"We Care About Oceans" Thematic Presentations
National Wildlife Federation

PART II

FURTHER INFORMATION ON SLIDE TOPICS

Further information, relating to topics covered in various slides, follows.
Numbers in parentheses match slide numbers as listed in Part I.

EARLY OCEAN EXPLORERS (5-7)

Since ancient times, there have been seafarers. Turning first to the shore for food, then voyaging to uncharted waters, many people have made their livelihoods from the ocean. Beckoned by the lure of bigger fish, the thrill of exploring new waters and discovering new lands, the temptations of riches from afar, the wealth to be gained in trading, and the opportunities for new lives, many turned to the ocean. Yet, for those who chose to make their living at sea, life also meant dangers, hard labor, separation from family, sickness, and even death.

Even so, the exploring spirit tugged men seaward. The first sea explorer known to history is Hennu, an Egyptian who made a voyage about 2000 BC to the Land of Punt, on the Red Sea coast. Hennu returned from this land laden with treasures of gold, ivory, and myrrh. Hennu may not have been the first sea voyager, but with him begins the history of sea traveling. From the ancient Greeks and Phoenicians, who advanced the art of ship-building, to the adventurous and daring Vikings of the Middle Ages, explorers have sailed the ocean to find out what lay beyond familiar waters.

The greatest age of exploration began in Europe in the 1400's and lasted for the next 200 years. Pushed primarily by the desire to make fortunes by trading silks, spices, and luxuries from the Indies, Europeans charted new routes and eventually mapped the major seas and land masses of the world.

Each October we celebrate Columbus Day in memory of the explorer who is credited with discovering the New World. Christopher Columbus believed that the Atlantic Ocean was quite small and that Asia was much larger than it really is. He decided that the shortest route to the East must be westward from Europe across the Atlantic. This is how he came to sail to the New World. Columbus set sail on August 3, 1492, and on October 12 sighted land at San Salvador in the Bahamas. He was convinced that he had come to the East Indies. Nevertheless, we celebrate this day as the "discovery" of America.

Other explorers shared Columbus' belief that the land across the Atlantic was Asia, then around the early 1500's they began to question this view. Amerigo Vespucci is credited with recognizing this land as a whole new continent, later named "America" in his honor.

Still the quest for a westward route to the Indies continued to drive many explorers across the Atlantic. They explored much of North and South America. Ferdinand Magellan, a Portuguese sailor, was one of the most famous explorers. Although he was killed in the Philippines some of his ships eventually became the first to sail around the world, making a long passage southwest to India.

Captain James Cook, a British naval officer, searched for a northwest passage to the Indies. As he traveled north along the west coast of North America, looking for a through passage, he explored the Pacific coast. Cook made three voyages to the Pacific between 1768-1776. On each of his voyages, he took along a scientist and an artist. Cook himself was a curious and perceptive observer of the life he saw on his voyages and he recorded his observations of plant, animal, and human life.

By the time of Cook's voyages, scientific exploration of the seas had become possible because of the invention of accurate instruments for determining location. Sailors were able to tell where they were by using a sextant to determine latitude and clocks to determine longitude.

Like Cook, many explorers in the early 1800's included nature studies in their voyages. Explorers began to look into the sea as well as across it. In 1872 the "Challenger" sailed from England to begin a 3 1/2 year study of the oceans. The ship's scientists made measurements, gathered observations of the sea, and took specimens of plant and animal life. This expedition marked the start of a new age of exploration; the science of oceanography, the study of the marine environment, had been born.

KELP FOREST (12-19)

The undersea kelp forest is a unique environment, but it has many similarities to a forest on land.

The kelp that grows in the ocean forest is a kind of alga, distantly related to the matted green freshwater alga that is seen on some ponds. Giant kelp is the fastest growing plant in the world, growing as much as 2 feet in a day. Nutrients from the water and energy from the sun (through photosynthesis) support this rapid growth. Each blade of kelp has a gas-filled bubble attached to it which keeps the leaves floating on the surface where they can take advantage of the sun's rays. The kelp's unique system of trans-location (nutrient movement) takes the nourishment produced in the surface part of the blade downward to stimulate growth in the lower parts of the plant as much as 100 feet beneath the surface, where sufficient sunlight is not available. Without this process, the kelp would not be able to flourish and form the dense shadowy forests that are so attractive to other marine organisms.

Like a hardwood forest on land, an underwater kelp forest is home to a variety of wildlife. The inhabitants of the kelp community include sea stars, lobsters, mussels, and urchins along the ocean floor, many fish, shrimp, and snails in the middle depths, and sea otters at the surface of the water. At the base of the kelp forest food web are tiny floating plants (phytoplankton) and the kelp itself. Mussels filter the phytoplankton out of the water for food. Spine-covered sea urchins graze on the fallen kelp leaves and even on living kelp itself. Mussels and urchins are in turn eaten by larger animals such as sea otters.

The kelp-sea urchin-sea otter food chain is an interesting one, and one that dramatically affects the entire kelp ecosystem. Studies in the Aleutian Islands have shown the sea otter to be an important factor in controlling the sea urchin population. When sea otters were abundant along the Pacific Coast, the sea otters kept the sea urchin population in check, and kelp forests flourished. Man entered and drastically reduced the population of sea otters. This allowed the sea urchin population to increase and the sea urchins effectively eliminated many kelp beds along with the habitat they afforded.

By the early l900's, nearly all sea otters along our shores had been killed for their prized furs. An international treaty signed in 1911 provided protection for the remaining sea otters. Today, sea otter populations have recovered in some areas, bringing local sea urchin populations back into balance, to the benefit of kelp plants and kelp forest wildlife.

Many people are unaware that kelp forests are commercially important, too. Because of its fast growth, kelp can be harvested much like a farmer harvests a hay field. A harvesting boat cuts the kelp to a depth of 3-4 feet below the surface leaving plenty of plant left for regrowth. The kelp is then taken ashore, ground, and chemically processed to extract a product called algin. Algin gives kelp plants strength and resilience to withstand the force of waves surging back and forth. When extracted, algin helps bind oily and watery fluids together (salad dressing), keeps pigment particles mixed in a liquid (paints and cosmetics), and makes ice cream and shoe polish smoother and creamier.

Like a hardwood forest, a kelp forest has great ecological value and it can be scientifically managed for the benefit of both man and the native wildlife. In commenting on the importance of kelp communities, biologist Charles Darwin noted that "if in any country a forest was destroyed, I do not believe nearly so many species of animals would perish as would here, from the destruction of the kelp." As responsible stewards of the oceans' resources we must manage the kelp forests wisely for the good of wildlife as well as people.

MARINE HABITATS (25-34)

Just like the land environment, the ocean environment is made up of many different wildlife habitats, or "living places," ranging from tiny tide pools to huge deep-ocean trenches. Brief descriptions of the environmental conditions and wildlife of six marine habitats are given in the following paragraphs.

Estuary

An estuary is a partly enclosed coastal water body in which salty sea water mixes with fresh water draining from the land. Weather conditions and the rising and falling tides constantly affect estuarine waters, changing the levels of salt, oxygen, and nutrients critical to life. Estuaries exist in all shapes, sizes, and forms, including bays, lagoons, fjords and river mouths. Estuaries are known as "nature's nurseries," since many kinds of animals reproduce and raise their young in and around estuaries. Some fishes pass through an estuary on the way to fresh-water spawning grounds or simply use the estuary as a feeding place. It is estimated that at least two-thirds of all marine animal populations spend part of their lives in estuaries or are dependent on other species that do.

Sandy Beach

You probably think of a sandy beach as a place where you sunbathe, collect shells, build castles, swim, or fish. A beach may seem deserted at sunrise, but it is constantly alive! Crabs burrow beneath the sand, sandpipers comb the shore for food, and small fish teem in the shallow waters. In another sense, the beach itself is alive: winds, waves, and currents carry sand up and down the beachface. Harsh winter waves tend to flatten the beach, but the gentle waves of summer rebuild the beach and dunes. As years pass by, some beaches grow larger while others erode hundreds of feet.

Rocky Shores

Have you ever observed rocky shores? You may have noticed that some shores are steep and rugged, while others are relatively flat and smooth. Rocky shores all have one thing in common: they are always being shaped by the ocean's forces--scoured by waves and washed by tides. Plants and animals that live along rocky shores must be strong and adaptable to changing conditions. Imagine living underwater, buffeted by strong currents for half your lifetime, while the other half of your time you are exposed to air, wind, and breaking waves. This is what it is like to live in the pools of the intertidal zone. Plants and animals below and above this zone may experience similar but less frequent changes. Surprisingly, life forms on a rocky shore are sometimes more varied and abundant than on a sandy beach.

Coral Reef

Life in a coral reef is so abundant, varied, and colorful that coral reefs have been called "moving rainbows." Coral reefs can only be formed in shallow, warm, tropical waters. A reef is formed by communities of many species of coral, animals that build skeletons of calcium carbonate. Much of the reef consists of rich detritus (particles of broken rocks and the remains of dead plants and animals that once lived there). If you were to swim in a coral reef, you might see life forms ranging from algae to shrimps, sponges, sea urchins, worms, tritons, sea stars, snails, octopi, turtles, and exotic fishes. In such a habitat one has an excellent opportunity to observe the continual action of the animals that make up the coral reef food web.

Continental Shelf

Picture a very gently sloping underwater plain extending many miles offshore from the coastline to a depth of several hundred feet. This describes what the continental shelves that surround the continents look like. Man has long known that the continental shelves are some of the oceans' richest parts. What makes the continental shelves different from other parts of the ocean? For one thing, the shelves are adjacent to productive estuarine breeding and feeding grounds. And the shallow coastal Waters of the shelves are often warmer, less salty, and more turbid (cloudier) than the open ocean due to the runoff of fresh-water rivers from the continents. The shelves offer habitat for a great variety of marine plants and animals. Life forms range from huge masses of tiny plankton, to rich seaweed beds, schooling fishes, and even great whales. So it's no wonder that shelf waters have been called "forests of the sea."

Open Ocean

In comparison to the fertile continental shelves, one might say that large areas of the open ocean are biological deserts. Why? The average water temperature in the ocean is a chilly 39 F., and the water is from 2-6 miles deep. Plant life is generally limited to the upper several hundred feet of sea water since deeper waters do not receive enough sunlight for photosynthesis; thus, food may be abundant in surface waters and on the sea floor (where dead organisms sink). To a large extent, the presence of food supplies only at the surface and on the sea bottom restricts marine animal life to these zones. The rest of the water "column" in the open ocean is generally not a very lively place.

CURRENT OCEAN ISSUES

Food From The Oceans (8-10, 22, 33, 37, 38)

Fish is an important food source for many of the world's people. In Japan, for example, the average person eats seven times as much fish as the average American. And fish accounts for more than one-fifth of the body-building animal protein in the diet of people of the world's developing nations.

The yearly world catch of ocean finfish and shellfish tripled between 1950 and 1970. But since 1970 the yield from ocean fisheries has remained about 60 million metric tons per year. In fact, catches of several commercially important fishes, such as Atlantic herring and cod, have dropped in the past decade. These declines have been blamed, at least in part, on overfishing, pollution, and changes in ocean currents.

The U.N. Food and Agricultural Organization estimates that through the development of new fisheries in areas such as the southwest Atlantic and western Indian Ocean, the annual world marine catch can be increased by as much as 50%. But some experts question whether our harvest of marine creatures can be raised this much without a tremendous increase in the world fishing effort and depletion of many fish populations.

As we approach the harvestable limits of traditional ocean fisheries, the development of new marine food sources is becoming critically important if the world's growing population--6 billion people by the year 2000--is to be fed. One promising resource is krill, a shrimp-like animal with a very high protein content. Krill are found in huge swarms in frigid Antarctic surface waters.

The annual catch of krill is only about 80,000 metric tons; but fisheries experts estimate that there are so many Antarctic krill that we could harvest at least 50 times this many krill each year without seriously depleting krill populations. Krill are also a major food source for most large Antarctic animals, such as penguins, seals, and the endangered baleen whales (e.g., blues and humpbacks). So before we begin large-scale harvests of krill for human food, we must consider the effects our actions might have on the Antarctic wildlife.

Another great hope for man's future is aquaculture, the farming of aquatic plants and animals (the underwater equivalent of agriculture). Worldwide, aquaculture currently produces about 6 million tons of seaweed, finfish, and shellfish each year. Some of the countries leading the way in aquaculture research and development are Japan (the top seaweed producer), China (the top finfish producer), India, the United States, and the Soviet Union.

Aquaculture has tremendous potential as a means of food production; yields of up to 125 tons of mussels per acre have been reported in Spain. Scientists forecast a doubling of world aquaculture productivity by the end of this decade if enough of our resources are devoted to this fascinating science.

A popular plan for getting more food from the seas is "ocean ranching" of salmon. In experiments, salmon have been raised to fingerling size in Pacific coast hatcheries, then released at selected inland sites. These salmon move into the open ocean as they grow older, then eventually return to the release site to spawn at which time they can be harvested. In this way, we can take advantage of the salmon's natural anadromous life cycle and use the Pacific Ocean as a giant ranch.

Endangered Marine Wildlife (22, 35,36)

As a result of decades of unregulated slaughter of thousands of whales, there are now 8 whale species classed as "endangered"-- blue, bowhead, finback, gray, humpback, right, Sei, and sperm. Only a handful of countries, most notably Japan and the Soviet Union, still support a large-scale whaling industry. The 24 member nations of the International Whaling Commission (IWC) now regulate the whaling industry to some extent. The IWC has banned the killing of several of the great whales species, and has set the 1981 world whale harvest quota at less than 15,000 whales. Conservationists hope that annual whale quotas will continue to be substantially curtailed, insuring the survival of the great whales.

Six sea turtle species--green, hawksbill, leatherback, loggerhead, Atlantic Ridley, and Pacific Ridley--are also on the U.S. List of Endangered and Threatened Species. Sea turtles have been killed for their meat, oil, and shells; their eggs are also used as food. Sea turtles' habit of coming ashore to lay their eggs on sandy beaches makes the turtles and their eggs vulnerable to predators and poachers. Sometimes sea turtles drown after accidentally getting caught in fishing nets.

On the bright side, trained conservationists are now assisting scientists and wildlife managers by patrolling sea turtle nesting areas and moving the turtle eggs to safer sites. By protecting the eggs from raccoons, birds, and poachers, and transporting the freshly hatched turtles back to the sea, these people are helping the sea turtles survive.

Ocean Pollution (39-47)

Until recently, man did not realize that the seemingly infinite world ocean could be scarred by pollution. Coastal waters have been used as dumping areas for pesticides, detergents, toxic metals, oil, acids, and sewage. National Wildlife Federation attorney Ken Kamlet estimated that about 100,000 tons of wastes were dumped off U.S. shores in a recent year. A single oil well blowout in 1979 dumped 140 million gallons of oil into the Gulf of Mexico. The National Academy of Sciences has estimated that 2,100,000 tons of oil has been spilled in the seas annually as a result of the ocean transport of petroleum products.

The seriousness of the marine pollution problem is illustrated by the words of Thor Heyerdahl, famed ocean explorer-scientist, describing his 1970 raft voyage from Africa to America, "We were to observe solidified oil lumps on 43 of the 57 days it took Ra II to cross the Atlantic . . . on certain days the oil was thickly clustered over large areas . . . we observed almost every day empty bottles, tin cans, and plastic containers."

But there is good news for ocean wildlife! Thanks to concerned citizens (like you) and conservation organizations, there is hope that the oceans will always be blue and alive. The National Wildlife Federation has taken a lead role in promoting the adoption of laws to phase out the ocean dumping of sludge (the solids removed from treated sewage) and industrial wastes in U.S. waters. Recent NWF actions have also resulted in tighter controls on the ocean disposal of dredge spoils (sediments removed from the bottoms of harbors or navigation channels). Encouraging steps like these show that our oceans, the "reservoirs of life," can be preserved through wise planning and the cooperation of everyone who uses and needs the oceans.

Ocean Energy (40)

The abundance of ocean energy is evident to anyone who spends a day at the beach--the ceaseless pounding of the waves, the strength of the nearshore currents, the steady rise and fall of the tides, and the warmth of the water itself--the question now is whether we can find efficient and environmentally acceptable ways to convert this energy into reliable electric power. Several schemes to make use of the energy of the oceans are now under consideration.

The most popular ocean energy proposals involve the harnessing of tidal energy. Tidal power plants located in estuaries (arms of the sea) can use the force of the ebbing and/or flooding tides to spin turbines and generate electricity in a way that is in some respects similar to the operation of a hydroelectric power dam on a river. There are costly engineering difficulties associated with building a tidal power plant. But as the prices of fossil fuels climb, tidal power production is becoming attractive from an economic standpoint. In 1966, the French opened the world's first large-scale tidal power

plant on the Rance River. With the increased interest in development of tidal power, countries like Canada (Bay of Fundy), the Soviet Union, India, Argentina, and other countries are investigating sites that have large tidal ranges (and, hence, the most power production potential). The 1980s may be the decade in which tidal power becomes an important means of providing electricity for many coastal regions.

Another proposed method for producing power from the seas is ocean thermal energy conversion (OTEC). The oceans act as giant solar energy collectors. In some tropical seas, the surface waters are 30-35 F. warmer than waters a few hundred meters beneath the surface. Engineers are now studying the feasibility of using this temperature difference to produce power at sea by conversion of the ocean's thermal energy into electrical power (in a manner similar to a steam generator).

The practicality of using waves or ocean currents to produce electricity is also being examined. Supporters of the development of ocean power resources claim these ocean energy sources have the following advantages over land-based coal, oil, and nuclear power plants: they are virtually inexhaustible ("renewable"), relatively pollution-free ("clean"), and, in the case of thermal energy, ocean resources can be developed for power production without altering large tracts of land.

Petroleum and Marine Mineral Resources (11, 39-41)

Salt, magnesium, and bromine are being commercially extracted from sea water. The sea floor holds other priceless resources, including millions of tons of potato-sized metallic nodules containing nickel, copper, manganese, and cobalt. These nodules form very slowly on the ocean bottom as dissolved metals are precipitated from sea water. If international sea-mining agreements can be reached, large-scale mining of metallic nodules may soon begin. The environmental impacts of sea floor mining are not fully known; this subject merits further study. (See the 1981 Wildlife Week Activity Guide for more background on the Law of the Sea).

From an economic viewpoint, petroleum is the ocean's most valuable resource. Offshore drilling now accounts for production of about 10,000,000 barrels of oil daily worldwide. Major improvements in offshore drilling technology have made it possible to drill for petroleum in water several thousand feet deep. Drilling in deeper water in areas like the North Sea allows the oil industry to recover much more of the sea's petroleum stores.

But exploiting the ocean's mineral wealth is not without its drawbacks. The common theme of many of today's resource issues is "food vs. fuel." Will pollution and environmental disruption associated with offshore drilling or tidal power production cause significant harm to ocean fisheries? (See the 1981 Wildlife Week Activity Guide for information about one such issue, the Georges Bank controversy.) We now must face the problems associated with developing the resources of the seas (food, energy, minerals) for our growing population, while protecting the quality of the ocean environment for the sake of marine wildlife and man.