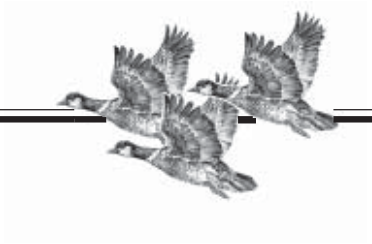


Section 4
Human and Natural Influences

Conservation Issues

Target Grades: K-8th

Objective:

To help student become aware of potential hazards to Alaskan plant and animal populations and reasons for special status.

Concept:

Many of the endangered and threatened species in Alaska are vulnerable to population declines because of their rarity, their restricted distribution, their dependence on limited habitat and their sensitivity to environmental disturbances. All of these characteristics make them vulnerable to adverse weather conditions or natural or man-made disasters.

You Will Need:

- *Endangered and Threatened Species Cards*
- *Chairs*
- *Music and tape player*

What to Do:

Pass out the endangered and threatened animal species cards to be used as name tags for the students. Punch a hole through the cards and thread them with string. Have the students hang them around their necks.

Explain the general rules for musical chairs. As the students move around the chairs the music plays, when it stops each student must find an empty chair.

The student who is left out must find their species on the Endangered Species Situation Handout and read about their plight. The student must follow the instructions for their species. Only those species who are recovering or stable will have instructions to stay in the game, otherwise the student is out. A species that has had a "success story" gets to choose another species to "bring back" with them to the game. Encourage the students to think of a way the species they chose could be "brought back."

Spectacled Eider

Photo by Doyle Ohnemus

Remove a chair for each student that is removed from the game after each round.

At the end of the game discuss the different species that were involved and the similarities and differences of their situations. Discuss which causes for a threatened or endangered status were man-made and which were natural. Explore ideas for preventing and/or restoring damaged populations. Discuss pros and cons of each possible solution.

Follow up and Extensions:

Group Discussions:

Discuss impacts on various populations as a class. Brainstorm ideas for helping threatened or declining species of sea ducks.

This lesson was adapted from *Our Wild Neighbors: An Educational Resource Book About Alaskan Animals* by the Alaska National Park Service.

Endangered Species Situation Handout

Possible Reasons for declines or recovery in the population of each species

☹ **Steller's Eider** was listed as a Threatened Species in 1997 due to declines in western Alaska and possibly northern Alaskan populations. Concerns are increased subsistence harvest, increased predation on smaller goose nesting colonies in proximity to eider nesting areas, decline in availability of preferred foods in wintering areas for reasons unknown.

☹ **Black Scoter** has had a recent decline in Western Alaska possibly due to contaminants (toxic metals or other chemicals in their food chain) in molting areas.

☹ **Surf Scoter** has had recent declines in breeding in western Canada and possibly Alaska because of their susceptibility to oil spills and other contaminants in intertidal feeding areas that cause winter die-offs.

☹ **Long-tailed Duck** has had a long-term decline in western Alaska, but is stable on the Arctic Coastal Plain. It is on the Audubon Watchlist. Concerns for the species are predation by bird and mammal predators in nesting areas, lead shot poisoning and heavy metal contamination.

☺ **Aleutian Canada Goose** populations are increasing - grab a chair and another species and get back in the game!

😐 **Killer Whales** species populations are probably increasing but are vulnerable to oil spills in coastal wintering areas - stay in the game!

☹ **Short-tailed Albatross** are endangered and have lost some of their nesting habitat in Japan due to a volcanic eruption on one of their two nesting islands. They are vulnerable to being caught in fishing nets because they are attracted to the bait that looks like the shrimp they feed on.

☹ **Eskimo Curlew** were over-hunted for food from 1870-1890 and are thought to be extinct.

☹ The **Steller Sea Lion** population in western Alaska is threatened after a large decline. Suspected causes include shooting by fishermen, change in the quantity or quality of the fish they eat, and the effects of climate change on ocean food webs.

☹ The **Humpback Whale** was overhunted and is an endangered species.

☺ The **Peregrine Falcon** declined because of the use of DDT for pest control which contaminated the food chain, but Alaskan populations have recovered - grab a chair and another species and stay in the game!

☹ It is unknown why the threatened **Spectacled Eider** has declined. Scientists believe it may be a combination of loss of food source, pollution, and overharvest.

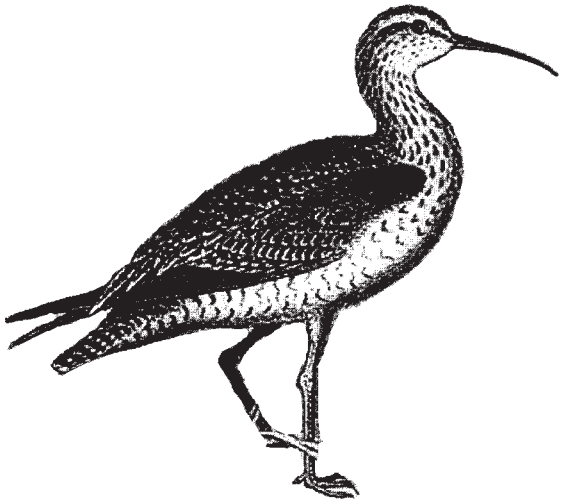
☹ **Sea Otters** are declining in Southwest Alaska possibly due to increased predation by Killer Whales.

☹ **Aleutian Shield Fern** is endangered because of its very restricted habitat requirements.

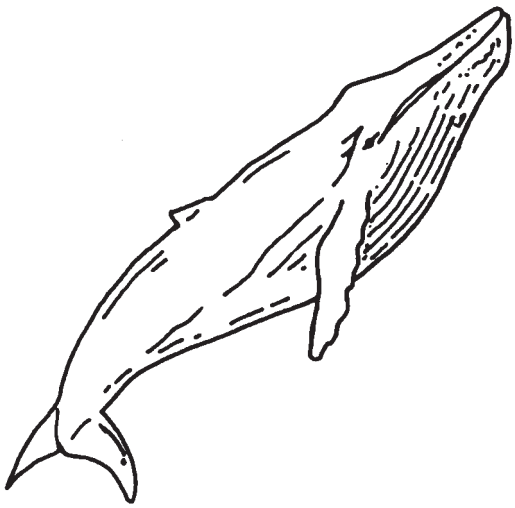
😐 **Pribilof Rock Sandpiper** populations are stable but vulnerable to oil spills and extreme cold in Cook Inlet where they winter and overgrazing of their nesting areas by reindeer on Pribilof Islands.

☹ **Kittlitz's Murrelet** populations have been declining. Their habitat in bays with tidewater glaciers is shrinking as the climate has been warming and the glaciers melt. The *Exxon Valdez* oil spill killed 5-10% of the world population.

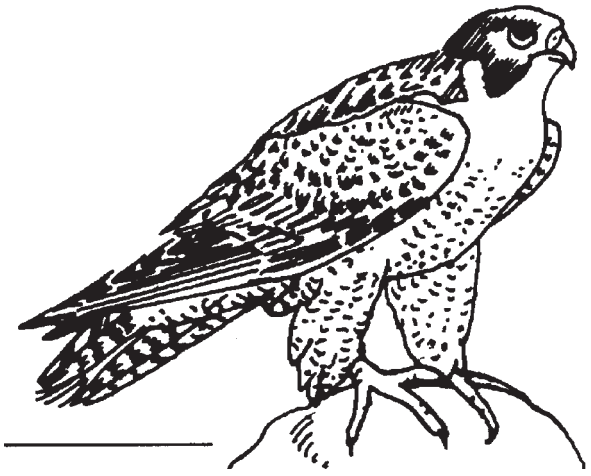
Endangered Species Cards



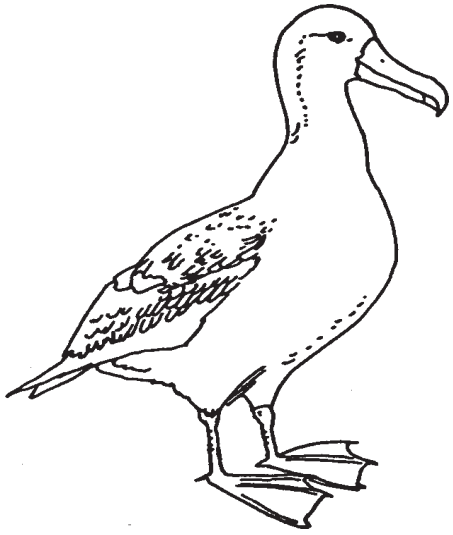
Eskimo Curlew



Humpback Whale

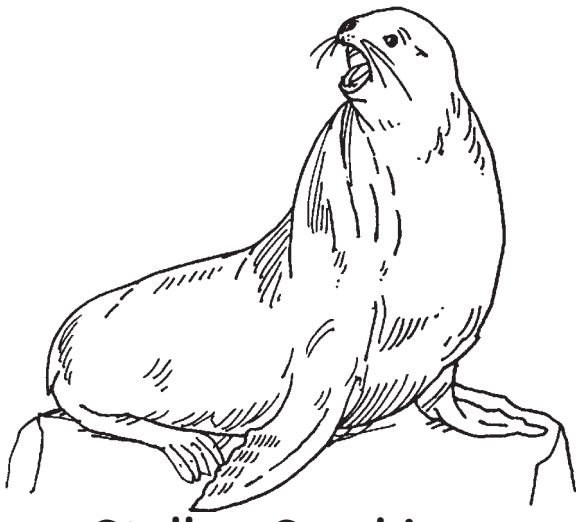


Peregrine Falcon



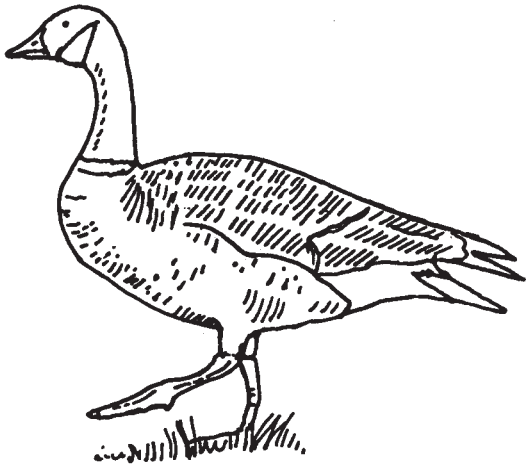
Short-tailed Albatross

Spectacled Eider



Steller Sea Lion

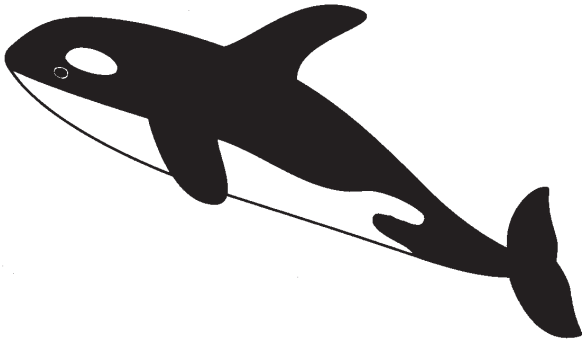
Endangered Species Cards



Aleutian Canada Goose

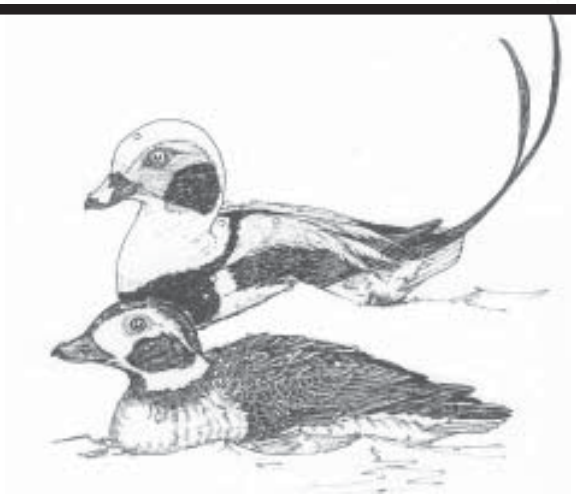
Aleutian Shield Fern

Black Scoter



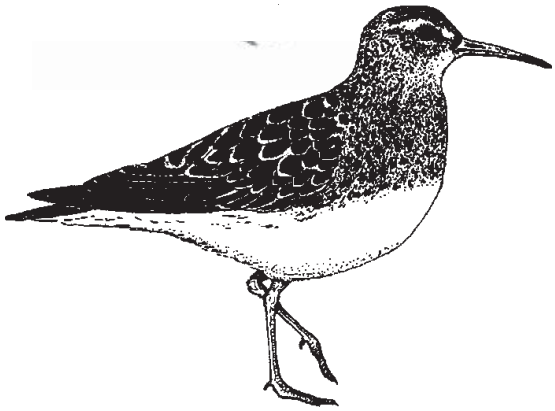
Killer Whale

Kittlitz's Murrelet

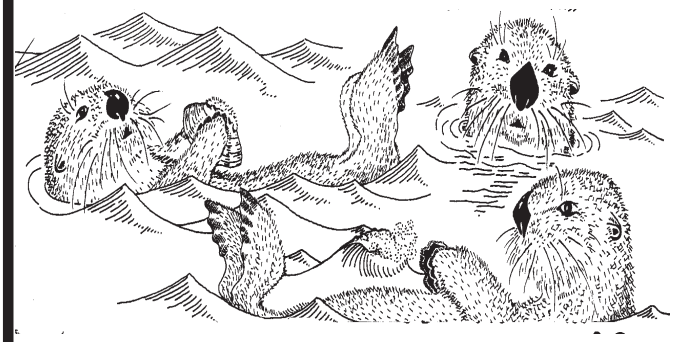


Long-tailed Duck

Endangered Species Cards

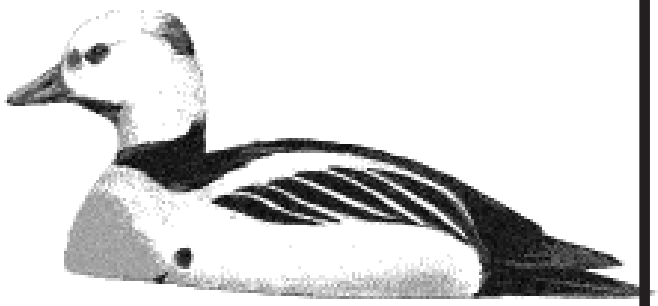


Pribilof Rock Sandpiper



Sea otters

Surf Scoter



Steller's Eider

Marine Pollutants

Target Grades: 3rd-8th

Objective:

To help student become aware of hazards to Alaskan plant and animal populations through exposure to pollutants in the oceans.

Concept:

Many of the endangered and threatened species in Alaska are vulnerable to population declines because of their rarity, their restricted distribution, their dependence on limited habitat and their sensitivity to environmental disturbances. All of these characteristics make them vulnerable to natural or man-made pollutants.

You Will Need:

- *Candy*
- *Plastic Baggies*
- *Graph Paper*
- *Colored Pencils*

What to Do:

Divide the candy amongst the baggies. You may either have 1 baggie per student or 1 baggie per group of students. You should have about 30 pieces of candy per baggies. Each baggie represents a watershed.

Use the table at the bottom of this section to initiate a discussion about the pollution problems facing our oceans today. Discuss the various sources of these pollutants and their possible impacts to plants and animals.

Have the class assign a pollutant (or group of pollutants) to each color of candy. For example: Brown = sediment, red = pesticides, green = fertilizers or nitrogen.

Distribute graph paper to each student (or group). Have the students draw a bar graph of the pollutants in their ocean. Label the x-axis with the names of the candy colors or pollutants and the y-axis with numbers.

Give each group a baggie with candy. Have the students separate and count the number of each color and graph them on the paper. The students can use colored pencils to draw in the bars. Have the students try to determine what activities were happening in their ocean or in a country where ocean currents would carry their pollutants to their ocean.

Give each group a bird, plant or marine mammal and have them brainstorm possible impacts to their organism from the pollutants found at their site. Present their findings to the class.

Wrap up with a discussion about possible solutions to the pollution problem, or regulations and monitoring that could go on to keep oceans from becoming over polluted.

Adapted from: University of Arizona Cooperative Extension Service, *Use Your Head, Protect Your Watershed!* Developed by Dr. Kitt Farrell-Poe, September 1997.

Marine Pollutants Table

Pollutant Type	Sources	Effects and Trends
Toxins (e.g., mercury, PCBs or dioxin)	Industrial and municipal wastewaters; runoff from farms, forests, urban areas and landfills; erosion of contaminated soils and sediments; vessels; atmospheric deposition	Poison and cause disease and reproductive failure; fat-soluble toxins may bioconcentrate, particularly in birds and mammals, and pose human health risks. Inputs into U.S. waters have declined, but remaining inputs and contaminated sediments in urban and industrial areas pose threats to living resources.
Biostimulants (organic wastes, plant nutrients)	Sewage and industrial wastes; runoff from farms and urban areas; airborne nitrogen from combustion of fossil fuels	Organic waste overload bottom habitats and deplete oxygen; nutrient inputs stimulate algal blooms (some harmful), which reduce water clarity, cause loss of seagrass and coral reefs, and alter food chains supporting fisheries. While organic waste loadings have decreased, nutrient loadings have increased (NRC, 1993a, 2000a)
Oil	Runoff and atmospheric deposition from land activities; shipping and tanker operations; accidental spills; coastal and offshore oil and gas production activities; natural seepage	Petroleum hydrocarbons can affect bottom organisms and larvae; spills affect birds, mammals and nearshore marine life. While oil pollution from ships, accidental spills, and production activities has decreased, diffuse inputs from land-based activities have not (NRC, 1985)
Radioactive isotopes	Atmospheric fallout, industrial and military activities	Few known effects on marine life; bioaccumulation may pose human health risks where contamination is heavy.
Sediments	Erosion from farming, forestry, mining, and development; river diversions; coastal dredging and mining	Reduce water clarity and change bottom habitats; carry toxins and nutrients. Sediment delivery by many rivers has decreased, but sedimentation poses problems in some areas; erosion from coastal development and sea-level rise is a future concern.
Plastics and other debris	Ships, fishing nets, containers	Entangles marine life or is ingested; degrades beaches, wetlands and nearshore habitats
Thermal	Cooling water from power plants and industry	Kills some temperature-sensitive species; displaces others. Generally, less a risk to marine life than thought 20 years ago.
Noise	Vessel propulsion, sonar, seismic prospecting, low-frequency sound used in defense and research	May disturb marine mammals and other organisms that use sound for communication.
Human pathogens	Sewage, urban runoff, livestock, wildlife	Pose health risks to swimmers and consumers of seafood. Sanitation has improved, but standards have been raised.
Alien species	Ships and ballast water, fishery stocking, aquarists	Displace native species, introduce new diseases; growing worldwide problem (NRC, 1996).

From: *Marine Pollution in the United States*, published by the Pew Oceans Commission, 2003. This table was originally adapted from Weber, 1993. Abandoned Seas: Reversing the Decline of the Oceans. Worldwatch Paper 116. Worldwatch Institute, Washington, D.C.

Marine Pollutants Analysis Table

Color	Contaminant	Effect
Red		
Orange		
Yellow		
Green		
Dark Brown		
Light Brown		
Purple		

Describe the major form of activity that is occurring at your site and what kinds of pollution are a result of that activity. Include a description of any impacts on the local wildlife and/or human population in your designated area:

Recommendations for improving conditions at your site:

Island Isolation Game

Target Grades: 3rd - 6th

Objective:

Students will describe the factors that affect the relationship between habitat fragmentation and biodiversity. Students will create a graph that demonstrates the relationship between biodiversity and the size of a habitat.

Materials:

- Large playing area
- 4 large traffic cones
- Two 25-ft ropes
- Two 40-ft ropes
- Duct tape
- Flip chart paper
- Markers
- Stop watch

Introductions:

Worldwide, habitat loss is one of the biggest threats to biodiversity. In Alaska, biodiversity and the status of a species population can be affected by whether or not they are confined to a specific habitat area - in particularly - the Aleutian Islands. This game will focus on the particular challenges that living on an island present to plants and animals. Students will explore the concept of island biogeography and play a game that simulates island environments and challenges them to survive and move between island habitats. Their findings will help them understand some of the dynamics that occur on the Aleutian Islands and also understand some of the dilemmas facing plants and animals in other parts of the world where habitat fragmentation is occurring.

The students will become species trying to move between habitat fragments, or islands, and they'll begin to understand why animals have such a tough time living in fragmented landscapes. The same principles apply to animals that require a specific small area for their habitat needs. Your group will also try to come up with some ways they can help species move between habitat fragments more easily.

The students will also take a closer look at the relationship between the size of a habitat and the biodiversity it supports.

You will need a big open area about 60 feet by 40 feet, with plenty of extra room for students to work in groups outside the playing area. Use four traffic cones or other visible markers to mark the boundaries. Use two 25-ft roped to make two small islands with diameters of about 8 feet. Use two 40-ft ropes to make two large islands with diameters of about 13 feet. Arrange the islands in the playing area as they are arranged in the diagram below. Tape the rope to the playing surface, if possible, so the students can't move the "islands."

Background:

More species can live on islands that are large and close to the mainland than on islands that are small and far from the mainland. This is a theory that Robert MacArthur and Edward O. Wilson came up with after studying how many species lived on different sized islands. Their theory relates to current studies about habitat fragmentation and island studies. Your students will learn the basics of island biogeography by imagining they are species trying to get to different-sized "islands" at different distances from the "mainland." Then they will apply the concepts of island biogeography to habitat islands. They'll explore some of the threats facing species in habitat islands and think about ways we can reduce those threats.

Island Isolation Game *continued...*

Some of the reasons we lose species and biodiversity in small patches of habitat are:

Luck of the draw: When a piece of habitat is destroyed, some species could be wiped out by chance alone. If a species uses only a small part of a larger area, and that part happens to be destroyed, that species and its habitat are lost. Species that are very rare or that are found only in small population are especially at risk when their habitats are broken into smaller and smaller chunks.

Patchy habitat, less diversity: Small patches of habitat often do not have as much diversity as larger areas that include several different types of habitat. A large area that is fragmented (patches of similar habitat are unconnected and far apart) will often contain fewer usable habitat areas and thus fewer species because some species are not able to find enough patches to meet all of their habitat needs. Many scientist think this is the main reason diversity is lower in habitat patches.

Road blocks: Some species can live in habitat fragments if they can move from one are to another to get everything they need, such as food, shelter, and mates. Unfortunately, many fragments are surrounded by barriers that prevent species from moving between different areas.

On the edge: When we build developments and break habitats into small chunks, we create more boundaries between the habitat and the outside world. Conditions at these boundaries, called edges, are very different than the conditions in the habitat's interior.

Fragmentation doesn't affect all species in the same way. Some are more sensitive to habitat loss than others. And some species can even benefit from fragmentation and the edge effect. All of the factors listed above affect different kinds of species in different ways, and that's what makes the problem of fragmentation so difficult for conservationists trying to protect a wide variety of species.

Procedures:

Introduce the activity by explaining to the students that they will be investigating a well-known ecological theory call the theory of island biogeography. Briefly explain that scientists Robert MacArthur and Edward O Wilson wanted to study species that traveled from the mainland to nearby islands in the ocean. The scientists wanted to know how many species from the mainland lived on islands of different sizes at different distances from the mainland. They were also interested in those species that became "locally" extinct, which means they were no longer living on the islands, but could still be found living on the mainland.

Tell students that they'll be doing a similar investigation outside. Some students will be animals immigrating to "islands" you've laid out in the yard. Other students will be playing predators, diseases, and different forces out tin the "open ocean," that can cause animals to become extinct.

Rules:

Familiarize the students with the playing area. Show them the islands and their sizes and the distances from the mainland.

Select about 2/3^{rds} of the group to be species immigrating to the islands and about 1/3rd to be taggers that represent threats that can cause immigrating species to become extinct. Explain that immigrating species will have one minute to run from the mainland to an island, but they'll have to avoid

Island Isolation Game *continued...*

being tagged by the students in the laying area because being tagged will make them extinct on the islands. Have the students you select to be extinction taggers choose one of the name tags representing a cause of extinction (predators, diseases, pollution severe weather, introduced species, catastrophic events, etc.)

Explain that once you give the signal, species on the mainland should begin immigrating to the islands by making a run for them. Species can be tagged out of the game only when they are out in the open ocean. If they are on an island or the mainland, they can't be tagged. So although they're safe on the mainland, tell students that at the end of the game you'll only count the species that successfully have made it to an island.

Round 1:

Taggers spread out in the playing area and must keep moving. They may not crowd around an island. Yell "Immigrate!" to begin the game. Keep time and blow a whistle or shout "Stop!" at the end of one minute. Let students who become extinct help you monitor the game.

Evaluate the Results:

Have the students count the number of animals species on each island. Keep track of the results on a piece of easel paper.

Discuss the results of Round 1 – evaluate the results and have the students suggests alterations for Round 2 that would change the results.

Did you find that the larger island close to the mainland had more species? Ask the students to speculate as to why this is so.

If your students found different results than MacArthur and Wilson found, talk about some reasons they may have had a different outcome.

Regardless of how many species made it to islands at different distances, more student should be on islands that are large than on islands that are small. Ask student why this is true.

(Small islands don't have the space or variety of different habitat types to support many different species, just as the small islands in the game were not big enough to hold many students. If a small island was overcrowded, a student could have been pushed out and, while moving to another island, would have been open to an extinction tagger).

Round 2:

Make the adjustments to the number of species, taggers, habitat areas, etc. suggested after Round 1 and play another round following the same procedure as for Round 1. When the round is over, evaluate the differences between the results of the tow rounds. Play additional rounds if there is time and chart the results.

Wrap-Up

Discuss habitat islands:

Ask the students to think about what's happening to many of our natural areas and what that may have to do with ocean islands. ***Why might conservationist use the MacArthur and Wilson model when they think about designing reserves in natural areas?*** *(Explain that many of our forests and other natural areas have been separated from each other, Only small patches of the continuous vegetation*

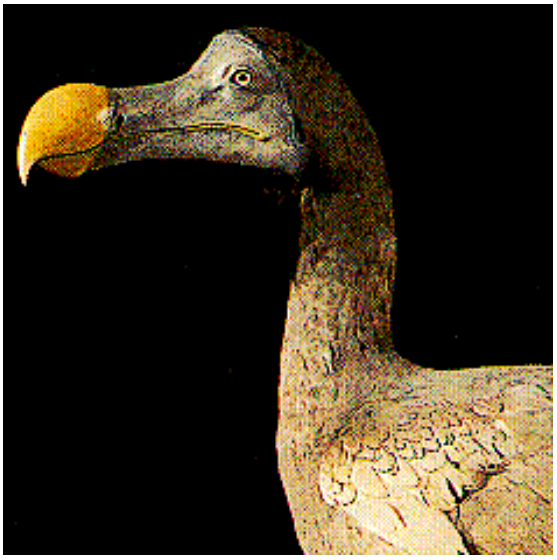
Island Isolation Game *continued...*

that once covered much larger areas still remain).
Ask students why animals need to move between habitat islands. *(Many islands are too small for all the species living in them, and they can become crowded. Competition for resources may force animals to move to find more food or shelter. Some animals need to migrate. Others may be looking for mates.)*

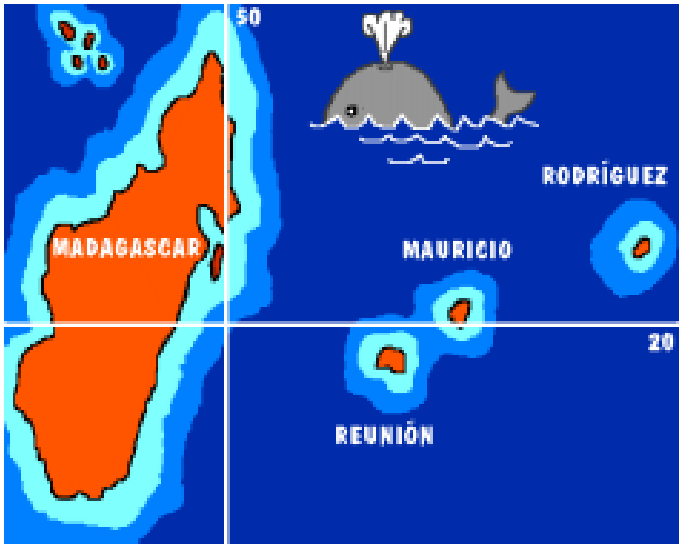
Ask students what kinds of barriers the animals might face.
(Animals are often killed trying to cross roads. Many animals also become easy targets for predators to spot when they leave their habitat. Animals traveling a long distance through developed areas may not be able to find enough food and could become pests to humans by rummaging through garbage cans or waiting for people to provide food.)
Record the students' ideas on easel paper if you can.

Engage the students in a discussion of the comparisons between the results of their game and the situation on the Aleutian Islands.

How does Island Biogeography affect the plants and animals found on the Aleutians?
What are the benefits to the plants and animals by the designation of the Aleutian Islands and the Pribilof Islands as part of the Alaska Maritime Wildlife Refuge?
Are there other areas of the state where the theory of Island Biogeography can be applied?



Extinct Dodo Bird



Islands the extinct Dodo inhabited

Adapted from:
World Wildlife Fund. 1999. ***Windows on the Wild: Biodiversity Basics, An Educator's Guide to Exploring the Web of Life.*** Acorn Naturalist, Tustin, CA.