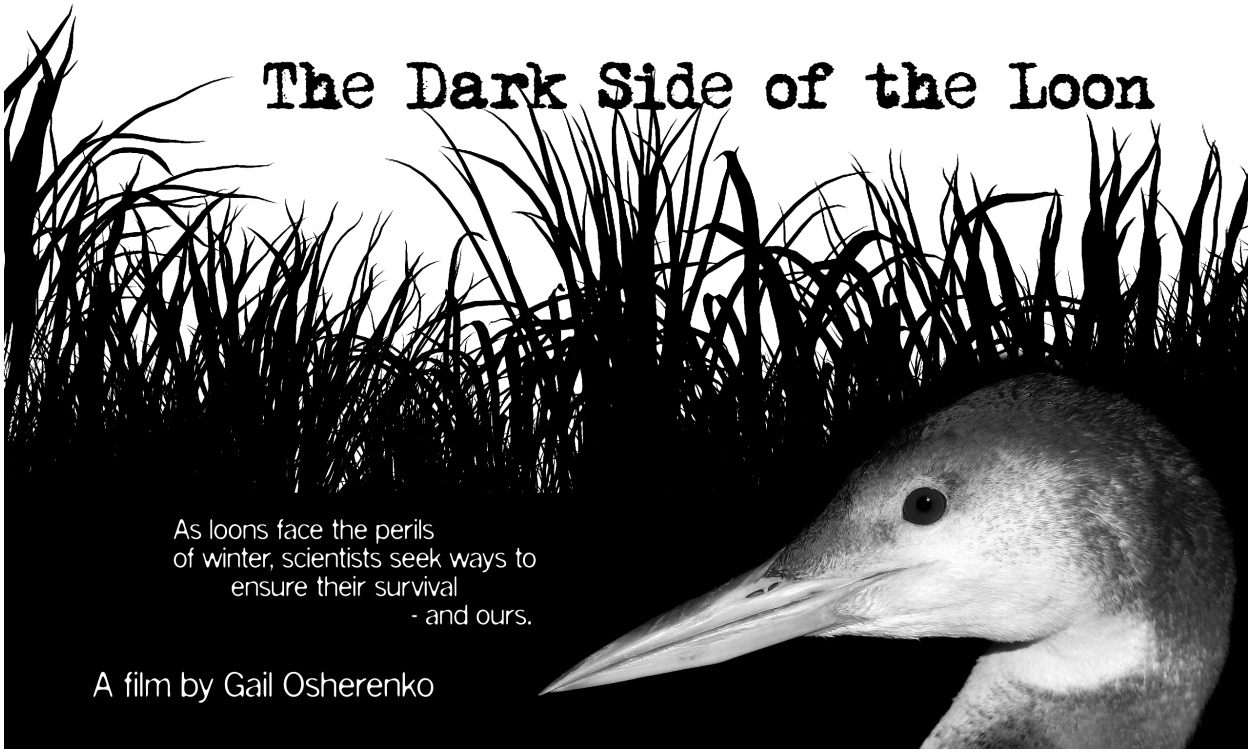
High School Curriculum Guide



The Dark Side of the Loon

Filmed and produced by **Gail Osherenko**

Where and how do loons survive in winter?
Learn from the experts who study them.

42 min. 37 sec. Available on DVD-R, 4:3 ratio.

Curriculum developed by Project Latitudes Consulting.

Table of Contents

Film Highlights

The eerie calls and striking black and white plumage of the common loon captivate those of us who spend time on northern lakes and ponds between April and October. Then the loons disappear. Quiet descends. Where do they go? How do they survive in winter?

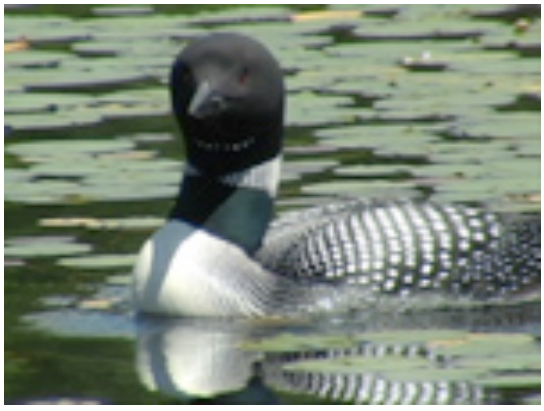
Common loons change their brilliant breeding plumage for dull feathers that provide better camouflage in winter, but make them less obvious in the marine environment. They seldom call, so it's easy to miss them even in the bays and harbors we frequent.

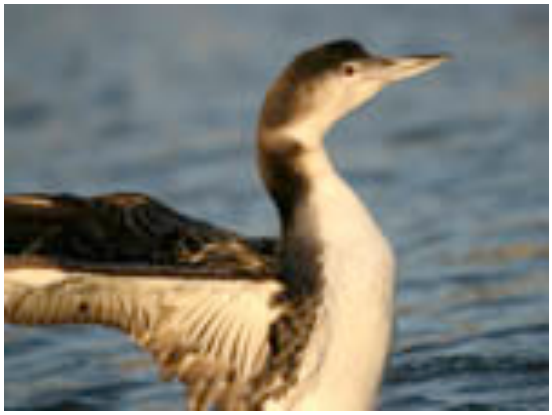
Exploring The Dark Side of the Loon, you visit two "loon pools" (protected winter gathering grounds). On the east coast at North Carolina's Cape Lookout National Seashore, conservation biologist and ornithological expert Dr. Paul Spitzer, is our guide.

On the west coast in Morro Bay, California, biologist and aviculturist Darwin Long conducts the only long-term and detailed study of wintering common loons. He has been banding and studying loons amidst the remaining fishing fleet as well as the kayaks and yachts of what is now a busy tourist mecca.\

In Massachusetts, wildlife veterinarian Dr. Mark Pokras, with his students and colleagues, has necropsied dead loons for 20 years to understand the causes of their mortality, both natural and human caused.

You'll learn how scientists in the field and laboratory unlock the mysteries of a bird that has survived for 60 million years. And you'll discover how loons are helping scientists to understand the perils loons face in winter, and how humans can help ensure their survival – and ours.





The Dark Side of the Loon is filmed, narrated, produced and edited by Gail Osherenko. Shannon Dybvig, assistant editor and webmaster. Still photos of loons in Vermont are by photographer Orah Moore of Haymaker Press.

Background Information about Loons[1]

There are five species of loons in North America (genus, Gavia); common loon, red-throated loon, Pacific loon, Arctic loon, and yellow-billed loon. Arctic loon and yellow billed loon sightings are very rare in Morro Bay. These birds breed, migrate and winter north of the Canadian border and into the Arctic. The predominant species on Morro Bay is the common loon. While all loons have similar adaptations, we will focus on the common loon, *gavia immer*. (Morro Bay Winter Loon Study, 2009)

Range & Migration

Migrations of hundreds of Pacific loons per hour can be seen in April (the first two weeks) along the California coast. Observation posts near the Piedras Blancas lighthouse are the best viewing points. Red throated migration can be seen albeit in smaller numbers during the same time. Both of these birds employ a lower, slower flight strategy, seldom higher than 30 feet above the water. (Morro Bay Winter Loon Study, 2009)

The common loon's range is the widest of all five species. The common loon breeds on inland lakes from southern New York State through the lower Great Lakes / St. Lawrence seaway along the Canadian-American border to the West Coast. Their migration patterns have been speculated but field biologists are presently confirming these routes (first generation, subcutaneous radio and satellite transmitters yielded poor results but new technology has greatly improved and good results are now being gathered). Last spring, we tracked for the first time on the West Coast, the departure of a common loon from it's wintering grounds (Morro Bay, California) to its breeding territory (Lower Stillwater Lake, Montana). This particular bird was banded in Montana in 1997 and we speculate she has spent each winter here since then. We observed her almost daily during the 2004 2005 winter season. We don't know if she flew up the coast and turned east at the Columbia River or moved directly inland from Morro Bay, over the Sierra. Common loons stop each evening and rest and feed before continuing their migration, so their routes must follow inland water courses. As is true for many species, spring migration is much quicker. This particular bird took five days to cover almost 1000 miles. Common loons can fly at 60 miles an hour or faster, and have been recorded in flight at 8000 feet. Our surveys show from 30 to 50 use our Bay during the winter season (late October through April). The population trails off after April to as low as one or two birds in late summer, early fall. Early in the week of October 17 there were three loons in our Bay, a week later there were 12. (Morro Bay Winter Loon Study, 2009)

Features

The loon is most closely related to alcids, Penguins and albatross. Loons are densely feathered and spend all of their time in the water, save nest building, copulation and incubating duties. Adult common loons range from 2100 g to 6000 g., can have a wing span of up to 46 inches and measure almost 3 feet from tip of bill to tail. Loons are visual predators, have excellent eyesight and a nictitating membrane to protect their eyes during dives as deep as 200 feet and up to 15 minutes long. They employ their sharp bill and strong neck as a final thrust after pursuing prey. They do not use their wings underwater (for propulsion) as cormorants or

[1] This section is compiled from the sources listed under Sources and cited at the end of each paragraph.

murrelets. They have a unique adaptation that allows a greater range of motion and more power to their legs. Their fibula extends beyond their femur in what is called a cnemial process. This projection allows for attachments of muscles past the point of the fulcrum, giving their legs greater leverage, strength and flexibility. This gives them the advantage in chasing and (very successfully) catching piscine prey. Loons lack many of the hollow bones of other birds to help facilitate their diving and foraging. They possess very large, strong webbed feet, another adaptation making them excellent swimmers. This ability comes at a cost, loons are unable to walk upright and must push themselves along the ground on their chests. (Morro Bay Winter Loon Study, 2009)

Certainly the image of the common loon foremost in everyone's mind is that of the breeding adult with the striking, checkered black-and-white feathers on the back and distinct white necklace on the iridescent black neck and head, red eyes and snow white breast. But loons do not exhibit this type of plumage until they reach four years and only during the breeding season (April through August). The winter plumage of the adult loon is much more subdued. The checkered pattern on the back is less distinct, the black head becomes grayish-brown, the throat and breast assume an egg white hue. The eyes of adults are always red (an indicator of adulthood in many species), and the adult bill remains dark gray/black all year. First-year, second-year, and third-year birds are similar to winter-plumage adults, but have rusty, brown eyes and show much more (light) gray in the bill, these non adults also show more scalloping on their backs, the white trailing edge of the feather. Both adults and juveniles go through a cataclysmic molt in February and March, losing all of their heavily worn flight feathers. During this time they are flightless, in fact any loss of feathers can affect loons. Their wing loading is such that they are just on the verge of not being able to fly, like their relative the Penguin. (Morro Bay Winter Loon Study, 2009)

Behavior

Loon behavior differs markedly from summer to winter. Breeding adults are extremely territorial, especially the males. They have been known to attack and kill intruders on their breeding lake. On the wintering ground, however, we have found a communal behavior, much less aggressive. Adults are perhaps most aggressive when their precocial chicks are a few weeks old. Their aggressive behavior diminishes as the chicks reach two to four weeks old, are able to dive on their own and have become more adept swimmers. The soft gray, down feathers of the chick makes it difficult for them to dive for any duration. In general, eggs are laid in May or June, and chicks hatch in June or July and are able to fly by August or September. By the end of September, loons start leaving the breeding grounds. Whether the chicks follow the adults to the wintering grounds, whether they share the same wintering grounds, whether they are members of the same raft, we have not determined yet. But it is sure that the chick makes this journey the first year and not again for another three years. The return trip to the wintering grounds is much less hurried than the migration north and may take a month or more. While wintering birds vocalize amongst themselves (clucks and hoots), the long tremolos and wails of the breeding grounds diminish soon after their arrival on the wintering territory. (Morro Bay Winter Loon Study, 2009)

Environmental Issues

Common loons (*Gavia immer)* have been proposed as indicators of aquatic health in the northern lake ecosystems they inhabit and are subjects of intense study. Loons are listed as a threatened or endangered species in several northeastern states. Because of a variety of environmental and human factors, their numbers and range in New England have decreased from historic levels over the last century. Despite recovery over the last few decades due to management of these populations, mortality has increased in some areas. Previous studies of

loon mortality have documented lead toxicosis, oil spill contamination, respiratory aspergillosis, botulism, trauma, net or monofilament fishing line entanglement, and an emaciation syndrome of unknown etiology as leading causes of death. Environmental contaminants, such as mercury and organochlorines, are elevated in some populations as well, though it is debated whether this is linked to increased mortality. (Sidor, I., Pokras, M., Major, A., Poppenga, R., Taylor, K., & Miconi, R., 2003)

Threats to the Loon Population in Vermont

Vermont's loons continue to face many short- and long-term threats to their viability, including: (1) water level fluctuations on lakes where water levels are regulated; (2) shoreline development and human disturbance; (3) mortality through lead poisoning, entanglement with monofilament fishing line, and fishing gear ingestion; and (4) possible contamination of Vermont waters (e.g., effects of acid precipitation and methylmercury accumulation). Two natural sources of mortality include predation and intraspecific competition between breeding pairs and extraterritorial (rogue/intruder) loons. (Hanson, E.W., Rimmer, C.C., & Parren, S.G., 2006)

Vermont Loon Recovery Plan

Recent increases in the total loon population and numbers of nesting pairs provide evidence that conservation efforts have aided the loon recovery process in Vermont in spite of challenges such as MeHg and lead fishing gear. Increasing numbers of territorial pairs and ponds with more consistent loon activity indicate a potential for further growth in the breeding population. The invaluable assistance of volunteer observers, camp owners, VFWD biologists and game wardens, and Vermont State Park and GMNF staff have greatly enhanced the effectiveness of statewide loon conservation efforts. Monitoring and management efforts, participation of volunteers, education of lake-users, and water level management should continue to be the primary tools for ensuring success of Vermont's breeding loons. (Hanson, E.W., Rimmer, C.C., & Parren, S.G., 2006)

Implementation of the comprehensive Vermont Loon Recovery Plan has been ongoing and has helped the VLRP realize its population recovery goals. The majority of the short-term, high priority goals have been implemented since the mid-1990s. The post-delisting monitoring and management plan needs to address continued threats to loons in Vermont and the species' dependence on the VLRP's management and educational efforts. it should be emphasized that over 50% of the breeding loons in Vermont have directly benefited from VLRP management programs, and that many of these pairs would likely fail without such assistance. VLRP management programs will continue to help guide loon conservation efforts in the future. In recent years, the VLRP has focused its efforts on outreach and technical assistance (e.g. distribution of loon conservation fact sheets, programs targeted at lake associations, direct involvement with camp owners) and strengthening the volunteer program to assist with monitoring and management needs. (Hanson, E.W., Rimmer, C.C., & Parren, S.G., 2006)

Sources

The paragraphs above are excerpted from the following sources:

The Morro Bay Winter Loon Study http://www.morrocoastaudubon.org/loons/loonfacts.html Retrieved March 6, 2009. (Background: Range and migration, behavior, features)

Sidor, I., Pokras, M., Major, A., Poppenga, R., Taylor, K., & Miconi, R. (2003). Mortality of Common Loons in New England, 1987 to 2000. *Journal of Wildlife Diseases, 39(2),* 306-315. (Environmental Issues)

Hanson, E.W., Rimmer, C.C., & Parren, S.G. (2006). *The 2006 Breeding Status of Common Loons in Vermont*. Vermont Institute of Natural Science and Vermont Fish and Wildlife Department. (Threats to the Loon Population in Vermont, Vermont Loon Recovery Plan)

Additional Resources for Information about Loons

Vermont Loon Recovery Project http://www.vtecostudies.org/loons/

Biodiversity Research Institute http://www.briloon.org/

Environment Canada, Common Loons http://www.ns.ec.gc.ca/wildlife/loons/index.html

Paul R. Spitzer, "Common loon mortality in marine habitats," Environ. Rev./Dossiers environ. 3(3-4): 223-229 (1995). http://pubs.nrc-cnrc.gc.ca/cgi-bin/rp/rp2_abst_f?/er_a95-011_3_ns_nf_er3-4-95

Filmmaker, Gail Osherenko

Gail Osherenko filmed, produced, and narrated The Dark Side of the Loon in 2007-2008. She resides in Santa Barbara, California except during the summers when she studies loons in Vermont. Filmmaking combines her passion for nature and photography, and her experience in environmental law and science. She teaches coastal and ocean law and policy at the University of California's Bren School of Environmental Science and Management and is a Project Scientist with UCSB's Marine Science Institute. She holds a law degree from UC Davis, and worked as an environmental lawyer before moving to Vermont in 1981 and becoming immersed in Arctic studies. She studied and taught Arctic natural resources issues at the Center for Northern Studies in Vermont and at Dartmouth College in New Hampshire before relocating to Santa Barbara in 2003. Her first film Arctic Expedition focuses on climate change capturing images of polar bears, Arctic wildlife and the Svalbard icecap.

Activity

Overview

This high school curriculum guide for Gail Osherenko's docu-science film, *The Dark Side of the Loon*, provides worksheets with questions that allow students to organize the information given in the film about loons, draw conclusions about loon research, and participate in a migration tracking simulation.

Objectives

Upon completing this activity, students will be able to:

- Explain the work of loon scientists
- Understand details about loon feathers
- Understand threats to the loon population
- Simulate the migratory patterns of loons

Grade Level

9-12

Time

Part 1: One 45 minute class period for each Student Page.

Part 2: Two 45 minute class periods.

Materials

Copies of Student Pages

Access to internet and printer

CA State Standards

These activities relate to Biology Standards in **Ecology (6a,b,c)** through topics related to biodiversity, changes in an ecosystem, and fluctuations in population size. In addition the activities address standards in **Investigation and Experimentation (a,g,m)** through the use of technology, modeling, and investigation of a science-based societal issues.

Instructions

Part 1: Drawing conclusions from the film

1. Pass out A. Student Pages: The Work of Loon Scientists, B. Student Pages: Flight Feathers and C. Student Pages: Migration Map prior to viewing the film. Allow students to take notes while viewing the film, however also allow time after viewing for students to fill in answers to the questions. Ask students to share out their answers.
2. Pass out the Student Pages A, B and C. Have students answer questions individually or in small groups. Share out answers after sufficient work time.

Part 2: Google Map Loon Migration Tracking Simulation

1. Break students into small groups or partners at a computer station.
2. Give student groups one of the four loon migration descriptions.
3. Ask students to follow the directions on the loon migration simulation sheet.
4. When the loon travels to Mexico, students will have to manually add the migration line and measure distance. Review how to measure distance on a map using a map key. Each loon migration varies in difficulty.
5. Allow time for students to answer questions about the simulation.
6. Demonstrate how to graph the time and distance loon traveled (see Teacher Page E).
7. Students will have printed images from google maps of where the loons have traveled. Create a loon travel collage on a classroom wall.

Activity Extensions

1. Conduct a Clean Up of a local beach, pond, or lake area. Remove trash and enjoy the natural environment.

2. Visit a bird rescue center or arrange for them to give a guest presentation at your school. Set up a day to volunteer.
3..Visit a “loon pool,” if there is one in the area, to record observations of aquatic life.
4. Visit a natural history museum or science museum to learn more about loons and other seabirds.
5. Write a letter to a local representative or an editorial for the local paper if hunting waterfowl, using lead sinker or using lead shot in upland hunting are lawful in your area.

A. Student Pages: The Work of Loon Scientists

Sampling methods:

1. What information is gathered from feathers?

2. What information is gathered from blood samples?

Measurements:

1. Darwin Long measures the loon's length, bill, wing length, girth/circumference. Why does he collect this information?

2. How might scientists use these measurements?

3. What questions are they asking about loons?

   (1)

   (2)

   (3)

Ethics of capturing and handling birds (satellite tagging and banding):

1. Consider how much harm is caused to the loon when it is captured for scientific study.

1. a. List the factors that contribute to harming loons in the chart under "Harm." Next, give each Harm factor a rating on a scale from 1-10. 1 represents just a very small amount of harm to loon and 10 represents a massive amount of harm to loons.

1. b. Next, give some thought to the benefits to capturing loons for scientific study. List the beneficial factors under "Benefits." Give each one a rating using the same scale you used for the harmful factors.

Harm	Rating	Benefits	Rating
Total Harm Rating =		**Total Benefits Rating =**	

1. c. Add up the ratings for each factor to determine if the Harm outweighs the Benefits or vice versa. Which is it?

1. d. In your opinion, is it worth it to capture and handle birds for scientific study?

1. e. Do your results and your conclusions surprise you?

2. How might the scientists gain the information without capturing the birds and taking them into the laboratory?

3. What precautions do you see Darwin take to protect the captured loons?
[Note: The film records the work-up in the laboratory at Morro Bay during February and March 2008. Later that year, the studies of wing-loading were complete, and the scientists at the Biodiversity Research Institute altered the protocol for study so that the studies and banding took only 15 minutes per loon and could be done on board the capture boat.]

4. Research current laws in your state and at the federal level regarding lead in fishing gear and lead bullets.

Does your state law...	yes or no
ban the use of lead shot in upland hunting?	
ban the use of lead shot in hunting for waterfowl?	
ban the sale of lead sinkers?	
have a program to voluntarily trade lead sinkers for sinkers made of nontoxic material?	

See Activity Extension #5.

Policy issues:

1. What can individuals do to enhance the likelihood of loon survival?

2. Would you advocate to protect loons and their habitat?

3. How does learning about what affects loon health promote human health?

4. Research policies and laws regarding bycatch (see glossary for definition) in commercial fisheries.

    a. What is being done at the federal/state/international level to reduce the unintentional killing of marine mammals, sea turtles, seabirds in commercial fisheries?

    b. What can students do to further more protective laws and policies?

Career choices:

The film tracks three scientists each conducting research on loons but in quite different ways. Discuss the differences in the activities of Paul, Darwin and Mark.

	Paul	Darwin	Mark
Career Title			
Education Requirements			
Positive Aspects			
Negative Aspects			

1. Which career would you be most interested in and why?

2. How much time do you think these scientists spend outside versus inside in a lab or in front of a computer?

3. Do you think there trade offs in salary and monetary compensation between being a field biologist and a veterinary?

B. Student Pages: Flight Feathers

Source: The Wonder of Bird Feathers, available at <www.earthlife.net/birds/feathers.htm> viewed Aug.15, 2008

Healthy Feathers

Loons Scientists in the film often examined the loon's feathers as a way to determine the birds health. In the table below, create lists describing what a healthy feather looks like and what an unhealthy feather looks like.

Healthy Feather	Unhealthy Feather

Loon Age
What do feathers indicate about the age of a loon?

Feather Types
Darwin Long at Morro Bay collected two different feather types from the captured loon, one feather that had grown in before the bird arrived at Morro Bay, and one feather that grew while the bird lived at the bay.

What information did he look for in each feather?

Feather from Loon BEFORE arrival at Morro Bay	Feather from Loon AFTER arrival at Morro Bay

C. Student Pages: Migration Map

Seasonal Migration Patterns/Flyways

Loons migrate to salt water areas during the winter months, and inland freshwater areas during their summer breeding season. Take a look at the map above and contemplate the areas inhabited by Loons in summer, then in winter. Next, draw the Flyways listed in the table on the map, using arrows to show the direction of travel from summer to winter. Label your arrows or use different colors for each and create a key. (Note that the Flyway descriptions in the table below are very simplified.)

Birds/Flyways	Summer Months	Winter Months
Loon Migration	Coastal, salt water areas	Inland freshwater areas
Pacific Flyway	Arctic waters, around Alaskan coast to Northern Pacific Coast	Southern Pacific Coast
Central Flyway	North/West Central U.S.	Eastern Mexico
Mississippi Flyway	North Central U.S.	Gulf of Mexico
Atlantic Flyway	Northern Atlantic Coast	Southern Atlantic Coast

Consider the map and answer the question, “How is the loon’s migratory pattern different from other migratory birds?”

What do you think are some reasons for different migratory patterns?

Adaptations
What physical changes occur in the loon after they migrate to the Winter Range? What might be possible reasons for these changes? Fill in the table below with your answers.

Physical Changes	Possible Reasons for this Adaptation

Population Fluctuation Factors
Fluctuations in the North American loon population are affected by relative birth rates, mortality rates, immigration and emigration. Explain each factor and how they might be measured.

Factor	Description	How Measured
Birth Rate		
Mortality Rate		
Immigration		
Emigration		

D. Student Pages: Loon Migration Tracking Simulation #58869

Using Google Maps you will simulate the migration of individual common loons that have been tracked by Seaturtle.org. **Loon #58869**

Instructions:
1. Begin at the Google Maps home page. Select the option “Get Directions”
2. Under location “A” write the first location in the table below. A marker should appear on the map.
3. Select “Add Destination” and write the next location. A marker should appear and the distance from each location will be given.
4. Continue adding destinations. When the loon crosses into Mexico google can’t calculate the distance. Print the map you have created, find the location on the map separately, add the route line, and measure the remaining distances manually.
5. Print any location photographs provided.

DATE	LOCATION	TIME TO TRAVEL (hours)	DISTANCED TRAVELED (miles)
11/08/05	Flathead Lake, MT	0	0
11/08/05	Stampede Reservoir, CA	6 hours 7 minutes	
11/10/05	Walker Lake, NV		
11/14/05	Pyramid lake, NV		
12/28/05	Walker Lake, NV		
1/14/06	Cabo Tepoca, Mexico(wintering location)		
4/26/06	Gulf of California		
4/27/06	Island Park Reservoir, ID		
4/29/06	Canyon Ferry Lake, MT		
4/30/06	Murray Lake, AB		

D1. Student Pages: Simulation Questions #58869

1. Estimate the time of travel between each location and add it to the chart above. Copy the distance traveled from Google Maps or input from your measurements.

2. This loon's destination is the wintering location. Did it arrive in the most direct route? why or why not? Weather reports indicated flooding in Nevada during this time? How might it affect the loon's travels?

3. How much time did the loon spend in the wintering location? How would it spend it's time there?

4. How is this model similar and how is it different from the flight a loon might actually make?

5. Use data collected in the table and graph the distance and time the loon traveled. Plot time on the x-axis and distance on the y-axis.

E. Student Pages: Loon Migration Tracking Simulation #58870

Using Google Maps you will simulate the migration of individual common loons that have been tracked by Seaturtle.org. **Loon #58870**

Instructions:
1. Begin at the Google Maps home page. Select the option “Get Directions”
2. Under location “A” write the first location in the table below. A marker should appear on the map.
3. Select “Add Destination” and write the next location. A marker should appear and the distance from each location will be given.
4. Continue adding destinations. When the loon crosses into Mexico google can’t calculate the distance. Print the map you have created, find the location on the map separately, add the route line, and measure the remaining distances manually.
5. With teacher permission, print location photographs provided.

DATE	LOCATION	TIME TO TRAVEL (hours)	DISTANCED TRAVELED (miles)
10/06/05	Flathead Lake, MT	0	0
11/07/05	Warm Springs, MT		
11/09/05	Warm Spring, MT	N/A	
11/09/05	Goshute Mountains NV	4 hours 28 minutes	
11/14/05	Gulf of California		
12/01/05	Farther south along the Gulf of California (wintering location)		291 miles

E1. Student Pages: Simulation Questions #58870

1. Estimate the time of travel between each location and add it to the chart above. Copy the distance traveled from Google Maps or input from your measurements.

2. This loon's destination is the wintering location. Did it arrive in the most direct route? why or why not? What might affect the loon's travels?

3. How much do you think the loon spend in the wintering location? How would it spend it's time there?

4. How is this model similar and how is it different from the flight a loon might actually make?

5. Use data collected in the table and graph the distance and time the loon traveled. Plot time on the x-axis and distance on the y-axis.

F. Student Pages: Loon Migration Tracking Simulation #58871

Using Google Maps you will simulate the migration of individual common loons that have been tracked by Seaturtle.org. **Loon #58871**

Instructions:
1. Begin at the Google Maps home page. Select the option “Get Directions”
2. Under location “A” write the first location in the table below. A marker should appear on the map.
3. Select “Add Destination” and write the next location. A marker should appear and the distance from each location will be given.
4. Continue adding destinations.
5. With teacher permission, print location photographs provided.

DATE	LOCATION	TIME TO TRAVEL (hours)	DISTANCED TRAVELED (miles)
10/09/05	Flathead Lake, MT	0	0
10/10/05	Jordanelle State Park, UT		
10/23/05	Yuba Reservoir, UT		
10/30/05	Lake Mead, NV (wintering location)		
4/16/06	Utah Lake, UT		
4/17/06	Jordanelle State Park		
4/17/06	Fontenelle Reservoir, WY		
5/1/06	it was located on Bear Lake, UT		

F1. Student Pages: Simulation Questions #58871

1. Estimate the time of travel between each location and add it to the chart above. Copy the distance traveled from Google Maps or input from your measurements.

2. This loon winters in Nevada. What are the advantages and disadvantages to wintering in Nevada rather than the Gulf of California in Mexico?

3. How much time did the loon spend in the wintering location? How would it spend it's time there?

4. How is this model similar and how is it different from the flight a loon might actually make?

5. Use the distances between location on the "Google" map print-out to graph the time and distance the loon traveled. Plot time on the x-axis and distance on the y-axis.

G. Student Pages: Loon Migration Tracking Simulation #58872

Using Google Maps you will simulate the migration of individual common loons that have been tracked by Seaturtle.org. **Loon #58872**

Instructions:
1. Begin at the Google Maps home page. Select the option “Get Directions”
2. Under location “A” write the first location in the table below. A marker should appear on the map.
3. Select “Add Destination” and write the next location. A marker should appear and the distance from each location will be given.
4. Continue adding destinations. When the loon crosses into Mexico google can’t calculate the distance. Print the map you have created, find the location on the map separately, add the route line, and measure the remaining distances manually.
5. With teacher permission, print location photographs provided.

DATE	LOCATION	TIME TO TRAVEL (hours)	DISTANCED TRAVELED (miles)
10/07/05	Flathead Lake, MT	0	0
11/09/05	Lake Lowell, ID		
11/10/05	Bridgeport Reservoir, CA		
11/18/05	San Diego, CA		
12/05/05	Magdalena Bay, Baja Mexico (wintering location)		
12/01/05	100 miles up the coast		
4/19/06	Punta Abreojos, Mexico		
4/20/06	Bahia San Luis Gonzaga, Mexico		
4/20/06	100 miles up the coast		
4/29/06	Minersville Reservoir, UT		
4/30/06	Sulpher Creek Reservoir, WY		

G1. Student Pages: Simulation Questions #58872

1. Estimate the time of travel between each location and add it to the chart above. Copy the distance traveled from Google Maps or input from your measurements.

2. This loon was released in Montana, but where do you think it was captured from? What evidence supports your hypothesis?

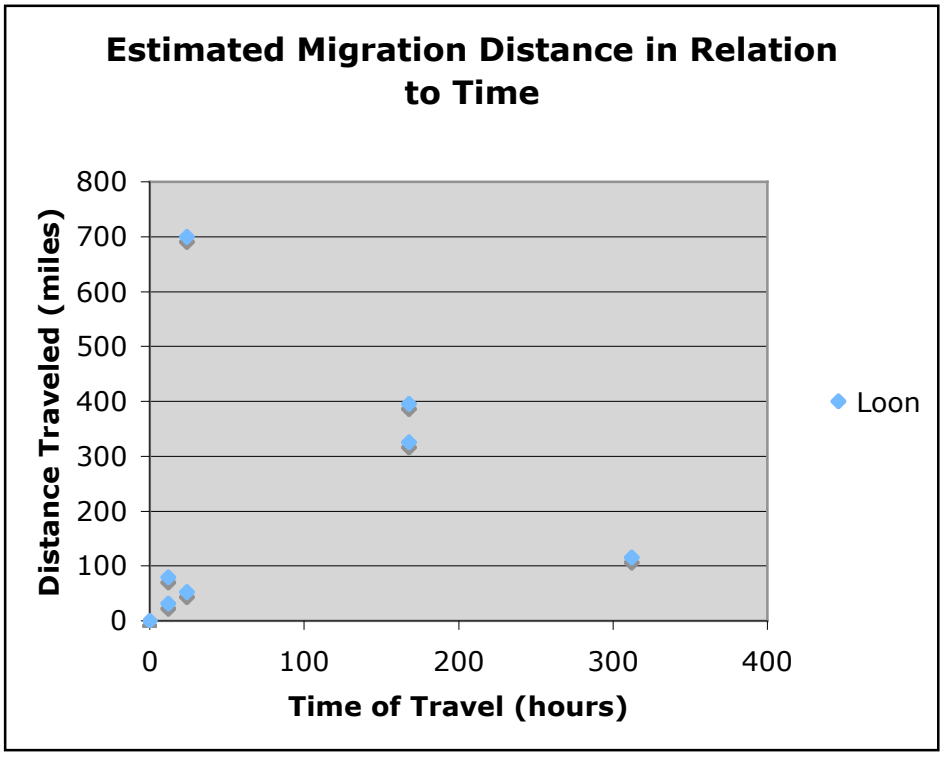
3. How much time did the loon spend in the wintering location? How would it spend it's time there?

4. How is this model similar and how is it different from the flight a loon might actually make?

5. Use the distances between location on the "Google" map print-out to graph the time and distance the loon traveled. Plot time on the x-axis and distance on the y-axis.

H. Teacher Pages: Sample Data Table and Graph for #58871

DATE	LOCATION	TIME TO TRAVEL (hours)	DISTANCED TRAVELED (miles)
10/09/05	Flathead Lake, MT	0	0
10/10/05	Jordanelle State Park, UT	24	700
10/23/05	Yuba Reservoir, UT	312(24 hours x 13 days)	115
10/30/05	Lake Mead, NV (wintering location)	168	325
4/16/06	Utah Lake, UT	N/A stayed in wintering location for several months (use the previous time when graphing)	395
4/17/06	Jordanelle State Park	24	52
4/17/06	Fontanelle Reservoir, WY	12	31
5/1/06	Bear Lake, UT	N/A stayed in UT for a few weeks	79



Glossary

adaptation: a change, as of an organism's structure, to conform to environment

aspergillosis: infection with or disease caused (as in poultry) by molds of the genus *Aspergillus*

bycatch: species caught in a fishery while it is intended to catch another species or reproductively-immature juveniles of the target species. [Source: en.wikipedia.org/wiki/Bycatch} -
Bycatch describes living creatures that are caught unintentionally by fishing gear. Unlike target species—animals specifically targeted for capture.
Source; <www.seagrant.gso.uri.edu/factsheets/Bycatch.html>

cnemial process (cnemial crest): the extension above the "knee" on the tibiotarsus (upper leg bone), where the leg muscles attach. The femur attaches at a joint on the tibiotarsus below the cnemial process. This creates a "lever", such that when the leg muscles contract on top of the tibiotarsus and pull against the femur, the bird is able to generate very strong diving action from the lower portion of its legs and feet.

dinoflagellate: (*noun*) an order of chiefly marine usually solitary phytoflagellates that are typically enclosed in a cellulose envelope, that have one transverse flagellum running in a groove about the body, one posterior flagellum extending out from a similar median groove, usually a single nucleus, and yellow, brown, or occasionally green chromoplasts, and that include luminescent forms, important elements of marine food chains, and the flagellates of the genera Gonyaulax and Gymnodinium that cause red tide

El Niño: El Niño-Southern Oscillation (ENSO; commonly referred to as simply El Niño) is a global coupled ocean-atmosphere phenomenon. The Pacific ocean signatures, El Niño and La Niña are important temperature fluctuations in surface waters of the tropical Eastern Pacific Ocean. The name El Niño, from the Spanish for "the little boy", refers to the Christ child, because the phenomenon is usually noticed around Christmas time in the Pacific Ocean off the west coast of South America. ....

ENSO is associated with floods, droughts, and other disturbances in a range of locations around the world. These effects, and the irregularity of the ENSO phenomenon, makes predicting it of high interest. ENSO is the most prominent known source of inter-annual variability in weather and climate around the world (about 3 to 8 years), though not all areas are affected. ENSO has signatures in the Pacific, Atlantic and Indian Oceans.

During major warm events, El Niño warming extends over much of the tropical Pacific and becomes clearly linked to the intensity of the Southern Oscillation. While ENSO effects are basically in phase between the Pacific and Indian Oceans, ENSO effects in the Atlantic Ocean lag behind those in the Pacific by 12 to 18 months. Many of the countries most affected by ENSO are developing countries that are largely dependent upon their agricultural and fishery sectors for food supply, employment, and foreign exchange.
Source: http://en.wikipedia.org/wiki/El_Ni%C3%B1o-Southern_Oscillation

emaciation: a wasted condition of the body

emaciation mortality: death due to emaciation

fidelity pattern: A known individual bird's frequency of return to a specific geographic location for a particular ecological need (wintering or maturation), and the portion(s) of that location it prefers to feed, rest, socialize, etc. throughout each day. The higher the fidelity toward a location, the greater the probability that a known individual bird can be found during a survey of that location at a specific time of the year the bird chooses to live there.

flyway: routes followed by migratory birds, generally north and south, from breeding grounds to winter grounds

gillnet: the name of the net used in gillnetting, a common commercial fishing method, used to snare target fish. Fish try to swim through deliberately sized mesh openings but are unable to squeeze through swimming forward. Once in this position, they are prevented from backing out due to the tendency for their gills to become caught. This effectively traps them.
Source; http://en.wikipedia.org/wiki/Gillnet

ghost nets: broken or cast off pieces from commercial fishing nets that float unattended in the ocean entangling and killing living organism

immunosuppress: (*verb*) to suppress the natural immune responses of

loon calls: the wail, tremolo, yodel, hoot (to hear them and learn more, go to Environment Canada)

methylmercury: (*noun*) any of various toxic compounds of mercury containing the complex CH3Hg- that often occur as pollutants formed as industrial by-products or pesticide residues, tend to accumulate in living organisms (as fish) especially in higher levels of a food chain, are rapidly and easily absorbed through the human intestinal wall, and cause neurological dysfunction in humans -- see MINAMATA DISEASE

molt/molting: “A feather is a "dead" structure, somewhat analogous to hair or nails in humans. The hardness of a feather is caused by the formation of the protein keratin.

Since feathers cannot heal themselves when damaged, they have to be completely replaced. The replacement of all or part of the feathers is called a molt. Molts produce feathers that match the age and sex of the bird, and sometimes the season.

Molting occurs in response to a mixture of hormonal changes brought about by seasonal changes. The entire process is complex and many questions remain regarding how the process is controlled. A basic understanding of molting patterns can, however, be a useful aid in identifying many species and in determining their age.”
Source: <www.birds.cornell.edu/AllAboutBirds/studying/feathers/molting/document_view>

morphology: mor·phol·o·gy - *noun*
1 : a branch of biology that deals with the form and structure of animals and plants especially with respect to the forms, relations, metamorphoses, and phylogenetic development of organs apart from their functions -- see ANATOMY 1; compare PHYSIOLOGY 1
2 : the form and structure of an organism or any of its parts

morphometrics: measurements of form, shape, and structure

necropsy: an examination of the body of another species (a nonhuman animal) after death usually with such dissection as will expose the vital organs for determining the cause of death or the character and extent of changes produced by disease; a postmortem examination done on a nonhuman animal. Distinguished from autopsy which is a postmortem examination done on one’s own species.

neurotoxin: a poisonous protein complex that acts on the nervous system

nictitating membrane: the transparent membrane that moves over the surface of the eye front to back for protection to re-moisturize during "blinks", and to protect the eye during activity. For loons and some other diving birds, the nictitating membrane also corrects light-refraction through a thickened transparent center portion of the membrane during dives, similar to a contact lens. All birds have nictitating membranes, and are sometimes referred to as "third eyelids".

parasite - an organism living in, with, or on another organism in which a the parasite obtains benefits from a host organism which it usually injures

juvenale plummage - feathers of young loon one year old or less

primitive species: Paul Spitzer comments that some people say loons are “primitive” birds, but he argues that their migration and winter molt demonstrate that they are highly evolved.

Primitive refers to how long the species has existed on the planet. He argues that to be a migratory animal is an advanced adaptation.

genetics, genetic samples
[Darwin Long took blood samples, 2 ccs., that will be sent to a laboratory to determine the genetic make-up of a loon as well as to determine whether it is female or male.]

rachis: central hollow supporting shaft of a feather

wing loading: the ratio of weight (of the loon body) to wing area; a measurement of how much total weight is supported by how large a wing