

Oil pollution

Oil spills and Oil slicks

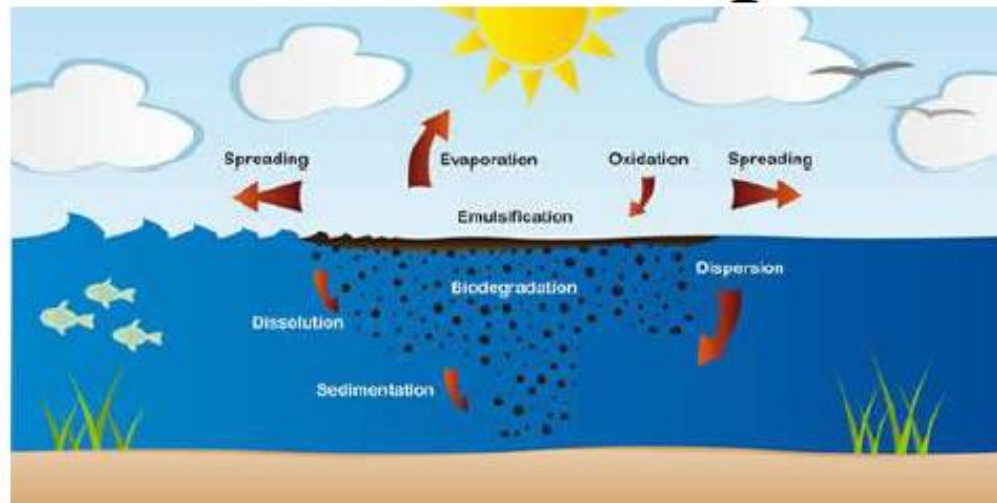
- During oil transportation some oil is discharged from tankers either accidentally or deliberately. This is called oil spills.
- Oil spills produce oil slicks.
- These oil slicks are carried away by winds and currents
- Oil spills and oil slicks cause oil pollution and sea water contamination.



Tanker is wrecked
into two halves

When spilt on the
sea, oil tends to
form a slick on the
surface

Fate of an oil spill



- Oil in the spill mixes with sea water and forms an emulsion at the surface. This emulsion is called “chocolate mousse”.
- Small amount of the mousse is dissolved in sea water.
- Oil droplets begin to weather off by the volatilization and the photooxidation of lighter volatile substances.
- Oil droplets thicken and become denser and tarry with time and sink to the sea bed.
- Often, the tar accumulate debris forming tar balls, which may eventually be cast ashore.
- The oil is slowly broken down naturally by aerobic bacteria where the rate is dependent on the supply of oxygen and nutrients, i.e. nitrates and phosphates.

M/T Haven Tanker, 1991

Location: Genoa, Italy

Gallons: 42 million



How It Happened:

An ill-maintained tanker exploded and later sunk off the coast of Italy. The accident killed 6 people. The Italians attempted to tow the *Haven* to shore, but failed, and the 820 ft-long vessel sunk off the coast of Genoa. Today it is believed to be the largest shipwreck in the world and is a popular tourist destination for divers.

The Cleanup:

Immediately after the incident, Italian authorities scrambled to fight the fire and control the spread of the spillage using 6 miles of inflatable barriers that were submerged below the water surface around the vessel. The rest of the surface oil was sucked up using vacuums.

Odyssey , 1988

Location: 700 nautical miles off the coast of Nova Scotia, Canada

Gallons: 43 million



How It Happened:

In November 1988 the Liberian tanker *Odyssey*, virtually full to the brim with North Sea crude oil, broke in two and sunk in the North Atlantic 700 miles off the coast of Nova Scotia. It also caught fire as it sunk.

The Cleanup:

Because the incident took place so far from the coastline, the oil was expected to dissipate naturally and no clean up response was conducted.

Impacts of a Major Oil Spill

1. Destroys Marine Life
2. Destabilizes Marine Communities
3. Degrades Shore Amenities
4. Harms Economic Activities
5. Impacts Human Welfare



1. How does the oil spill destroy Marine Life?

1. The aromatic fractions and the heavy metals in oil are so toxic. If ingested lead to direct toxic effects and mortality of birds and mammals.
2. Upon ingestion, oil chemically attacks the lipid in the cell membranes of the gut epithelium. It begins to die and slough off causing mortality to birds and mammals.
3. Clean-up activities damage the marine life by crushing and removing from the habitat.
4. Sea birds are oiled at the sea surface, loose their insulation and either drown when they become waterlogged, get hypothermia or die from oil ingestion while trying to preen.



Marine birds and otters

5. Oil can sink to the ocean floor and destroy the habitats of benthic animals.
6. Oil can react with oxygen in the air to form acids that are carried by wind and eventually fall back to the ground as acid rain.
7. Oil washes up on beaches, coral reefs and marshes, and threaten those habitats and the wildlife species there.
8. Sea turtles, whales, fish, otters and other animals can become oil-soaked and die.
9. Deer, bears, wolves, dogs, and cats can die from eating oil-soaked beach plants and animal carcasses.

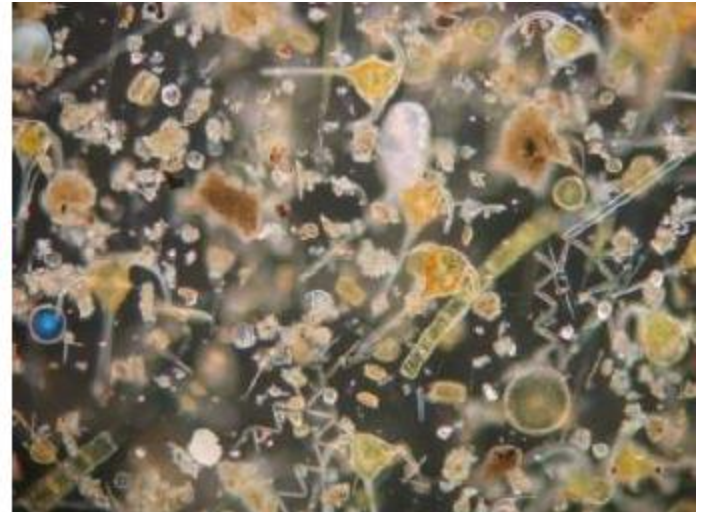
2. How does the oil spill Destabilizes Marine Communities and Populations?

Case study: Torrey Canyon wreck in the UK.
Rocky shore community of Cornwall were heavily
contaminated with oil.

Eg. Grazing gastropods and barnacles in rocky
shore were vulnerable to oil pollution

- gastropods were prevented from grazing by the
covering of oil,
- Barnacles ingested oil residues during filter-
feeding and suffered toxic effects.

Both groups were also highly sensitive to
dispersants and detergents that were used in the
clean-up.



- The gastropods were ‘key stone species in the rocky shore community’
- In the absence keystone gastropods, the shore soon exhibited a ‘green flush’ where the rocks became covered with algae.
- It took nearly ten years for the damaged rocky shore to recover to its former state.
- Therefore the ecological balance of a marine community is shifted as some species in the community are totally lost while others survive with only limited mortality due to oil pollution.

3. How does the oil spill Degrade Shore Amenities?

1. Oil on the water's surface can catch on fire and pollute the air.

2. Contamination of coastal amenity areas lead into public disquiet and concern regarding impacts to boating, sun-bathing, swimming, angling and other recreational pursuits.

The degree of impact to recreation is largely based on the season it occurred. Summer being the highest impact period due to recreation and tourism.



Management of oil pollution

Basically, two options;

- Prevention
- Recovery

1. Prevention

1. Design safer oil tankers.

Double lined bottom instead of single metal layer.

Separate compartments for oil storage. In a double-hull tanker, the cargo tanks are separated from the ship's outer hull to protect against the impact of an accident.

2. Thorough training of tanker crews.

- Develop better emergency procedures.
- Improve navigation skills.

3. The petroleum industry should work closely with government agencies, universities and research centers to combat the menace of oil spill incidents.

4. Prepare a coastal Inventory and Shoreline Oil Sensitivity Mapping. When a spill occurs, Canada utilizes the Shoreline Cleanup and Assessment Team (SCAT) process adopted from Alaska to determine when and how each individual shoreline will be cleaned based on geomorphological, ecological and archaeological factors.



2. Recovery

- There are four basic options for dealing with an oil spill
 1. Monitor only
 2. Disperse
 3. Contain and recover
 4. Shore clean-up methods