

Oil Spills of the Gulf of the Farallones

Slide Show

#	Topic (photographer)	Script (<i>italicized words in glossary</i>)
1	Title Slide	Welcome to a slide show sponsored by the Gulf of the Farallones National Marine Sanctuary and the Farallones Marine Sanctuary Association. Today's topic is oil spills in the Gulf of the Farallones National Marine Sanctuary. The <i>PUERTO RICANO</i> Oil Spill Restoration Fund provided funding for the production of this slide show.
2	Map of Sanctuary	<p>The Gulf of the Farallones is located just outside of San Francisco Bay. The northern boundary of the Sanctuary is at Bodega Head and the southern land boundary is just north of Muir Beach at Rocky Point. The boundary of the National Marine Sanctuary is at the mean high tide level.</p> <p>Another National Marine Sanctuary – the Monterey Bay National Marine Sanctuary protects the shoreline south of the Gulf of the Farallones Sanctuary to Cambria.</p>
3	SE Farallon Island (K. Evans)	The Gulf of the Farallones is a biologically rich area. There is abundant life on the Islands and the surrounding open water. The Farallon Islands are home to the largest concentrations of breeding seabirds in the contiguous United States.
4	Seals on island (M. Webber)	Also living here are the largest and most diverse eastern Pacific populations of seals and sea lions south of Alaska. Seabirds and marine mammals come to the region to feed on the abundant krill and fish. An oil spill in the area could affect these animals.
5	Sea star	Sea stars and other invertebrates make their homes on the rocks. Sandy beaches with worms, clams, and shorebirds also live in the Sanctuary.
6	Fish	Plankton, fish, and sharks live in the water. These photos may make you think that this is from a remote location. Remember the Sanctuary is very close to your home. Oil pollution and other threats to the environment are right in your backyard and can affect the wildlife in the Sanctuary.
7	Picture of oil	Today's topic is oil pollution. First, what is oil? Oil, also called petroleum or <i>fossil fuel</i> , is a natural product that forms during the decomposition of plants and algae from millions of years ago (That's why it is called fossil fuel – it is fuel from fossils). Oil is a mixture of organic compounds that are used for fuel, to make plastics, and many other products that you use every day.
8	Types of Oil	<p>Oil is a combination of many <i>hydrocarbon</i> molecules, some with one carbon all the way up to molecules with 30 carbons. It includes both hydrocarbon chains, such as methane and kerosene and aromatic rings of benzene and toluene.</p> <p>The oil that is pumped out of the ground is called <i>crude oil</i>. It is transferred by ship or by pipeline to refineries where the different components of oil are</p>

separated to make *gasoline*, kerosene, lubricating oil, fuel oils, and many other products. Each product is a different combination of hydrocarbons.

- 9 Sources of Oil in Marine Environment Oil enters the ocean in many ways. Most of the oil that enters the marine environment is from industrial discharge, urban runoff, and vessel operations. They account for over 60% of the oil pollution. Big spills account for only about 12% of the oil entering the marine environment each year. That may not sound like a lot, but in 1999, 1.1 million gallons of oil were spilled in US waters. 96% of the oil was from spills of less than 100 gallons each.
- The first source of oil on this list is natural seeps. Why are we concerned about oil in the water if there are natural sources of oil already? The chemical properties of oil make it harmful to wildlife, including the natural seeps which we can do nothing about. However in the Gulf of the Farallones NMS, oil from natural seeps are not a problem.
- 10 Chart with shipping lanes With every vessel that travels in and out of San Francisco Bay, there is the potential for oil entering the marine system and into the Gulf of the Farallones National Marine Sanctuary. As shown on this chart, the major shipping lanes, where all vessel traffic travels, run through the Gulf of the Farallones or the Monterey Bay National Marine Sanctuaries. These are some of the busiest shipping lanes on the west coast.
- 11 Container ship (D.Hatch) Ships use oil as their fuel. Large container ships, ...
- 12 Fishing ships ... small fishing vessels, ...
- 13 Cruise liner ... and large cruise liners are just some of the traffic that pass through the Sanctuary waters. Routine operations may release oil into the water which is illegal.
- 14 *T/V PUERTO RICAN* Many people think that oil tankers like this one are the only threat of spilling oil into the water. The reason for this is that when tankers spill oil they often release millions of gallons at once, while the smaller daily spills and leaks don't make headline news.
- This ship made headlines news in 1984, and we will use this as our case study today.
- 15 PR with oil (Herz) On October 31, at approximately 3:24 am, the U.S. registered tanker vessel *PUERTO RICAN* experienced two major explosions. The vessel was about twelve miles (20 km) west of the Golden Gate Bridge and just outside of the Gulf of the Farallones Sanctuary. Initially it was carrying 100,000 *barrels* of oil (lube oil, lube oil additives, and *bunker oil*).
- 16 PR with Coast Guard (Herz) The Coast Guard was immediately called and was on the scene to help fight the fires. The first concern of the incident was human safety. The next was to put out the fires, and then get the leaking ship away from the coastal habitats.

Some oil was released during the first day, which was removed by skimming. When the winds are calm, it is easy to remove it by skimming, because oil is less dense than seawater and it floats at the surface.

- 17 Burnt PR There were large holes in the side of the tanker and the ship was unstable. The winds and seas picked up making cleanup efforts much harder as more oil was leaking.
- 18 Oil sheen on water About 25,000 to 35,000 gallons of oil were released on the third day. A 20 foot by 20 foot classroom holds about that much oil. The high winds and waves caused the spill to dissipate within 2 miles.
- 19 Ship LocationMap The ship was towed from just outside of the Golden Gate Bridge where the explosions occurred to 11 miles south-southwest of the Farallon Islands and 25 miles west of the mainland. This occurred in the fall, during the oceanographic season of the relaxation period. There is a weak northward flowing current during this time that moves the water from the south to the north.
- 20 PR escorted They towed the leaking ship directly south of the Farallon Islands. The *PUERTO RICAN* was escorted farther offshore, away from the mainland and the Farallon Islands. While being towed, the vessel broke in two, and the stern sunk with 8,500 barrels of bunker fuel in its tanks.
- 21 Coast Guard Helicopter Skimming continued while aerial surveys were conducted to evaluate the size of the oil *slick*. At first, the oil slick was moving to the south away from the Sanctuary, but ...
- 22 Oil near Islands .. the flow of the slick shifted northward as the currents changed and came towards the Islands. Some oil reached the Southeast Farallon Island.
- 23 Mr. Clean Mr. Clean, a consortium of Bay Area oil companies set up to deal with oil spills, continued to skim the oil slick. By day 7, the skimming vessel by the same name as the consortium had recovered 400 barrels of dewatered oil/water *emulsion*. An emulsion is when one liquid gets suspended in another. This is typical of an oil spill – the waves mix the water and oil into an emulsion called *mousse*.
- 24 What happens to spilled oil? Let's move away from the T/V *PUERTO RICAN* for a minute and take a look at what happens when oil enters the water. Many physical, chemical, and biological processes act on the oil and alter its character
- Oil spreads over the surface in a thin layer and the oil moves with the water.
 - As mentioned before, the water and oil can turn into an emulsion that is a mixture of the oil and water.
 - Evaporation – Think about the fumes you smell at a gasoline station from gas or motor oil. They smell pretty bad. They are the same *aromatic* compounds that evaporate from an oil spill. Imagine if you were a seal surrounded by oil coming to breathe at the surface.
 - Some of the hydrocarbons are water-soluble and dissolve in the water but not very many dissolve.
 - Sedimentation means that some of the oil sticks to particles and sinks, but again not much happens. Yet the oil that reaches the bottom and gets buried

in the sediments sticks around for decades.

- *Biodegradation* is the break down of the oil by bacteria and microorganisms.
- And the last is dispersion....

- 25 Dispersion figure ...This is a process that we humans help along with chemicals called *dispersants*. They cling to the water and the oil to break the oil slick apart. We use them as a cleanup technique. They remove the oil from the surface protecting wildlife at the ocean's surface, but now it is mixed in the water. By adding chemical dispersants, we've added more chemicals which may be harmful to some living organisms, so this is not always the best form of cleanup.
- 26 Elephant Seal (K. Evans) Animals that come to the surface or to shore are at risk from oil spills. Seals and sea lions haul-out on land to rest, molt, and give birth. If there is oil on the beach, they may get it on their fur. Nursing pups may ingest oil that is on their mothers' fur.
- 27 Oiled Zalophus (P. Pyle) Here are California sea lions that have oil on their fur (they are the shiny ones in the middle). This photo was taken in 1993 on Southeast Farallon Island. This was not during a spill. This is a good example of chronically, illegally discharged oily water from a ship.
- Oil can be devastating to fur-covered animals such as fur seals and otters that depend on fur rather than fat or blubber for insulation. With oil on the their fur, it no longer can keep them warm and they die of hypothermia. In addition, sea otters, which continuously groom themselves, end up eating oil which can be quite toxic.
- 28 Oil slick (Herz) The slick from the *PUERTO RICAN* covered a large area. Fish are sometimes attracted to the oil, because it provides shade. But the oil is very harmful to fish when they encounter it. It can coat their gills, making it difficult for fish to breathe.
- 29 Plankton Plankton are killed very quickly when they encounter oil. Even small concentrations of oil will kill plankton after a few days. Oil is very toxic to them.
- 30 Common Murres These regal-looking Common Murres are very susceptible to oil spills. They are seabirds. They spend most of their time on the ocean and only come to shore to breed and rest. They dive for their food, sometimes down 300 feet, to catch fish or squid. During the fall, they float on the surface of the water in large groups. The *PUERTO RICAN* oil spill was during the fall ...
- 31 Oiled Murre ... and killed over 1,800 Common Murres.
- 32 Feather Feathers are used for insulation, buoyancy, and flying. As with the fur-covered mammals, a little oil can go a long way towards making a bird very cold. Most murres probably died of hypothermia, because the oil ruined the insulative properties of their feathers.

- 33 Oiled Sanderlings During the *PUERTO RICAN* incident, staff and volunteers from the Point Reyes Bird Observatory and other agencies surveyed the beaches for oil and oiled wildlife. They collected live birds to bring to rehab centers.
- 34 Mobile Vet Lab This is the inside of a Mobile Vet Lab that was used in 1996 during a spill in the Sanctuary. Here they remove oil with detergents and try to keep the birds warm.
- 35 Common Murres (Herz) Along the shores of the Sanctuary, many dead birds including Common Murres were washed ashore and collected during the *PUERTO RICAN* incident. Most birds died from hypothermia, while others ingested the toxic oil when preening their oiled feathers or eating oiled fish.
- 36 Assorted shorebirds (Herz) Along the shores, other birds feed at the sandy beaches and mud flats. Many different species of shorebirds as seen here were also killed by the *PUERTO RICAN* spill. Most major oil spills kill and injure shorebirds and seabirds. When assessing the damages from a spill, the impact on shorebirds is hard to determine, because many shorebirds fly away before they die and are not found on the beaches.
- 37 Map of oil Here is a map of where the oil from the *PUERTO RICAN* went. The day number is the number of days after the initial explosion. It began leaking in the southern part of the Gulf of the Farallones Sanctuary and moved northward, around the Islands, and made landfall along Point Reyes and into Bodega Harbor on day 10.
- 38 Oil Boom/intertidal Oil will coat anything that it comes in contact with. The invertebrates and algae are in danger when oil reaches the rocky intertidal zone. Booms were used to protect the intertidal region from the oil.
- 39 Bodega Harbor At Bodega harbor, a boom with a *sorbent* material was used to protect the harbor. The boom stops the flow of the oil, and the sorbent clings to the oil, essentially removing it from the water.
- 40 Oil boom protecting wetlands Oil booms were also used to protect wetlands.
- 41 PR at the Golden Gate Meanwhile, the bow of the *PUERTO RICAN* was towed back into San Francisco Bay. There it was removed from the water and the remaining amount of oil was estimated.
- 42 Oil Sheen The stern had sunk, just outside of the Sanctuary boundary. Initially there was a slick seen at the surface, but after a few months the oil dissipated. There were 8,500 barrels of bunker oil in the stern when it sank and probably leaked for several years.
- 43 Oil Spills in the Sanctuary The total estimated spill of the *PUERTO RICAN* was 1.4 million gallons of lubricant oil and bunker oil. That is much less than the major spills that you may have heard of. Here is a list of major oil spills in the Gulf of the Farallones. Remember tanker spills are not the only threat to the marine environment. One source of oil that you and your family can help with is urban runoff. If your

family has a car and you regularly change the oil in it – that is 3 quarts of oil changed four times per year – how many gallons of oil do you use? (3 gallons of oil per year) If every family in this classroom poured that oil down the drain, how much oil would you be putting into the ocean? (3 gallons x 30 students = 90 gallons per year)

- 44 Murre Restoration at Devil's Slide The US government works to find who is at fault for major oil spills and fines them for the damages. Do you recognize these birds? They are models of Common Murres. In 1986, the *APEX HOUSTON* oil spill killed over 6,000 of these birds. The fines went to help restore the Common Murres to their natural habitat on Devil's Slide and Pedro Point in San Mateo County.
- 45 Tarball and scale Another impact of oil spills is the creation of *tarballs*. Tarballs, which are semi-solid pieces of fuel and crude oil, are deposited on sandy beaches. These are toxic, and you should not touch them if you see them. Some are small . . .
- 46 Tarball at Limantour spit (J. Tarpley) . . . and others are much larger. During the Point Reyes Tarball Incident, tarballs were found along the Sanctuary beaches along with thousands of dead birds. The source of the oil may have been illegally dumped oil and the responsible party is unknown.
- 47 Sinking oil rig off of Brazil One way the Gulf of the Farallones National Marine Sanctuary protects the environment is through its regulations. It prohibits all exploration and development of oil and gas resources. Oil drilling releases oil into the water. By prohibiting these activities, the Sanctuary helps to protect the marine environment. It also prohibits oil tankers, barges, and merchant vessels within two nautical miles of the Farallon Islands, Bolinas Lagoon, and other Areas of Special Biological Significance.
- 48 Volunteers Through its Beach Watch program, the Sanctuary monitors the beaches along its boundary with the help of volunteers. Every two to four weeks dedicated citizen scientists survey their beaches for marine life and human activity. Fluctuations in bird and marine mammal populations are detected in the long-term database. Volunteers find and report oil or tarballs on beaches and collect and preserve oil samples as evidence. The Beach Watch program provides additional eyes and ears for the Sanctuary's sandy beaches.
- 49 Surveyor The information collected during Beach Watch surveys now provides a baseline to compare pre-spill mortality to post-spill mortality. Now when there is an oil spill, the Sanctuary sends out trained surveyors to the beaches to determine resources at risk and to collect and document oiled wildlife.
- 50 Oil sheen on Agate Beach They look for any oil on the beach . . .
- 51 Oiled feather sample . . . and survey the live and dead birds and marine mammals. They collect the dead birds as evidence against the party who spilled the oil.

- 52 Sea Siren Grounding (E. Ueber) The Sanctuary works with other agencies in the event of oil spills, including spills from small vessels. In the State of California, the Office of Spill Prevention and Response and the US Coast Guard are the initial responders in the event of an oil spill.
- During a spill, they work with local wildlife agencies, such as the National Park Service, to stop the spill, prevent oiling of protected habitats and species of special concern, and clean up the oil. After a spill, they assess the damages and restore wildlife populations and habitats to their original condition. The spiller is fined for cleanup and restoration costs.
- 53 Sunset (K. Evans) We depend on oil in our everyday lives. By reducing our use of oil and products that are made with oil, we help protect the natural beauty of the ocean from the threat of oil pollution.