sorbents are substances that can adsorb a liquid. The procedure for cleaning up oil is simple. Sorbents, peat moss, vermiculite (straw), and hay are materials we are familiar with.

Here are a few additional characteristics of sorbents:

- These are the products that produce the least waste and stop pollution from spreading. They are quite effective for cleaning up small spills.
- These are also employed to get rid of little tints left over from massive spill cleanups.
- Additionally, it might be challenging to work with sorbents since they can sink to the ocean's floor after absorbing oil and become thicker than water.

4. Burning:

It is comparable to burning rice husk after rice fields have produced rice. This technique involves safely lighting the floating oil on fire. As it can effectively remove 98% of all spilled oil, it is the most effective way of oil cleanup.



Additional advantages of burning the oil spilt on-site include the following:

- For the oil spread with a thickness of 3 millimeters and a larger spread, it operates safely and effectively.
- This procedure pollutes the environment by spewing hazardous fumes into the air from the combustion of oils.

5. Dispersants:

When booms are unable to contain oil, oil disintegration is our only remaining alternative. Chemicals called dispersants are applied to spilled oil to start the oil's breakdown. Oil molecules have a larger surface area after breakdown, which makes it simpler for them to bind with water. The bound molecules will be pushed further into the water as a result, where they will be available for subsequent degradation by bacteria.



<https://pixabay.com/photos/pollution-oil-containment-4756406/>

The following are some more characteristics of dispersant-based oil removal from the sea:

- Large oil spills are simple for them to remove effectively. When oil and water chemically interact, dispersants cause the oil to condense into tarballs. However, occasionally these tarballs get larger and reach the coast.
- Sometimes these chemical dispersants have negative effects on marine creatures that are not mobile.

Conclusion:

Marine oil spills have the potential to seriously harm marine life, as well as the communities who depend on the sea's resources and its economic activity along the shore. Generally speaking, the effects of oil toxicity depend on a wide range of variables, including the physical and chemical makeup, state (i.e., weathered or not), exposure routes and practices, and bioavailability of the oil.

Additionally toxic and a threat to fish, pelagic and benthic organisms are also threatened by oil dispersants, a common tool used to clean up oil spills. The physical destruction of habitats for plants and animals can have an indirect impact on marine life, as can cleanup efforts.

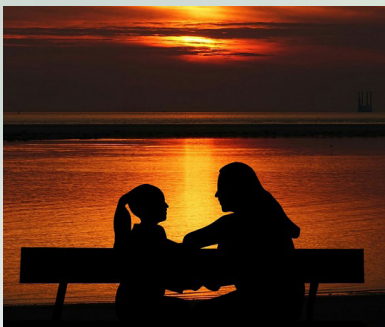
The potential of marine oil contamination has been recognized by the communities that are at risk, and as a result, they have created their own plans and policy concerns to address the threat.

Numerous socioeconomic effects are anticipated as a result of the various anthropogenic activities connected to oil spills, in addition to the inherent environmental pressures of the Gulf.

These are summed up by the threat to the fish industry, the desalination plants that provide the majority of the freshwater for the Gulf region's populations, as well as the scuba diving industry.



<https://pixabay.com/photos/oil-drill-petrochemicals-industry-4663237/>



<https://pixabay.com/photos/child-mother-daughter-parent-3354376/>

In order to increase awareness and avert further accidents, it is crucial that we comprehend the effects that oil spills have on the ecosystem. Numerous impacts are both permanent and irreversible.

The good news is that there have been much less oil leaks overall each year over time. We can only hope that this positive tendency will continue as public awareness of oil disasters grows.



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