Participate in a Biological Survey

Lesson Information

Summary: Students help scientists monitor habitat health and biodiversity by participating in biological surveys and inventories.
Duration: Four hours or more
Group size: Any
Materials: Access to the Internet

Learning Outcomes

Students will be able to:

- Collect data and organize information relating to ocean communities.
- Cultivate a sense of stewardship towards marine species and aquatic habitats through a biological survey.

Background

All animals and plants are interconnected in a vast web of life. The cement that holds this web together is biodiversity. (See the **Teacher's Notes** for a detailed discussion on the three levels of biodiversity.) Yet much of our biodiversity is disappearing, even before scientists have a chance to study or name many species. Scientists estimate that, at the current rate of extinction, as many as 25 per cent of all species on Earth — from micro-organisms to mammals — could vanish early in this century. Of the approximately 1,100 fish species in Canada, four have become extinct, two extirpated, and 54 listed as endangered, threatened, or vulnerable. This decline in biodiversity is cause for serious concern. The health of entire ecosystems is placed in jeopardy when key links are lost in the web of life. Wild species have already given us many life-saving medicines, and there's no telling how many scientific discoveries will never be made if we let species vanish.

Biodiversity disappears because of habitat disruption and loss, overharvesting, and the invasion of aquatic ecosystems by non-native species. These alien invaders sometimes upset the balance of an ecosystem so badly that native species disappear. For example, purple loosestrife was brought to Canada from Europe. Many people planted this exotic wildflower in their gardens. Now the species is rapidly invading Canadian wetlands, choking out native cattails and bulrushes. As these important plants disappear, so do the species that rely on them for food and shelter.

What can be done to conserve biodiversity? Canada ratified the UN Convention on Biological Diversity and drew up its own Canadian Biodiversity Strategy. This strategy builds on many laws, policies, and programs that already exist in Canada and promotes a more ecological approach to the way we use natural resources.

Scientists help biodiversity by gathering information on the range, abundance, and behaviours of wild species. This data makes it possible to understand the threats to biodiversity (such as habitat loss and the spread of alien invaders) and to propose solutions. Your students can help, too, by assisting scientists who are conducting biological surveys nationwide.

Procedure

1. Discuss biodiversity, its significance, and threats to species inhabiting ocean communities. Emphasize the importance of gathering scientific data. Information on the range, diversity, and abundance of wild plants and animals lets scientists know if there is cause for alarm and helps them recommend actions to protect species and their habitats. Explain that scientists can benefit from having "many eyes," namely volunteers across the country who take time to report wildlife observations.

2. Have your students investigate CWF's online **Directory of Wildlife Surveys**.

3. Ask them to report on aquatic surveys in which they would like to participate. Together, the class can agree on one survey.

4. Use information provided in the directory to contact the survey administrator by phone, fax, or e-mail. Ask for details on how your students can participate.

Evaluation

Have your students do additional research on the species surveyed, including life history, ecological importance, and threats to the species and its habitat, then report to the school or community.

Teacher's Notes

These notes will give you some basic background on ecological principals and conservation issues relating to oceans.

Biodiversity

Biodiversity means "biological diversity," or the variety of living things. Biodiversity is usually described at three levels: genetic, species, and ecosystem. Genetic diversity occurs within each species or population. A genetically diverse species or population will have members that exhibit a broad range of characteristics. Broad genetic diversity is what allows a species to adapt to changing conditions over time. Species diversity refers to the variety of species that occur in a particular area. It allows for more complex food webs and, therefore, more resilient ecosystems, since creatures may have several alternate food sources. Ecosystem diversity refers to the variety of ecosystems on Earth. The greater the variety of living spaces, the greater the variety of life forms that can inhabit them.

Ecosystems

Ecosystems include the living and non-living components of an area, along with interactions among them. The living parts of an ecosystem consist of micro-organisms, plants, and animals (including humans). Non-living elements include minerals, soil, water, and so on. Vital processes, such as the carbon cycle, water cycle, and energy cycle, also occur within healthy ecosystems. Ecosystems can be any size, from microscopic to enormous. Larger ecosystems contain smaller ones. For example, we might consider the world's oceans to be one giant, interconnected ecosystem, and the Pacific, Atlantic, and Arctic oceans to be smaller ecosystems within it. We might also consider each reef, estuary, salt-marsh, and beach to be a separate ecosystem.

Habitat

Habitat is where an animal or plant lives. All organisms, including humans, need the right habitat to survive. The four main components of habitat are food, water, shelter, and space. Habitat components for an ocean organism might be quite specific and far apart. For instance, the whooping crane requires nesting grounds on Canada's northern tundra in summer and coastal marshes along the Gulf of Mexico in winter. It also needs feeding and resting places to make the long journey between breeding and wintering grounds. That's why prairie wetlands are important habitats for this species and why human prairie communities that protect wetlands are part of a healthy ocean community. Sea turtles spend most of their lives in the open ocean, but without protected beaches where they can lay their eggs, they cannot survive. Many marine animals, including fish, depend on coastal habitats to meet all or part of their needs. Yet these parts of the ocean are the ones most affected by pollution and human development.

Natural communities

Natural communities are collections of living things that share the same space. The plants, animals, and micro-organisms that inhabit natural communities tend to depend on one another either directly or indirectly. For instance, polar bears depend directly on seals that make up the main part of their diet and indirectly on the fish that feed the seals. Polar bears, seals, and fish form part of an Arctic ocean community.

Watersheds and drainage basins

All land is drained by systems called watersheds, which include creeks, lakes, wetlands, and rivers that eventually empty into the ocean. Smaller, local watersheds flow together and can be considered as larger units on a regional level. Canada's watersheds are organized into five main drainage basins, the boundaries of which are determined by the ocean bodies they flow into: the Pacific, Atlantic, Arctic, Hudson Bay, and Gulf of Mexico.

Estuaries

Estuaries are areas where freshwater from rivers meets salt water from oceans. The mixing of these waters and daily rhythms of rising and falling tides create unique conditions that encourage rapid plant growth. Estuaries are critical habitats for a rich diversity of species. Canada's extensive coasts are lined with thousands of rivers of all sizes, from the tiniest coastal creek to the giant St. Lawrence River. Estuaries, great and small, add up to a major ecological asset for Canada. Unfortunately, our coastal areas, especially estuaries, are being increasingly disturbed by human development.

Bioaccumulation in food chains

Some toxic chemicals "bioaccumulate" in wildlife. Scientists discovered this phenomenon when they noticed that the levels of certain chemicals in some animals' bodies were significantly higher than those in the surrounding environment. These levels were highest at the top of food chains. The more links in a food chain, the higher the levels of toxic chemicals. Many types of chemicals are stored in fat tissues and eliminated by animals far more slowly than they are consumed. Over its lifetime, an animal will gather and store toxic chemicals at levels far above those in its environment. This bioaccumulation happens at each successive level of a food chain. Predators, such as polar bears, eagles, and people, are at the top of long food chains and sometimes accumulate concentrations of toxic chemicals in their bodies hundreds of times greater than those in the surrounding environment. Bioaccumulation can lead to serious health risks, including cancer.

Marine pollution

Eighty per cent of marine pollution originates from human activities on land, coming mainly from individuals and communities, not industries. Pollutants make their way to the ocean through sewers, waterways, and atmospheric currents.

Untreated or partially treated sewage from domestic waste-water often ends up in waterways. Its main threat to humans is the bacterial and viral contamination of shellfish, which can turn seafood into a lethal meal and lead to the closure of economically important fisheries.

Persistent organic pollutants (POPs) are a class of chemicals that accumulate in food chains and cause tumours, deformities, loss of reproductive ability, and even death in plants and animals, including humans. Some examples are DDT, PCBs, and dioxins. POPs enter the environment through pesticides sprayed on lawns and crops and industrial chemicals that leak from landfills. They are transported long distances by waterways, ocean currents, and the atmosphere. POPs affect ocean wildlife, such as beluga whales, fish, seals, and even arctic species like polar bears.

Heavy metals, such as mercury and cadmium, cause problems similar to those caused by POPs. They enter the environment through mining and smelting operations, the burning of coal for electrical generation, and pulp and paper industrial processes.

Oil is toxic to aquatic life if ingested or absorbed through the skin. It also fouls the fur and feathers of wildlife and smothers aquatic habitats and beaches. Oil finds its way into the ocean through marine oil spills and land-based sources like domestic storm sewers. Urban communities introduce an estimated 30 million litres of oil into aquatic ecosystems each year, as people carelessly pour waste oil down the drain.

Marine debris, particularly plastic litter, chokes and entangles wildlife, such as sea turtles, whales, dolphins, and seals. Litter gets into the marine environment through direct dumping from ships and by entering waterways from poorly managed waste-disposal sites.

Habitat Destruction

Coastal habitat destruction is a growing concern. As human communities expand, critical habitats, like salt-marshes, beaches, and estuaries, are altered to accommodate houses, harbours, and recreational facilities. The loss of habitats vital to marine migrators is another major threat. Many ocean travellers, including endangered waterfowl and shorebirds, use inland wetlands as stopovers during their migrations. Salmon travel up coastal rivers to reach spawning habitats. The importance of such habitats is often overlooked because wildlife does not visit them for long. Consequently, we often drain marshes for agriculture, obstruct rivers with dams, and develop shorelines for condominiums and marinas.