

# Delusa Wetlands Ecology



# Activity Guide





# Acknowledgments

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*Front cover photo credit: CACS*





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# Introduction

The Beluga Wetlands Ecology program is an opportunity for students to explore both a freshwater and a saltwater wetland. The focus is on understanding the functions of a wetland and providing an enriching outdoor experience for students to discover wetlands in a hands-on interactive way. Students will be making observations as well as collecting data for long term monitoring of the freshwater and saltwater Beluga Lake and wetland environments.

## Overview of program:

After a brief introduction to wetlands and the origin of Beluga Lake, students will be introduced to Clarice/ Clarence the Creative Chef who will lead a very engaging dialogue depicting the cooking of "Slough Stew" which will lay the foundation for learning about the importance of wetlands and the role of detritus in the food chain. Students will then break up into two groups. One group will go to Beluga Lake for the freshwater portion of the field trip and the other group will go to Beluga Slough for the saltwater/estuary portion of the field trip. These two parts are outlined below.

Part 1 - The instructor will provide a brief review of basic wetlands terminology and an introduction to freshwater wetlands, then describe freshwater wetland zonation. Students will learn about the characteristic plants of the transition zone and lake shoreline. They will discuss the importance of wetland habitats to local wildlife and wildlife use. On the Beluga Lake boardwalk students will conduct an aquatic invertebrate sampling activity. Wrap-up will include a species identification, and a discussion on the role of these invertebrates in the freshwater ecosystem. Emphasis will be on how the presence or absence of macroinvertebrates signals the health and ecological condition of a freshwater ecosystem and the importance of the lake as a nesting habitat for waterfowl.

Part 2 - The instructor will provide a brief review of basic wetland terminology and an introduction to saltwater/estuarine wetlands, then describe saltwater zonation as students investigate Beluga Slough. The instructor will also describe salt-tolerance in plants and assist with identification of plant species growing in the marsh. The instructor will explain sediment transport and deposition and relate it to one or more functional values of saltwater wetlands, and present various wildlife uses and values to humans that this estuarine ecosystem provides. Migratory waterfowl and animal signs will be pointed out. Emphasis will be on the importance of the slough as a refueling stop for migratory birds and mammals and its importance as a biological supermarket.

## Beluga Wetlands Ecology Learning Objectives:

*Students will*

- ❖ Compare and contrast fresh and saltwater wetland functions
- ❖ Identify wetland plants and wildlife characteristic of wetlands
- ❖ Collect and identify aquatic invertebrates in the field





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# Background

Wetlands are technically characterized as transitional lands between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water. They are areas where saturation with water is the dominant factor determining the nature of soil development and the types of plant and animal communities living in the soil and on its surface. Wetlands are very important ecosystems and provide habitat for 5,000 spp. of plants, 190 spp. of amphibians and 1/3 of all bird spp. in the U.S.

Wetlands must also have one or more of the following three attributes:

- 1) at least periodically, the land supports predominantly plants that grow only in water
- 2) the substrate is predominantly undrained hydric soil
- 3) the substrate is nonsoil and is saturated with water or covered by shallow water at some time during the growing season of each year

Alaska contains 174,683,900 acres of wetlands (in 14 categories) which is 43.3% of Alaska's surface area and 63% of the total wetland acreage in the United States, excluding Hawaii. There are many different wetland types in Alaska, including: bogs, muskegs, wet and moist tundra, fens, marshes, swamps, mud flats, and salt marshes. The U.S. Fish and Wildlife Service (USFWS) manages 22% of Alaska's wetlands (though most are marshlands which make up almost 2/3 of Alaska's wetlands) and over 80% of Alaska's wetlands are under public management of some kind. According to U.S. Fish and Wildlife Service, approximately 1/10th of the original wetland acreage in Alaska was lost between 1780 and 1980. Alarmingly, more than half of the wetlands in the United States have been lost since the birth of our country.

Alaska's wetlands provide many benefits:

- ❖ food and habitat for wildlife, fish and shellfish
- ❖ natural products for human use (e.g. clothing) & subsistence resources through hunting, fishing, and trapping (five spp. of salmon, shellfish, ducks, geese, beaver, otter, berries, labrador tea & willow)
- ❖ shoreline erosion and sediment control
- ❖ flood protection
- ❖ opportunities for passive recreation (wildlife viewing, photography, education, x-c skiing, hiking, sketching, open space & aesthetic enjoyment)
- ❖ nesting and feeding grounds for migratory birds
- ❖ feeding and nursery (spawning/rearing) grounds for adult/juvenile fish and invertebrates
- ❖ feeding grounds for non-resident mammals
- ❖ high production of plant/animal biomass
- ❖ water stored in wetlands help keep rivers, lakes & underground reservoirs full
- ❖ filtration for pollution / purify groundwater
- ❖ streambank erosion prevention with plants holding soil & helping to keep streams & rivers clear / natural storm barriers
- ❖ base of food chain in estuarine wetlands - the source of nutrients for ocean's "soup" mixture (detritus)

## Background *continued...*

### Beluga Wetlands

The Sterling Highway bisects what was originally an estuarine marsh with substantial fresh water flow from the north and tidal influence at the outlet. The design of water flow through the highway berm effectively maintains the upper wetlands as fresh water with no tidal influence and the lower wetland as a wetland complex of slough channels and salt marsh plant communities, where fresh water flows mix with tidal salt water during Homer's often extreme tidal dynamics (maximum range of approximately 27 feet).

### Beluga Lake and Upper Wetlands

Beluga Lake is a relatively shallow man-made impoundment of fresh water with emergent wetland plants along the shoreline and marsh and riparian plants grading into Lutz forest landward. The wetlands at the upper end of the lake has been designated the Homer Airport Critical Habitat Area. They provide important habitat for moose, particularly in winter, and staging and nesting habitat for waterfowl and shorebirds. A platform across from the airport provides viewing opportunities and access is also provided on the Calvin Coyle Trail.

Beluga Lake has been considered as a drinking water source for Homer, but high concentrations of chlorides and salts, sewage effluent discharges into the lake and conflicts with float plane operation precluded its selection.

The lake is an important habitat for migrating waterfowl particularly diving ducks such as goldeneyes, bufflehead and scaup, Trumpeter swans and Bonapart's gulls. Red-necked grebes nest along the shoreline.

### Historical Use of Beluga Lake and Beluga Slough

Beluga lake and Beluga slough were originally joined and the freshwater and saltwater mixed on a regular basis. In the early 1900's the railroad ran along the beach and access to the spit was by railroad or foot at low tide. In 1927 a road was built through the slough to the Homer spit causing the lake to be formed. There was still saltwater and freshwater influence on both systems at this time. In 1936 the Road Commission began work on improving the road from Bidarki Creek Canyon to Miller's Landing using gravel taken from Beluga Slough. The Homer Civic League built the road across the foot of Beluga Lake giving Homer an all weather road to the Spit. The airport was built during World War II and the fill for this was taken from Mariner Lagoon near Beluga Slough. The local airstrip was completed in 1941.

The road across Beluga Slough was paved and the culvert put in when the Dept. of Transportation took over management of Beluga Lake for use as a float plane facility. Beluga Lake is currently managed for float plane use and the level of the water is regulated by DOT to keep vegetation growth down in the summer. The culverts are designed to keep out any saltwater from high tides in Beluga Slough so there is no saltwater influence in Beluga Lake although there is freshwater release into Beluga Slough when Beluga Lake water level is being lowered.





## Background *continued...*

### Beluga Slough

Beluga Slough is a brackish, shallow salt marsh with an outlet to Kachemak Bay on the east end of Bishop's Beach. The marsh's high-value saltwater wetlands make up roughly 43 acres. Beluga Slough harbors the most diverse array of bird species (both migratory and resident) in the Homer area. During spring and fall migrations of hundreds, if not thousands, of birds feed on invertebrates, fish and vegetation within the slough. Year-round wildlife residents of the Beluga Slough include various bird species, small mammals, marine invertebrates and fish. This site is very accessible and extremely important as an outdoor science laboratory and classroom. With increasing demands for environmental education focusing on wetlands, especially estuaries, this area will become even more of a central focus for outdoor education in our community.

#### *Wetland functions for Beluga Slough include:*

- ❖ A natural filtration system for pollutants that might enter Kachemak Bay and eventually the slough.
- ❖ A nursery ground for juvenile fish and marine invertebrates.
- ❖ A staging area for feeding migratory waterfowl, shorebirds, and songbirds.
- ❖ Habitat for resident nesting, feeding, and loafing songbirds, waterfowl, raptors, shorebirds, and seabirds.
- ❖ Habitat for marine invertebrates, such as bivalves, crustaceans, and worms.
- ❖ Habitat for visiting mammals, such as black bears, moose, ermine, minks, and coyotes.
- ❖ A site for production of detritus, which ultimately reaches Kachemak Bay and there provides food and minerals for planktonic organisms.
- ❖ A site used for non-consumptive outdoor recreation (bird watching and photography) by Homer residents and visitors.
- ❖ A buffer against erosion that might impact the road connecting Homer and the Spit, as well as private and city property adjacent to the slough.
- ❖ A site used for environmental education by local/visiting students and Elderhostel participants and for training school teachers and staffs of local organizations in salt marsh ecology, estuaries, and ornithology.

### Salt Marsh Ecology Notes

The presence of a particular plant species, and the abundance of that plant depends on the flooding regularity and the degree of salinity found in the body of water. In order for plants to tolerate a higher than normal level of salt they must have special adaptations.



## Background continued...

### *Plants found in Beluga Slough have these characteristics:*

- ❖ thick, waxy leaves
- ❖ higher salt content within plant to prevent desiccation
- ❖ oxygen is “pumped” to roots of plants in the low marsh area (especially salt grass)
- ❖ Plants must tolerate mostly anaerobic conditions in the soil (little bacterial or fungal decomposition utilizing oxygen, sulfur and methane utilized instead) vs. aerobic conditions found in most land based soils where oxygen is used for decomposition.

Water temperature and salinity variations are determined by tides, turbidity, and air temperature.

### *Sedimentation process and sediment characteristics are influenced by:*

- ❖ Rates of accretion vs. erosion
- ❖ Amount of wave energy
- ❖ Meandering tidal creeks
- ❖ Material is deposited seasonally in layers:
  - ◆ Black clay mixed with undecomposed vegetation (late summer/fall)
  - ◆ Sand, especially in western portion of marsh (winter storms)
  - ◆ Light gray clay (spring/summer)

These layers can be easily seen in a "core" sample taken in the slough while out in the field.

### *Characteristics of the different zones found at Beluga Slough:*

Four characteristic transition zones can be easily seen from the top of the slough and then walked through on your field trip. These zones are the: high marsh, the low marsh, and the salt pans. These zones represent the very dynamic nature of this marsh ecosystem.

High marsh – higher elevation, therefore less affected by salt water and more by freshwater, the most common plants will be the sedges because they are a little less salt tolerant.

Low marsh – higher degree of salt tolerance in these plants, common plants: salt grass (most salt tolerant), sea blite, glasswort, arrow grass (not a true grass and has a toxin than causes cyanide poisoning, migratory mammals and birds have a special adaptation that allows them to eat this plant - which is high in protein at it's early growth stage, and not get poisoned), goose tongue (which can easily be confused with arrowgrass, but is an edible plant).

Salt pans - basically no plants found here - mainly mud and silt covered by the tide most of the time and is constantly changing with the tides and weather





## Background *continued...*

### *Other characteristics of Beluga Slough include:*

- ❖ Lack of many permanent residents, but large populations of a small diversity of species are possible.
- ❖ Many non-resident animals, some resident
- ❖ Mammals: moose, mink, coyote, black bear, red fox, red backed vole
- ❖ Birds: shorebirds, seabirds, waterfowl, corvids, songbirds, raptors
- ❖ Invertebrates: Baltic macoma, soft-shelled clam, blue mussel (small), Sitka periwinkle, amphipod spp., crab spp., isopod spp.
- ❖ Fish: three-spined stickleback, flounder spp., sculpin spp.

### *Beluga Slough food chain*

producers = phytoplankton and marsh plants

primary consumers = scuds (amphipods), clams, salmon, moose, waterfowl

secondary consumers = fish, shorebirds

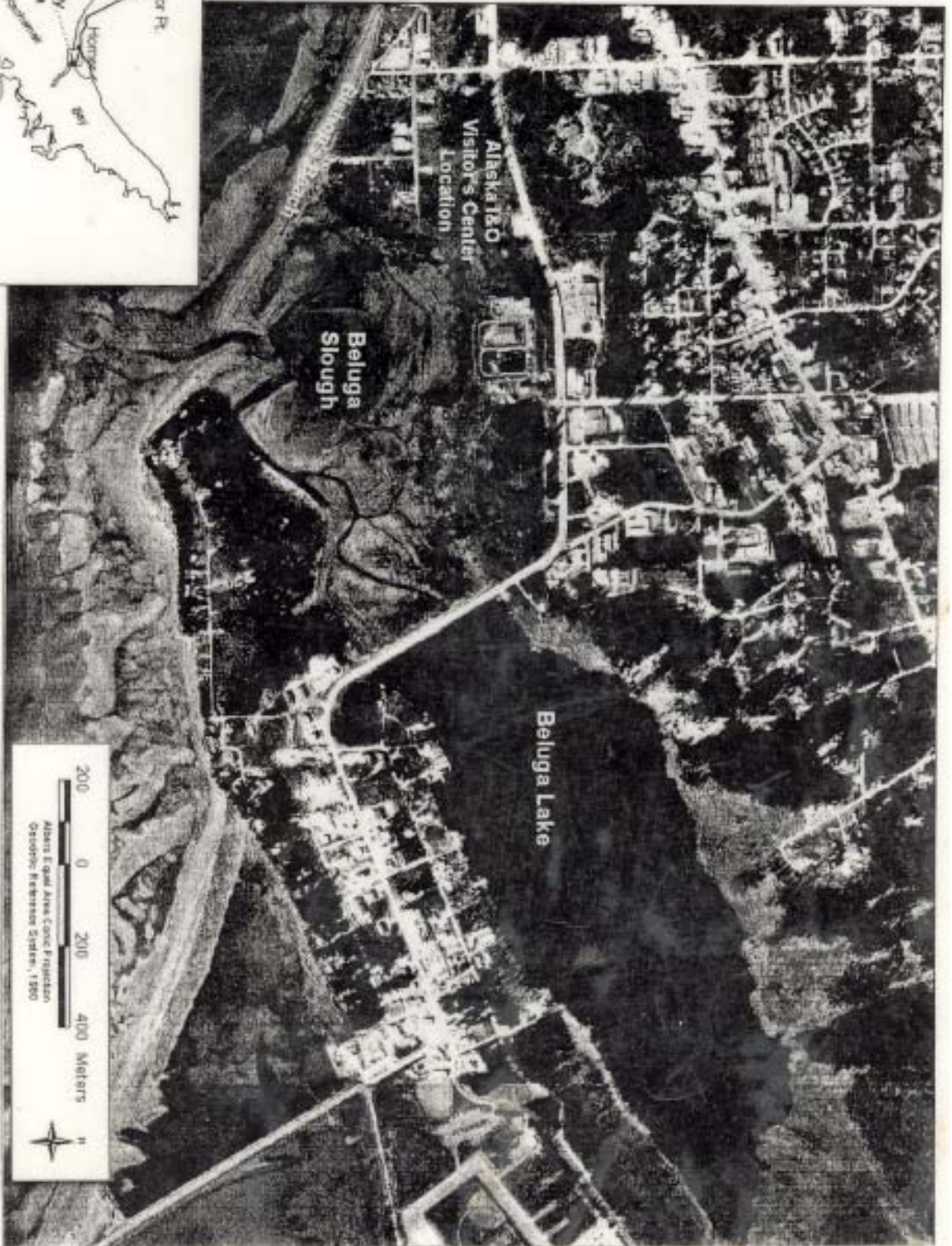
tertiary consumers = raptors

scavengers = crows, minks, coyotes, eagles, ravens, gulls

*These notes are based on information given by Carmen Field, AK Fish and Game, Estuarine Research Reserve.*



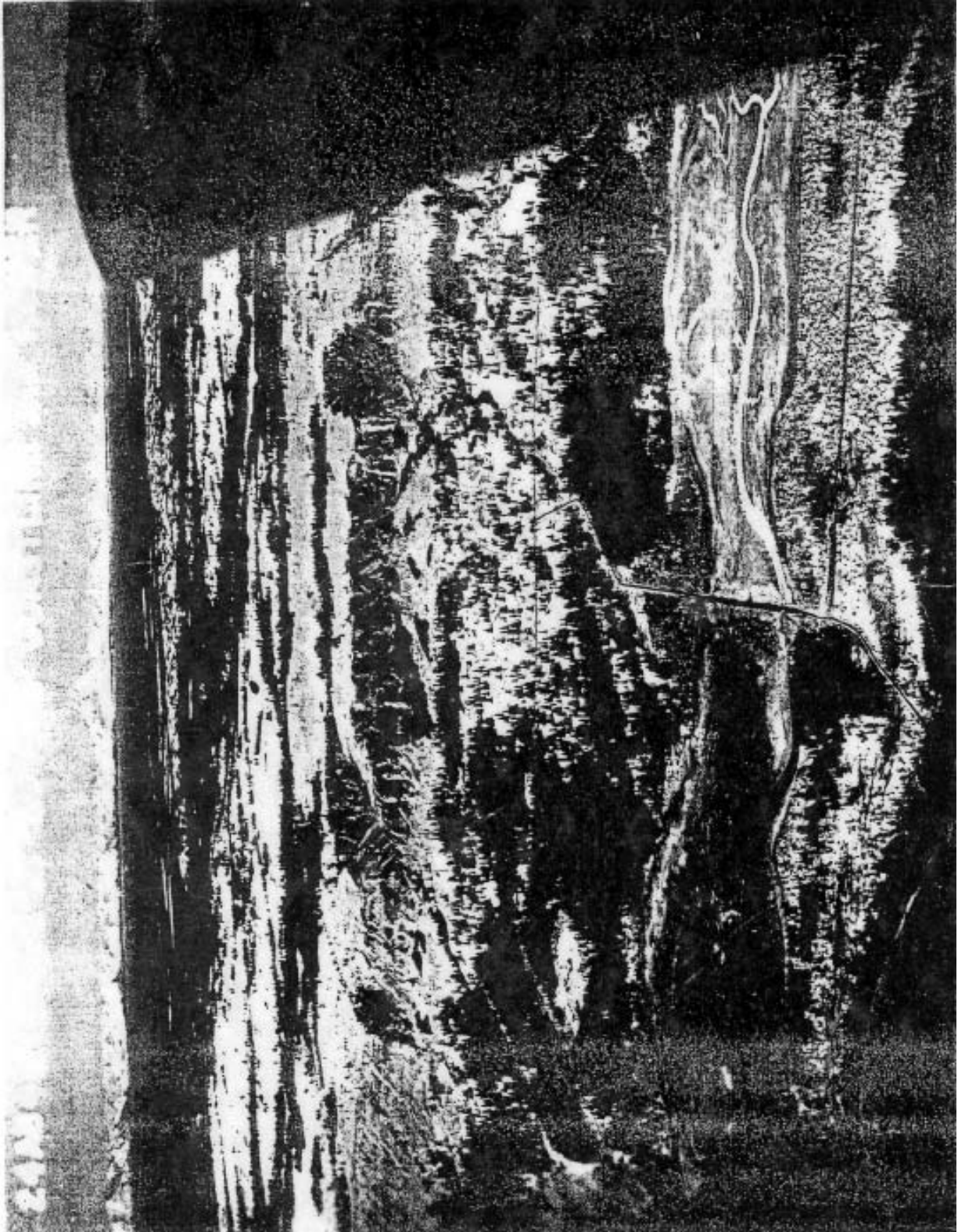
# Beluga Lake





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


# Beluga Slough



# Legend



Beluga Slough, KB-01-02, as viewed from the Southeast.

-  Free-oil Containment and Recovery, Shallow Water
-  Dam
-  Underflow Dam
-  Staging Area
-  Dam



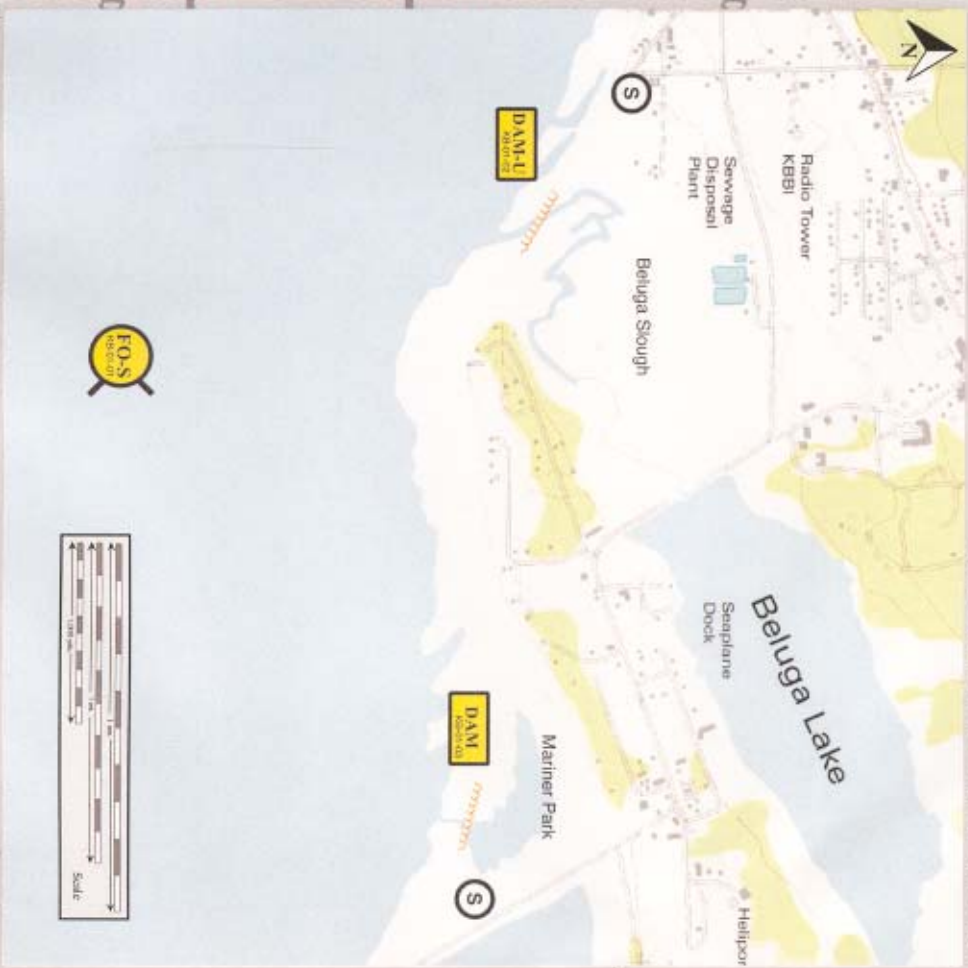
Mariner Park, KB-01-03, as viewed from the South.

December 2001

## Geographic Response Strategies for

# Beluga Slough, KB-01

Center of map at 59° 38.2' N Lat., 151° 31.1' W Lon.



This map is not intended to be used for navigation.

Soundings in fathoms

Tim L. Robertson



# Beluga Lake Plants and Animals

## Plants

### Upland

Willow (3 spp.)  
Lutz spruce  
Sitka & thin-leafed alder  
Kenai / paper birch

### Lake Edge

Lyngbye's & Ramenskii sedge  
Poison hemlock  
Grasses

## Animals

### Invertebrates:

Soft-shelled clam  
Amphipod  
Crab larvae  
Polchaete worm  
Dragonfly  
Damselfly  
Mayfly  
Caddisfly  
Blackfly  
Midge  
Mosquito  
Water strider  
Copepod  
Fairy shrimp  
Water boatman  
Water flea  
Diving beetle  
Whirligig beetle  
Leech  
Snail  
Clam  
Rattail

### Birds

Northwestern crow  
Common raven  
Black-billed magpie  
Belted kingfisher  
Glaucous-winged gull  
Mew gull  
Bald eagle  
Northern Harrier  
Goshawk  
Trumpeter Swan  
Mallard  
Green-winged teal  
American wigeon  
Eurasian wigeon  
Northern pintail  
Greater scaup  
Common goldeneye  
Canvasback  
Barrow's goldeneye  
Bufflehead  
Northern shoveler  
Red-necked grebe

Lapland longspur  
Fox sparrow  
Savannah sparrow  
Short-billed dowitcher  
Dunlin  
Whimbrel  
Yellowlegs  
Common snipe

### Mammals

moose  
red-backed vole

### Fish

sculpin  
stickleback





# Beluga Slough Plants and Animals

## Plants

### Adjacent Upland Land

Willow (3 spp.)  
Lutz spruce  
Sitka & t hin-leafed alder  
Kenai / paper birch  
Bluejoint reedgrass  
Beach rye grass

### High Marsh

Lyngbye & Ramenskii sedge  
Silverweed

### Low Marsh

Alkali grass - Puccinellia spp.  
arrowgrass  
goosetongue  
saltwort  
glasswort  
orach

## Animals

### Invertebrates:

Soft-shelled clam  
Baltic macoma  
Arctic rock borer  
Amphipod  
Crab larvae  
Polchaete worm

### Fish:

Flounder  
Sculpin  
Stickleback  
Sand lance  
Dolly varden (high tide)  
Silver salmon (high tide)  
Pink salmon (high tide)  
King salmon (high tide)

### Mammals:

Moose  
Black bear  
Coyote  
Ermine  
Mink  
Red-backed vole

### Birds

Northwestern crow  
Common raven  
Black-billed magpie  
Belted kingfisher  
Glaucous-winged gull  
Mew gull  
Bald eagle  
Merlin  
Peregrin falcon  
Violet-green swallow  
Tree swallow  
Snow bunting  
Bonaparte's gull  
Arctic tern  
Sandhill crane  
Greater white-fronted goose  
Canada goose  
Mallard  
Green-winged teal  
American wigeon  
Eurasian wigeon

Northern pintail  
Greater scaup  
Common goldeneye  
Barrow's goldeneye  
Bufflehead  
Northern shoveler  
Lapland longspur  
Fox sparrow  
Savannah sparrow  
Least sandpiper  
Western sandpiper  
Pectoral sandpiper  
Greater yellowlegs  
Lesser yellowlegs  
Short-billed dowitcher  
Dunlin  
Whimbrel





# PROGRAM ACTIVITIES





# Slough Stew

## Objectives

Students will be introduced to the saltwater and freshwater ecosystem in a hands-on, engaging format. Students will gain familiarity with basic terminology needed for their field experience.

## Concept

1. Detritus makes up the basis of the estuary food chain and is an essential component of wetland ecosystems.
2. Estuaries have a mixture of fresh and salt water.
3. Estuaries are ecologically rich and are very productive habitats.

## Background

Slough Stew is an interactive way to introduce students to the importance of detritus in a wetland ecosystem. It will introduce students to basic terminology they will need to explore both the lake and the slough. During the presentation the French Chef will begin by introducing a very special stew that he/she is famous for and soliciting help from the crowd to mix this wonderful stew up. Many students will have a job and will add their ingredients when called on. In the end, the mucky slop will be presented to a student to "try." Wrap-up will involved reviewing the importance of detritus to all living things found in the wetland. Students will learn that the slough is a mixture of freshwater and saltwater, detritus is the base of the food chain followed by phytoplankton and zooplankton. Incoming and outgoing tides mix all the "ingredients" up. The sun warms everything up and provides the energy to make the nutrient cycle work.

## Procedure

Welcome students, tell them they are very lucky because your sister/brother/cousin from Paris - a very famous chef - happens to be visiting and wanted



to come and share a new recipe that he/she is developing which was inspired by our beautiful Kachemak Bay. Call for Clarice/Clarence to join the group and lead them over to the "stage" area.

Use the script on the following page as a reference for leading this presentation.

## Materials

- ❖ Slough Stew Kit:
  - ◆ Apron
  - ◆ Chef's hat
  - ◆ Student Chef hat
  - ◆ Slough Stew Recipe Card
  - ◆ Large glass bowl
  - ◆ Two 1 cup measuring cups filled with H<sub>2</sub>O
  - ◆ Wooden spoon (Tide spoon)
  - ◆ Salt
  - ◆ Teaspoon
  - ◆ Salt shaker filled with sugar (phytoplankton)
  - ◆ Pepper shaker filled with cornmeal (zooplankton)
  - ◆ Detritus wrack - large bits of seaweed, grasses, shells, crab carapace, etc. (gathered ahead of time)

## Evaluation

Can students correctly use the terminology: detritus, phytoplankton and zooplankton? Can students give an example of why detritus is important to a healthy, productive ecosystem?





## Slough Stew Script

Ah, Welcome children! I am so glad to see you here. I have been traveling all over the world for the past year making my wonderful soups and stews and I am so glad to have found your little hamlet by the sea! It is wonderful here - so rich, so lovely, so healthy an environment!!!! I came here yesterday and was exploring your beaches and sloughs and came up with the most wonderful idea for a new stew that I would like to try to make. Would you like to help me with this undertaking - you will be like taster chef's and cheftests - we could be famous together! What do you think?

How many of you like to eat things from the ocean? What are some of those yummy creatures you like to catch and eat? Ah yes, I love the salmon and the crab - yes those crab are delicious - mmmm!!! Perhaps we could try to incorporate some of those yummy creatures into my recipe - we will see.

Now, I have been playing around with a certain recipe that I thought we could try - let's see where is that recipe card? Ah yes here it is. I need a volunteer to be my assistant chef. Yes, thank you! You will wear this most stylish chef hat and be known as the recipe card holder boy/girl. Now, class let's read the list of ingredients together - very loudly - very strongly - with passion!

OK good. Now I will need some volunteers to help me with these ingredients. (Pass out salt and pepper shakers, small spoon, big spoon, measuring cups with water, large salt container)

Ok good. Now we will get ready to mix and create a most wonderful new stew for the world to try! What is the first ingredient? Ah yes a large bowl. Here is a large bowl - no, no, no...this is no large bowl - this must be our bay - your bay - your wonderful Kachemak Bay - we will mix our creation in a bay - yes, yes that will be good. So this is not a bowl....this is a bay.

What is next? Ah yes, salt water....we must have salt water in our bay. Where is salt water boy/girl? Come forward and let's taste your salt water to make sure it is just right. Yes, you taste it...what does it taste like? (*should be just regular water*) No, no it is missing the most important ingredient - salt! Come forward salt boy/girl we will need you - and itty bitty spoon boy/girl too!! You must help us make ocean for lunch. We need to add one teaspoon of salt to our one cup of water to make salt water - such a simple, yet wonderful recipe. You can all go home tonight and tell your parents that you will make ocean for supper....it is so wonderful! Ok, mix up the salt - now salt water boy/girl you must taste to make sure it is good. Yes yes this is good. Now we can begin our slough stew! (*Pour salt water into bowl - have students leave ingredients in front and go back to the audience*). Very good, let's have a big hand for salt water boy/girl, salt boy/girl and itty bitty spoon boy/girl.

Now, what is next? Ah yes, a key ingredient to a slough or estuary is fresh water - now we need some fresh water, where is fresh water boy/girl? Come, come and add your cup of fresh water. Ah, ah, ah - you cannot just pour your fresh water into our Bay! Fresh water does not go whoosh into the Bay, fresh water goes trickle trickle - slowly from streams, rivers and rain....so pour your fresh water SLOWLY into the Bay. Very good. Give a hand for fresh water boy/girl.

We must keep moving here - what is next? Ah yes add billions of phytoplankton. Who has the phytoplankton? What is this phytoplankton? Ah yes, eensy weensy plants that float in the water - they are the base of the food chain - the first to be eaten - the boomers and the bloomers...Come up and begin counting please to add our billions of phytoplankton. (student begins to shake phytoplankton container - prompt them to try to count all the specks of sugar) One..two..three...20...100...will we ever get there? I

don't know, billions are so many - phytoplankton are so many - all these teensy tiny plants.....ok - that is good - we will call that billions, no? Give a hand for phytoplankton girl/boy!

Ok ok - we need those itsy bitsy animals that will eat these eensy weensy phytoplankton - what are they called? Ah yes - the zooplankton - let's all say that... "zooplankton" very small animals that float in the water....very good, now where is zooplankton boy/girl? Ok, the recipe says we need millions of zooplankton in our stew. You are lucky - millions is not as much as billions - you have gotten off easy. Ok begin shaking and counting...(student shakes cornmeal into bowl and counts) Good good - Oh I can see the zooplankton swimming after the phytoplankton and gobbling them up - oh how exciting - can you see this too? Oh - you have microscopic eyes just like me???? Ok good, good that is millions I think. Give a hand for zooplankton boy/girl.

Next we must add the spices! Ah, what will give this stew the wonderful bouquet to make it superb, irresistible, unusual and especially good? Yes, yes, the recipe calls for detritus....what is this detritus???? Ah yes, I remember now - it is the wonderful, stinky, smelly stuff that is found all over the beach and the ocean floor - even the forest floor - what makes it soo stinky and smelly - yes yes it is because it is dead decaying plants and animal parts - oh what would we do without this wonderful food for the animals and the nutrients that get put back into the oceans and soils? Oh I love the detritus....but enough about me...let's add this wonderful spice to our stew. Come up detritus boy/girl and add lots and lots of detritus. Good, good this is smelling so stinky so wonderful!!!

Now we must mix! How to mix all these ingredients? How do they get mixed in your wonderful bay? Yes, yes we have tides that come in and go out and help to mix all the water and the plants and animals together to make a rich rich soup. Where is tide spoon girl/boy? Come and let's mix....now we have how many tides here in your bay? Two? Yes, two high tides and two low tides.... and they come every six hours right? Ok that is good, so tide spoon girl/boy - you will stir going one way for six hours, then at (six hours from now) you will switch directions and stir for another 6 hours - then switch again....and again after 6 hours - we will check on you tomorrow at this time and see how you are mixing! No, no we will have to, how you say, abbreviate....yes, abbreviate and we will stir one minute for each tide cycle....count with me - tide in..tide out...tide in...tide out. Good, good we are all mixed and almost ready. Thank you tide spoon girl/boy.

There is one final ingredient that must not be forgotten - what is it? Yes, yes it is heat....soup is best when it is hot, no? How do we get our heat for our wonderful slough stew? Yes, yes the sun - the sun is our heat source and it will warm up our stew. Let's all work together to be the sun and "zap" our stew like a giant microwave in the sky! ZZZapppppp, ZZZapppppp, ZZZZaaaappppp.

Perfecto, perfecto now we are ready to taste. Where is my saltwater boy/girl (pick someone out of the audience to "taste test")? We are ready for a taste test - open wide and you can see what this wonderful slough stew tastes like.....no.....we will not eat this wonderful stew - but the fish, birds and animals that live in and around the lake and slough will eat this wonderful stew and it will help them survive and be healthy. All the ingredients - the fresh water, salt water, plankton and detritus - are very very important to a healthy bay - all wetlands as a matter of fact. Never forget this - and never forget how wonderful the small stinky stuff is for your local ecosystems.

Well, look at the time - I must go and catch my flight back to Paris - I have enjoyed being here with you - I will take this wonderful recipe back with me and we will all be FAMOUS!!!!!! Thank you so much - bon jour and bon appetite!



# Wetland Metaphors

## Objective:

Students will be able to create and use metaphors to help them understand the basic conditions and functions of a wetland.

## Concept:

Wetlands have many functions, for example: they are a nursery, a sponge for excess water, a filter for pollutants, a mixer of nutrients, a resting stop and food source for migratory birds and animals.

## You Will Need:

- ◆ large pillowcase, bag or box
- ◆ sponge
- ◆ small pillow
- ◆ egg beater
- ◆ cradle
- ◆ sieve or strainer
- ◆ can of soup
- ◆ 3" X 5" cards with pictures that show

## What to Do:

### Introductions:

The wetlands found in coastal and freshwater settings provide unique habitats that serve areas far beyond their boundaries. Freshwater wetlands often act as buffers in times of both flood and drought. Absorbing overflow from flooding, wetlands often swell with runoff water and reduce potential downstream effects of flooding. In drier periods, wetlands hold precious moisture after smaller bodies of water have disappeared. Both freshwater and coastal wetlands are nurseries for countless life forms. They contain a great diversity of plants and animals and provide habitat for migratory waterfowl. Wetlands have a unique ability to trap and neutralize sewage waste, allowing silt to settle and promoting the decomposition of many toxic substances. Yet it must be remembered that as remarkable as they are, the actions and capacities of wetlands still have limits. Too much pollution can destroy a wetland.



Many of the functions of Alaska wetlands can be explored through metaphor. A metaphor is a direct comparison between two things: it gives a vivid image through direct comparison. "A tree is a home," "books are windows of thought," and "she is a tower of strength" are three examples. In this activity, a variety of objects represent the characteristics of wetlands

## Procedures:

Both leaders should have a supply of objects to use for the wetlands metaphor activity. Keep them in a grab bag.. Ideally, it should be possible for each student to put his or her hand into the container and pull out an object at least once. Keep the grab bag in your backpack until the end of your session.

Discuss what a metaphor is and how we can use metaphors to explain some of the wetland functions we have learned about during the field experience. Briefly describe some of the wetland functions mentioned below.

### Functions of wetlands:

- ◆ Sponge Effect – provides runoff control.
- ◆ Filter Effect – takes out silt, toxins, wastes, etc.



## Wetland Metaphors continued...

- ◆ Nutrient Control – absorbs nutrients from fertilizers and other sources that may cause contamination downstream.
- ◆ Natural Nursery – provides protection and nourishment for newborn wildlife.
- ◆ Habitat – provides a home and/or resting place and food for resident and migratory wildlife populations.

Tell students that these activities and many more that they could probably think of are taking place in wetlands all the time.

Tell students that objects can be used to represent wetland functions. Metaphors offer a dramatic way of drawing a comparison. A metaphor gives a vivid image through direct comparison. For example: “Frank is a chip off the old block” or “She’s a barrel of laughs.” Now bring out the “Mystery Metaphor Container.” Tell the students that everything in the container can be a metaphor that relates to the functions of wetlands. Have the students divide into pairs. Announce that when it is their turn, you want a representative of each pair to draw an object from the container.

Have the designated student reach into the container and withdraw one object. When each pair has an object, ask them to describe and demonstrate the relationships between their object and the wetland. Encourage the students to build on each other’s ideas. You can also assist by strengthening their connections. NOTE: Allow the students time to discuss their ideas with each other before doing so in front of the entire class.

Ask the students to summarize the major roles that wetlands perform in contributing to a healthy habitat for wildlife. Ask them if their own attitudes about wetlands are different as a result of doing this activity. If yes, how?

### Extension:

If this is your only trip to the wetlands, follow-up your discovery walk with the completion of a wetland atlas showing the different organisms found in the Beluga wetland. See the Making and Atlas Activity for detailed instructions for this activity.

Have students write a poem or essay about wetlands using metaphors.

*Adapted from “Wetlands Metaphors.” Aquatic Project WILD. 1987. Western Regional Environmental Education Council.*

Metaphor examples:

<u>Object</u>	<u>Metaphoric Wetland Function</u>
sponge	absorbs excess water, flooding control
pillow	a resting place, for migratory birds.
egg beater	mixes nutrients and oxygen into fresh and saltwater wetlands
cradle	shelters and protects, like a nursery for young fish, insects, mammals, and birds.
strainer	strains debris and suspended material out of the water
can of soup	provides food.

(Pictures can be included in the Mystery Metaphor Container that illustrate other important comparisons such as: gardens: food production for animals, airports: land and take-off places for migrating birds, zoo: a natural menagerie of diverse wildlife, etc.)



# Wetland Cards

## Objectives

Students will become familiar with wetland species and their habitat needs. Students will learn about interrelationships among species.

## Concepts

Wetland species have special adaptations and requirements for habitat.

## Materials

- ◆ Laminated wetland cards

## Introduction

On the back of the Wetland Cards are a description of the size, physical description, habitat, predators and food for each species. Younger students may use fewer cards for the activities.

## Procedure

Choose enough cards to equal the number of students. Choose cards that relate to each other. For instance, you might choose a duck species, its food, and its predators.

Pick one option to do with your the students either as a follow-up to the field experience or a lead-in to the entire field trip.

Option 1: Give each student a Wetland Card. Each student should then learn about his/her species. For younger students, learning the name is sufficient. Each student then introduces their species and tells some information about it. Older students should tell only facts about their species, to see if the other students can guess the species.

Option 2: Put a Wetland Card on the back of each student. Students must then mingle and ask "yes" or "no" questions to try to figure out what their species is. Once they figure it out, they take the card off their back and read the information. When everyone has guessed their species, have students introduce their species, give their habitat requirement and a "Gee Whiz" about their species.

## Evaluation

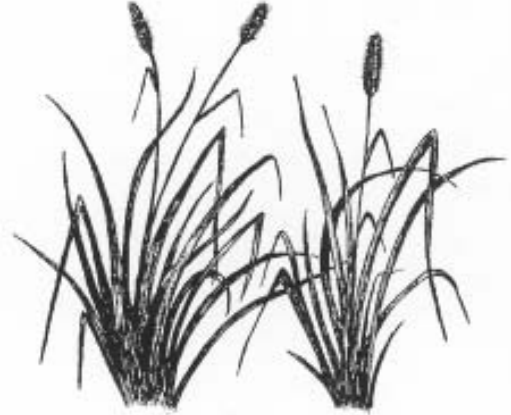
Can students identify a species by its picture? Can students identify food and habitat for main species? Can students identify wildlife species and their habitats, foods and predators?



# Wetland Cards



**Alder**



**Grasses**



**Paper Birch**



**Pendent Grass**



**Pond Weed**



**Arrow  
Grass**

# Wetland Cards

## Grasses

**Traits:** Ground cover plants with long, narrow leaves

**Habitat:** Wet, moist, and dry soils depending on the species

**Foods:** Makes its own by photosynthesis

**Eaten by:** voles, ground squirrels; the seeds are eaten by snow buntings, longspurs, redpolls

**Gee Whiz:** Their long, narrow leaf shape is less likely to be shredded or ripped by strong winds

## Alder

**Traits:** Broadleaf (deciduous) tree with horizontal lines (lenticels) on a smooth, gray bark; the leaf margins are finely toothed, and the fruit is a dark brown cone appearing in groups of three to nine.

**Habitat:** Disturbed sites such as gravel slopes, flood plains, landslides and along streams and marshes.

**Foods:** Makes its own by photosynthesis

**Eaten by:** Moose browse the twigs and leaves. Some birds eat the buds and seeds.

**Gee Whiz:** Alder roots usually have root nodules that fix nitrogen from the air and enrich the soil. They help other trees grow.

## Pendent Grass

**Traits:** Emergent, aquatic grass (plant) with long, narrow leaves; small red-brown flowers occur in one to seven tight clusters (spikelets) at the top of a tall stalk.

**Habitat:** Along lake shores and stream banks

**Foods:** Makes its own by photosynthesis

**Eaten by:** Geese, ducks, certain insects, snails, other aquatic invertebrates; it is a major spring forage for brown and black bears.

**Gee Whiz:** Loons and grebes use the leaves and hollow stems of this grass to build nests that float on the water

## Paper Birch

**Traits:** Broadleaf (deciduous) tree with toothed leaf edges and white, smooth bark; the male and female flowers appear on the same twig, and the seeds develop on a conelike fruit.

**Habitat:** Boreal forest; grows best on sites without permafrost.

**Foods:** Makes its own by photosynthesis

**Eaten by:** Moth larvae, aphids, metallic wood borers, pine grosbeaks, redpolls, ruffed grouse, moose, hares.

**Gee Whiz:** Birch are generally found in a mixture of white or black spruce, which replace it in the successional sequence after a fire. Birch sap is used to make syrup.

## Arrow Grass

**Traits:** An emergent, aquatic plant with long, narrow leaves that rise from a horizontal root; the rounded fruits are loosely arranged along the stem. May grow 4 to 35 inches (10-89 cm) tall, but they are usually small.

The leaves of this plant contains small amounts of cyanide, which causes vomiting, abdominal pain, cramps and diarrhea.

**Habitat:** Fresh or salt water wetlands.

**Foods:** Makes its own by photosynthesis

**Eaten by:** Ducks, geese, some aquatic invertebrates.

**Gee Whiz:** The same species of arrowgrass that occur in Alaska also grows in Canada, Europe, Asia and Siberia.

## Pond Weed

**Traits:** Aquatic plant with floating leaves having parallel veins; the leaves are submerged on young plants and are long and narrow in most species. Flowers occur in a spike.

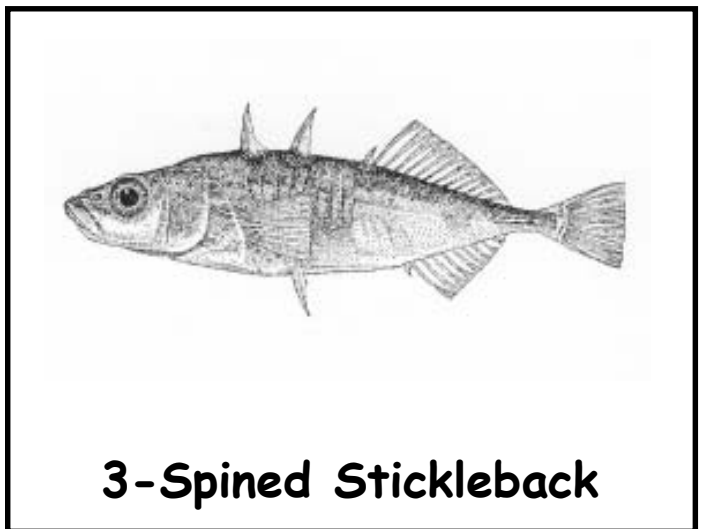
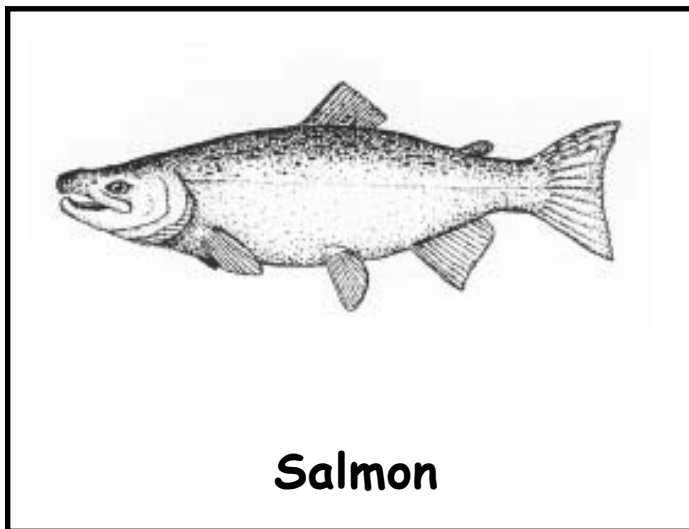
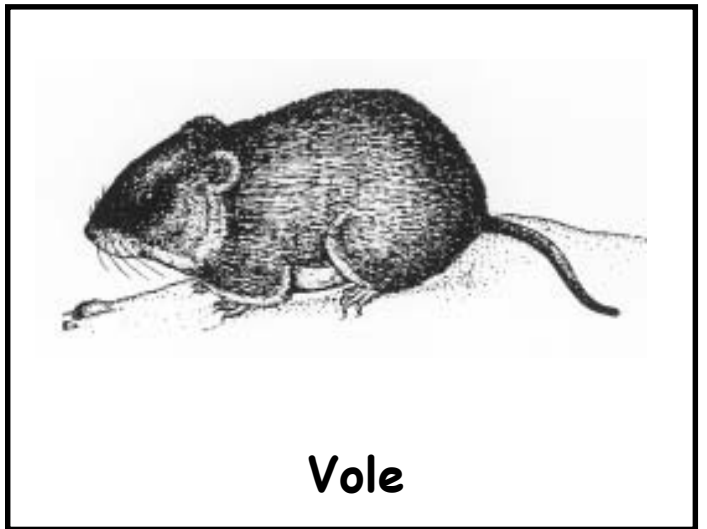
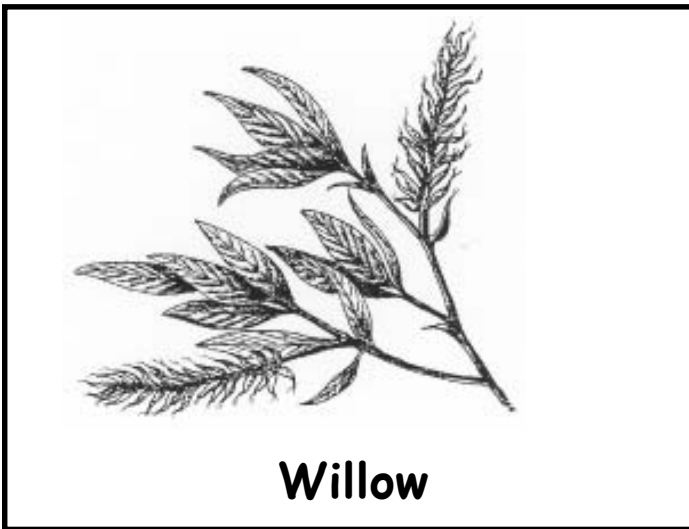
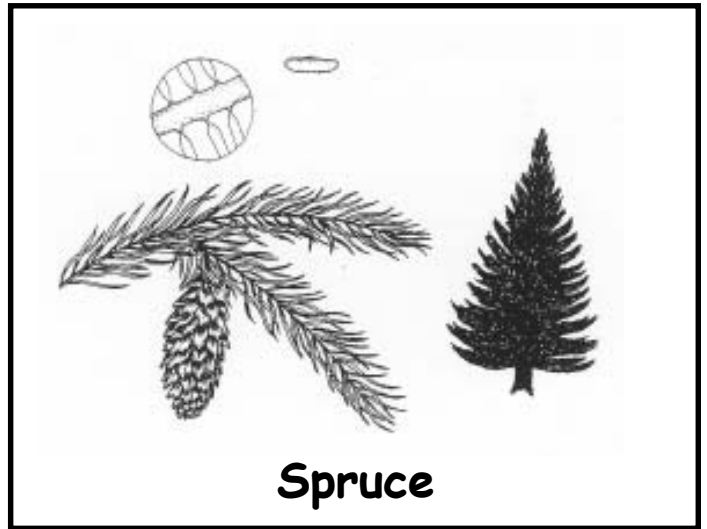
**Habitat:** Shallow to deep water in lakes and ponds throughout Alaska

**Foods:** Makes its own by photosynthesis

**Eaten by:** Insect larvae, snails, waterfowl

**Gee Whiz:** There are about 40 species of pondweed in North America, almost all of which are important either as food or shelter for animals.

# Wetland Cards



# Wetland Cards

## Spruce

**Traits:** Conifer tree with sharply pointed needles

**Habitat:** Well-drained soils in wet, moderate climates of coastal rainforest

**Foods:** Makes its own by photosynthesis

**Eaten by:** porcupines, crossbills, red squirrels, bark and longhorn beetles, redpolls, siskins

**Gee Whiz:** The Dena'ina Indians of Kachemak Bay used Sitka Spruce sap as a spring tonic, and the pitch as chewing gum or caulk for boats.

## Sedges

**Traits:** Herbs with long, narrow leaves that have parallel veins and solid, usually triangular stems ("sedges have edges" to their stems); the tiny, inconspicuous flowers grow in clusters.

**Habitat:** Shallow water, mud, or moist soil of fresh or salt water wetlands.

**Foods:** Makes its own by photosynthesis

**Eaten by:** ground squirrels, voles, geese, seed-eating birds such as snow buntings, longspurs, rosy finches.

**Gee Whiz:** The long, narrow leaf shape of sedges reduces fraying by strong winds.

## Vole

**Traits:** Small, mouselike mammals with rounded noses, short tails and legs, and long front teeth (incisors) for gnawing

**Habitat:** Forests, shrublands, wetlands, tundra

**Foods:** Fresh green vegetation, seeds, roots, berries, mushrooms and other fungi

**Eaten by:** Coyotes, wolves, foxes, marten, weasels, hawks, owls, jaegers, sandhill cranes, ravens, gulls, and other predatory birds

**Gee Whiz:** The singing vole makes a high-pitched trill when danger threatens the colony.

## Willow

**Traits:** Broadleaf (deciduous) tree or shrub with long, narrow leaves; both male and female flowers occur in soft, fuzzy catkins.

**Habitat:** Wetlands, forests, and tundras throughout northern regions of the world; prefer moist or wet sites.

**Foods:** Makes its own by photosynthesis

**Eaten by:** Moose, snowshoe hare, ptarmigan, redpolls, beaver.

**Gee Whiz:** Willow bark contains salicylic acid, the active ingredient in aspirin, and was used as a painkiller at least 2,400 years ago.

## 3-Spined Stickleback

**Traits:** Fish with three sharp spines on its back; animal (vertebrate)

**Habitat:** Fresh and salt water

**Foods:** Copepods, water fleas, midges, rotifers, seed shrimp, aquatic worms, molluscs, amphipods, leeches, flatworms, water mites

**Eaten by:** Salmon, Dolly Varden, loons, grebes, mergansers, adult sticklebacks will eat young sticklebacks

**Gee Whiz:** Sticklebacks have a high tolerance to low oxygen levels in shallow, frozen lakes. They can survive where other fish cannot.

## Salmon

**Traits:** Fish with an adipose fin; animal (vertebrate)

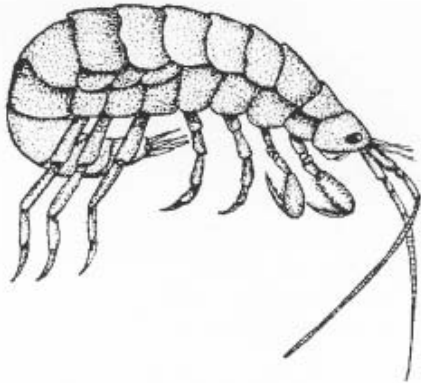
**Habitat:** Adults live at sea, but return to freshwater to spawn in rivers and river mouths.

**Foods:** Copepods, crustaceans, insects, other small fish or invertebrates.

**Eaten by:** Larger fish, seals, whales, eagles, bears, grebes, loons, humans.

**Gee Whiz:** Sockeye salmon, also know as red salmon, are the most abundant salmon in Alaska.

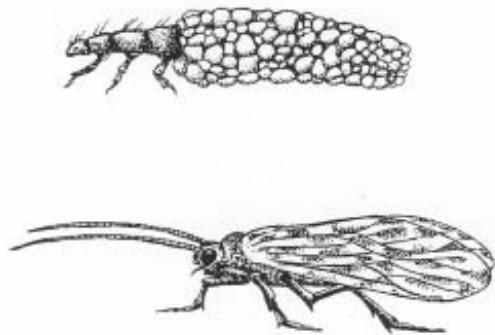
# Wetland Cards



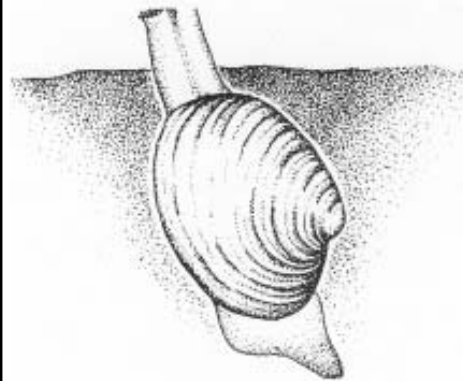
**Amphipod**



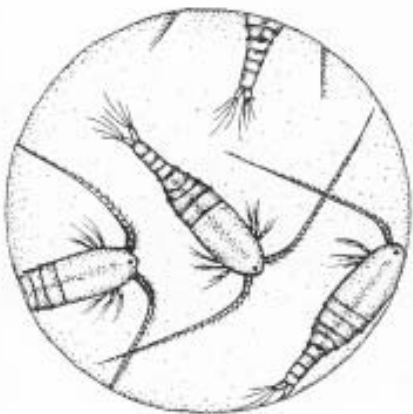
**Black Fly**



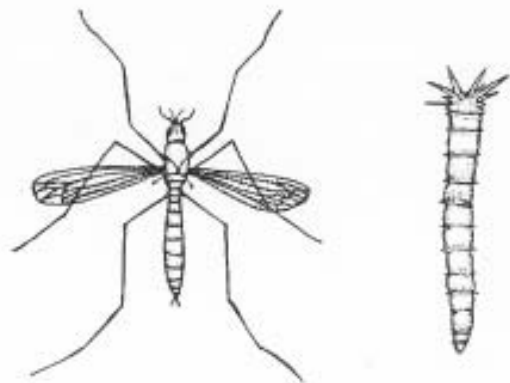
**Caddis Fly**



**Clam**



**Copepod**



**Crane Fly**

# Wetland Cards

## Black Fly

**Traits:** Adult black flies have six legs and are dark colored with broad wings and short legs

**Habitat:** Adults live around water. Larvae live underwater, attached to rocks and plants

**Foods:** Adult males feed on flower nectar. Adult females suck blood from birds and mammals. Larvae filter detritus (decaying matter)

**Eaten by:** Adults are eaten by swallows and some insects. Larvae eaten by fish, such as blackfish and dippers

**Gee Whiz:** Female black flies are vicious biters. Males don't bite.

## Amphipod

**Traits:** Crustacean with many legs, a hard exoskeleton, and a body compressed from side to side; eyes of amphipods not on stalks (unlike shrimp); invertebrate animal

**Habitat:** Salt water, fresh water lakes and ponds

**Foods:** Detritus and small invertebrates

**Eaten by:** Fish, water birds, whales, other aquatic predators

**Gee Whiz:** Beach amphipods, sometimes called sand fleas, are only .75 inches (2 cm) long, but they can leap 1.1 yards (1 m); that is farther than any organism of their size.

## Clam

**Traits:** Invertebrate animals (mollusc) with two-valved shells hinged on one side (bivalve), a small head, and a compressed body

**Habitat:** Varies by species; some burrow in sand, mud or rocks

**Foods:** Filter detritus, algae, protozoans, small crustaceans, insect larvae from the water

**Eaten by:** Snails, sea stars, certain fish, diving ducks, emperor geese, shorebirds, sea otters, humans

**Gee Whiz:** Clams can burrow very rapidly by extending their "foot" into the sand or mud, expanding the tip to act as an anchor, and pulling themselves down.

## Caddis Fly

**Traits:** Adults have wings covered with hairs. Long antennae. Larvae have hooklike parts at the ends of their abdomens and some have featherlike gills

**Habitat:** Adults are nocturnal and rest in cool, dark places. Larvae live in ponds, lakes, and streams

**Foods:** Adults eat flower nectar. Larvae eat aquatic plants, algae, diatoms, and aquatic insect larvae

**Eaten by:** Diving beetles, frogs, fish, waterfowl, shorebirds

**Gee Whiz:** Many larvae build cases made of leaves, twigs, or sand in which to pupate.

## Crane Fly

**Traits:** Long-legged, mosquito-like insects with two clear wings

**Habitat:** Adults: damp habitats with abundant vegetation; larvae: moist soil and decaying plants in forests; some live in water

**Foods:** Some adults eat flower nectar. Larvae eat algae, detritus, and larvae of other insects

**Eaten by:** Bats, shrews, insect-eating birds, centipedes, spiders, other insect-eating invertebrates

**Gee Whiz:** Although crane flies look like giant mosquitos, they do not bite. They do, however, eat mosquitos.

## Copepod (a main type of zooplankton)

**Traits:** Crustacean (invertebrate animal) with a short, cylindrical body of ten segments; the first few segments have appendages.

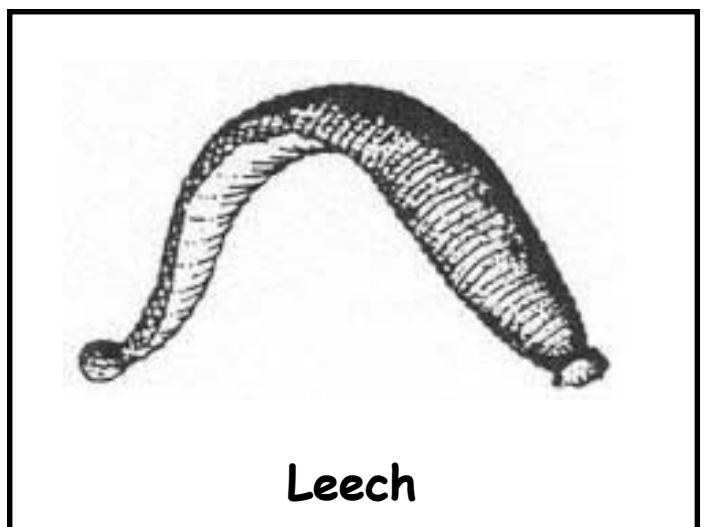
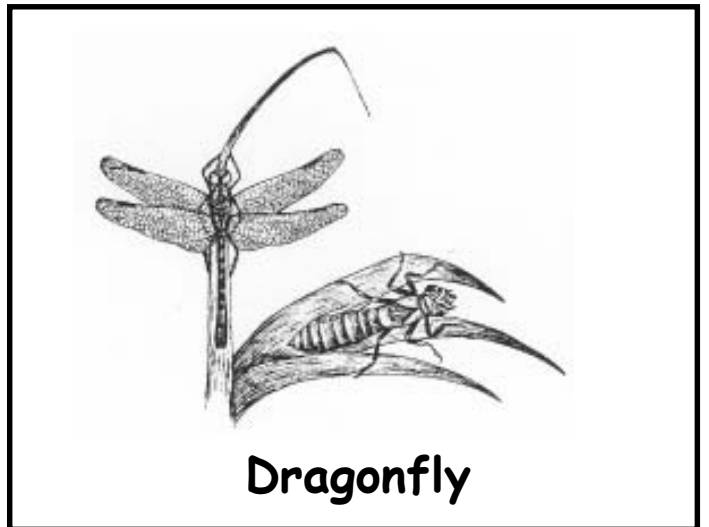
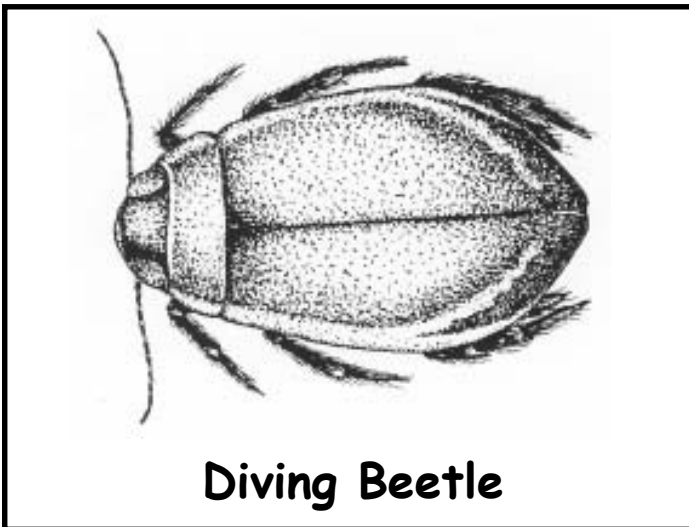
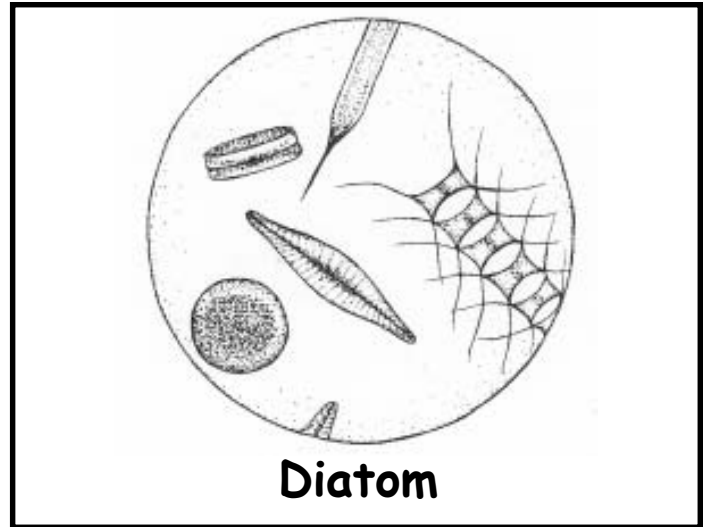
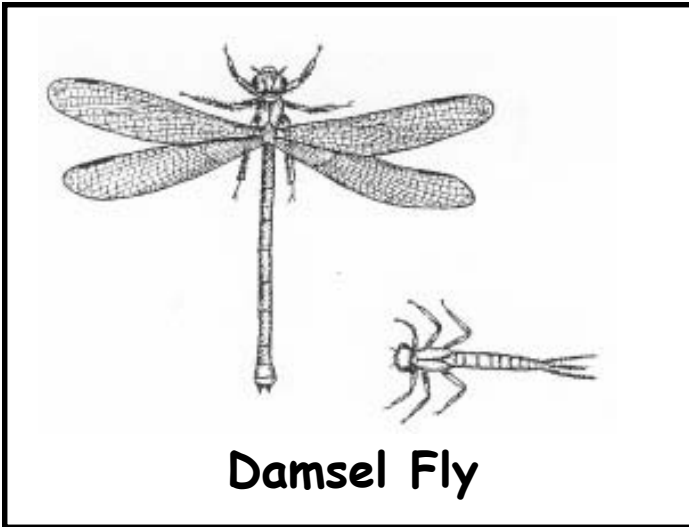
**Habitat:** Fresh and salt water wetlands and at sea

**Foods:** Filter detritus or algae from the water; some capture small zooplankton. Some are parasites on the gills of fish and large crustaceans

**Eaten by:** Fish and other aquatic animals, including whales

**Gee Whiz:** Although they are tiny, copepods and other small crustaceans are the chief food of humpback and gray whales.

# Wetland Cards



# Wetland Cards

## Diatom

### (a type of phytoplankton)

**Traits:** Microscopic, single-celled organisms (protists) that live individually or in colonies; diatoms have two lenslike shells made of silica (an element of glass)

**Habitat:** Fresh and salt water

**Foods:** Makes its own by photosynthesis

**Eaten by:** Amoebas, small crustaceans, larvae of invertebrates, fish

**Gee Whiz:** When diatoms die, their shells fall to the bottom of the sea. Large deposits formed over centuries are now mined and used by industry in a variety of products.

## Damselfly

**Traits:** Insects with very large eyes and short antennae; adults have four wings of the same size  
**Habitat:** Adults: near water; nymphs: on aquatic plants or the bottom of streams and ponds

**Foods:** Adults prey on flying insects, including midges and mosquitos. Nymphs eat mosquito larvae, tadpoles and small fish

**Eaten by:** Diving beetles, frogs, fish, waterfowl, shorebirds

**Gee Whiz:** Fossil records indicate that some prehistoric relatives of damselflies had wingspans of 27 inches (69 cm)

## Dragonfly

**Traits:** Insect with long, narrow abdomen; six legs, large eyes and four wings; invertebrate animal.

**Habitat:** Adults: near water; nymphs: bottom of streams and ponds or on aquatic plants.

**Foods:** Adults prey on small flying insects, including mosquitos and black flies. Nymphs prey on mosquito larvae, snails, tadpoles, and small fish.

**Eaten by:** Adults eaten by flycatchers, fish and swallows; dippers feed on nymphs.

**Gee Whiz:** Adults catch mosquitos in the air with their basketlike legs and eat their prey "on the wing."

## Diving Beetle

**Traits:** Aquatic insects; adults are oval-shaped and have legs with hairlike fringes; Larvae have large heads, long mandibles, and eight to ten abdominal segments

**Habitat:** Ponds, lakes, streams, rivers, estuaries

**Foods:** Adults and larvae prey on aquatic insects, small fish and tadpoles

**Eaten by:** Fish, water birds, water shrews

**Gee Whiz:** Diving beetles obtain air at the surface of the water, but can remain underwater by carrying an air bubble with them.

## Leech

**Traits:** Invertebrate that sucks blood from hosts (sanguivorous) and attaches with an anterior sucker. Swims near the substrate to avoid predation.

**Habitat:** Shallow regions of lakes and ponds

**Foods:** Parasitic on other invertebrates and vertebrates such as fish, birds and mammals. Prefer these to humans, but will attach to humans as well.

**Eaten by:** Fish, ducks and other birds

**Gee Whiz:** Some leech will even feed on other sanguivorous (blood sucking) leeches!

## Fairy Shrimp

**Traits:** Crustaceans (invertebrate animal) that swims upside down; 20 body segments with appendages on the first 11-12 segments; eyes on stalks; no hard shell covering body

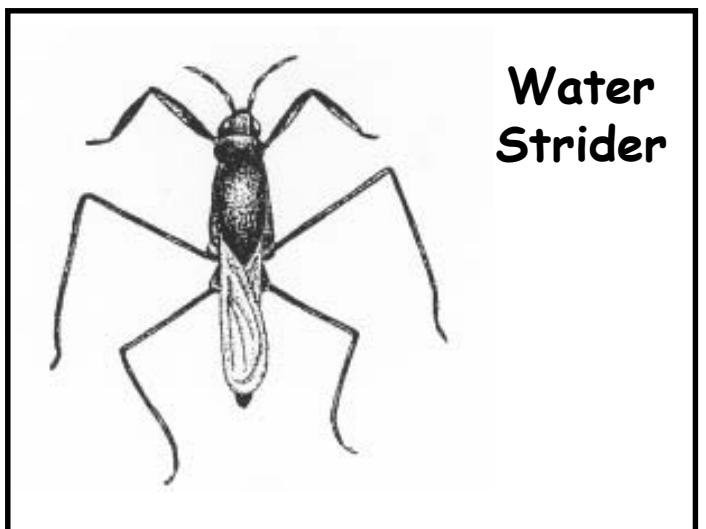
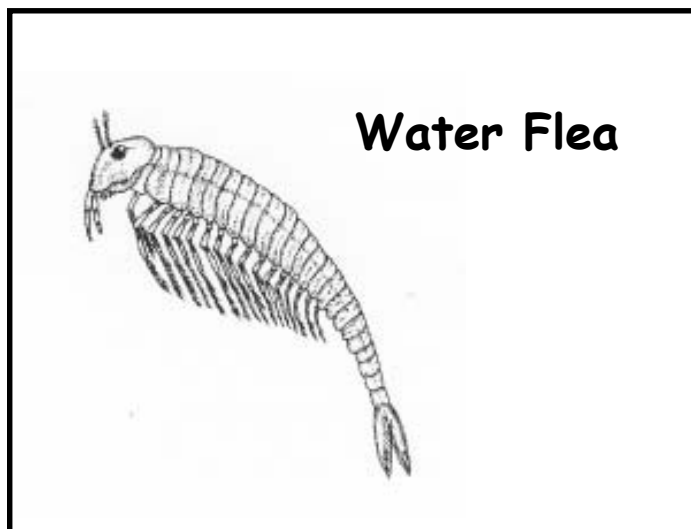
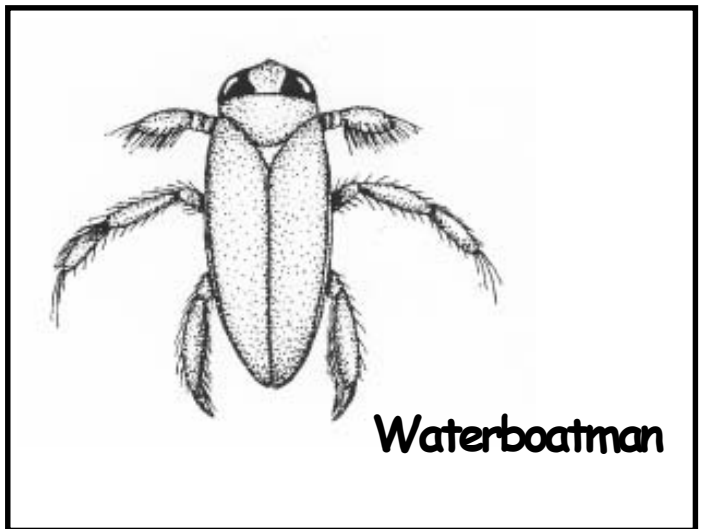
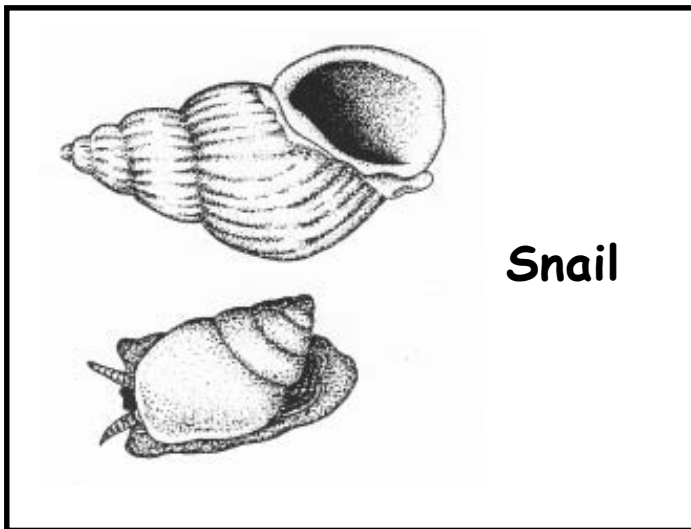
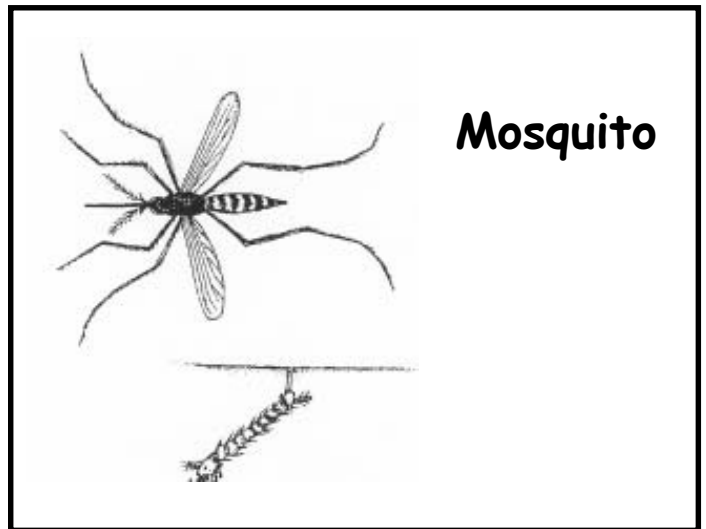
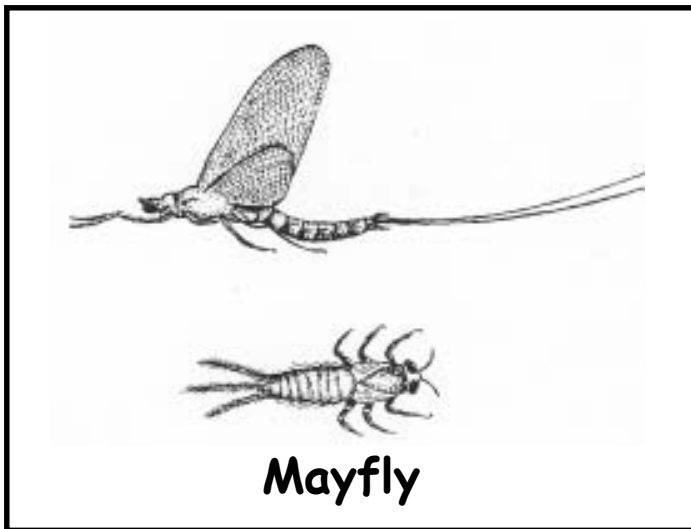
**Habitat:** Small ponds, springs, meltwater pools

**Foods:** Detritus, small crustaceans, rotifers, protozoans, algae, diatoms and other plankton

**Eaten by:** Ducks, phalaropes, water shrews, diving beetles, other aquatic invertebrates, fish

**Gee Whiz:** Females are often more abundant than males. In some types, no males are known and young develop from eggs that have never been fertilized.

# Wetland Cards



# Wetland Cards

## Mosquito

**Traits:** Adult insects have scales and long, tubular mouthparts (proboscis) for sucking. Larvae are wormlike

**Habitat:** All types; larvae are aquatic and live in ponds, lakes, and still waters

**Foods:** Adult females suck blood from birds and mammals. Adult males feed on flower nectar. Larvae feed on algae, protozoans and detritus

**Eaten by:** Adults eaten by dragonflies, fish, frogs, birds, bats. Larvae are eaten by fish and water birds

**Gee Whiz:** Some female mosquitos carry microscopic organisms that cause diseases in mammals and birds

## Mayfly

**Traits:** Delicate insects with two to three hairlike parts at the end of the abdomen; rear wings are smaller than forewings; invertebrate animal

**Habitat:** Adults near water; nymphs: streams, lakes, ponds

**Foods:** Nymphs feed on diatoms, algae and detritus; adults cannot feed because their mouth parts do not function

**Eaten by:** Diving beetles, frogs, fish, waterfowl, shorebirds

**Gee Whiz:** Most adult mayflies live for only two to three days; some live for just one to two hours.

## Waterboatman

**Traits:** Aquatic insect with four legs used for swimming; front legs modified to form scoops; the nymphs and adults look alike.

**Habitat:** Margins of lakes, ponds, estuaries

**Foods:** Decaying leaves

**Eaten by:** Diving beetles, frogs, fish, waterfowl, shorebirds

**Gee Whiz:** Water boatmen are like scuba divers. They trap an air bubble under their wings at the water surface, then use this "air tank" to breathe while diving underwater.

## Snail

**Traits:** Invertebrate animals (mollusc) with flat creeping foot, a one-piece shell, and a well-developed head

**Habitat:** Land as well as water; on rocks, sandy or silty bottoms, and aquatic plants in either fresh or salt water

**Foods:** Fresh water snails graze on algae, aquatic plants, detritus, and fungi. Some marine forms prey on other marine animals, including other molluscs

**Eaten by:** Crustaceans, fish, birds, mammals

**Gee Whiz:** There are more than 35,000 species of snails.

## Water Strider

**Traits:** Insect with body and long legs covered with stiff, waterproof hair that allows the insect to "skate" across the water surface.

**Habitat:** Ponds and streams.

**Foods:** Small living or dead insects on the water surface.

**Eaten by:** Fish, water birds, water shrews.

**Gee Whiz:** A water strider will sink and drown if the hairs on its legs become wet and it cannot reach a place to dry out.

## Water Flea

**Traits:** Crustacean (invertebrate animals) with a body compressed side to side; hard shell covers body but not head; uses second set of antennae to swim

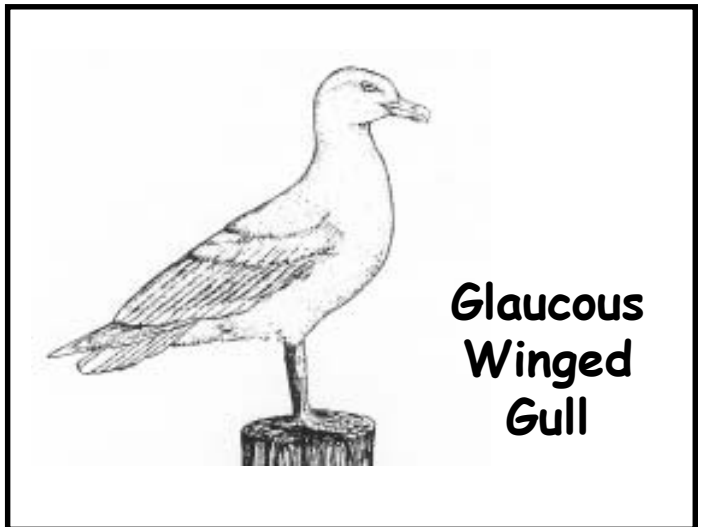
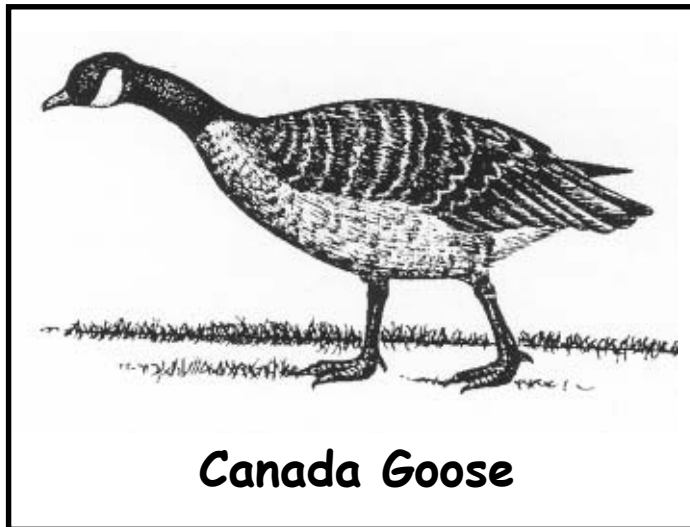
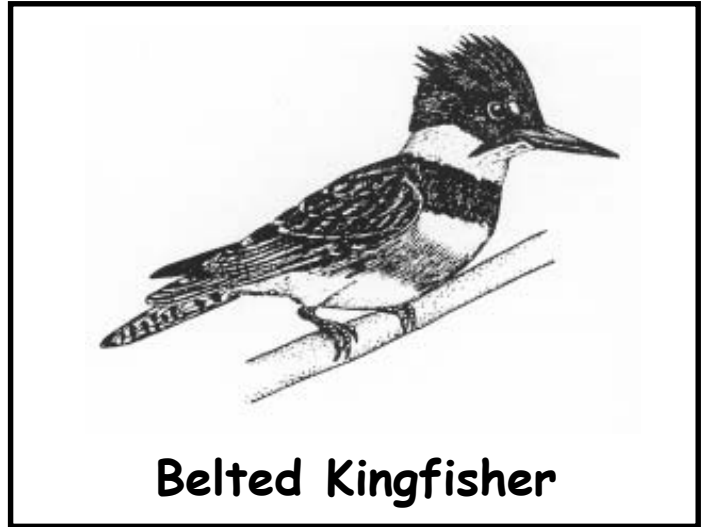
**Habitat:** Lakes, ponds and streams.

**Foods:** Filters detritus, protozoans, rotifers, crustaceans, algae, diatoms and other plankton from the water

**Eaten by:** Ducks, shorebirds, diving beetles, other aquatic invertebrates, fish

**Gee Whiz:** Females produce two kinds of eggs; thin-shelled eggs in the summer, which develop without fertilization, and thick-shelled ones in winter, which are fertilized by males.

# Wetland Cards



# Wetland Cards

## Belted Kingfisher

**Traits:** Medium-sized, chunky body; large head with crest; long, sharply pointed bill; small legs and feet; two front toes joined together

**Habitat:** Coasts, rivers, lakes, ponds

**Foods:** Sticklebacks, sculpin, blackfish, young salmon, herring, eulachon, crustaceans, molluscs, aquatic insects

**Eaten by:** Falcons, hawks, eagles

**Gee Whiz:** The kingfisher digs its upslanting burrow in creek, river, lake or pond bank for nesting. Nest is often lined with fish bones.

## Bald Eagle

**Traits:** Large, brown bird with rounded tail and wings; hooked yellow bill; long, curved talons; adults have white heads and tails

**Habitat:** Forested areas along coasts, lakes, rivers; also some treeless coastal regions

**Foods:** Waterfowl, small mammals, salmon, herring, dead and dying fish, mammals or birds washed up along shorebirds

**Eaten by:** Young occasionally eaten by ravens and magpies

**Gee Whiz:** Bald eagles are almost five years old when their heads and tails become all white.

## Common Raven

**Traits:** Large, black bird with wedge-shaped tail; broad wings; heavy bill

**Habitat:** Forests, shrublands, tundra, wetlands; builds a stick nest on cliffs or in trees

**Foods:** Small mammals, birds, berries, carrion (dead animals), eggs and young of other birds

**Eaten by:** Crows, marten, jays or other predators may take eggs

**Gee Whiz:** Ravens are very intelligent. They often work cooperatively to "steal" food from large predators and pets.

## Black-billed Magpie

**Traits:** large, black and white bird with glossy green and blue feathers; very long tail, large, stout bill

**Habitat:** Builds a domed stick nest in spruce or broadleaf trees; feeds in the forests and in openings

**Foods:** Small mammals, insects and other invertebrates, berries, carrion (dead animals), eggs and young of other birds

**Eaten by:** Squirrels, weasels, marten and ravens eat eggs and young

**Gee Whiz:** Abandoned nests of this bird are sometimes used by other birds including merlins.

## Glaucous Winged Gull

**Traits:** Large bird with pale gray wings and back; light can be seen through the white wing tips

**Habitat:** Wetlands in tundra and marine coastal bluffs

**Foods:** Scavenges on dead animals; also eggs and young of other birds, crustaceans, insects, fish

**Eaten by:** Young bears; eggs are eaten by jaeger, ravens, foxes

**Gee Whiz:** Gulls can stand on ice and still keep warm because of a special arrangement of blood vessels in their legs. Cold blood returning from the feet is warmed before it reaches the gull's body.

## Canada Goose

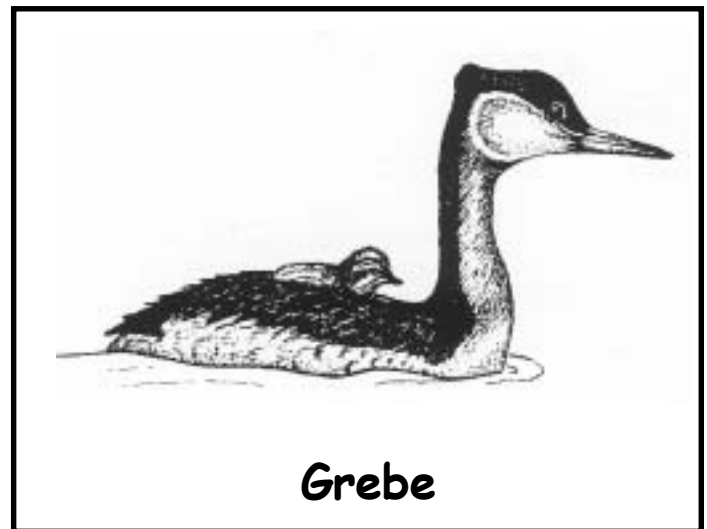
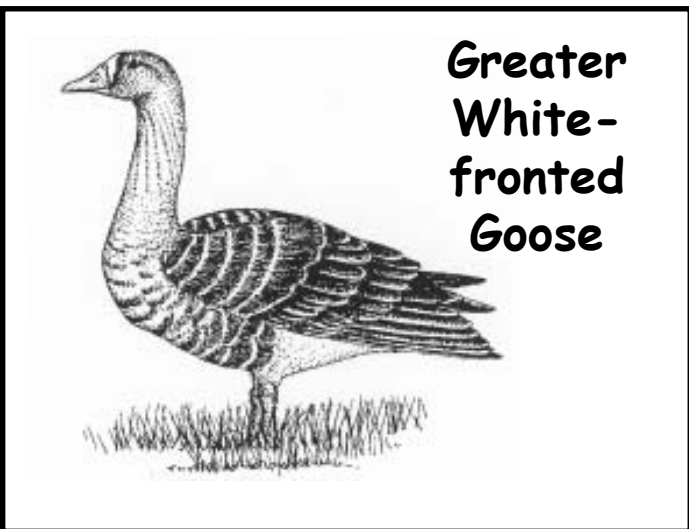
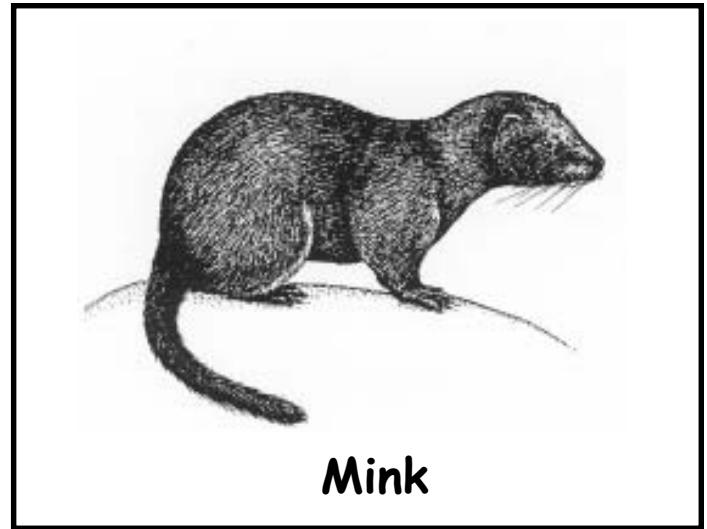
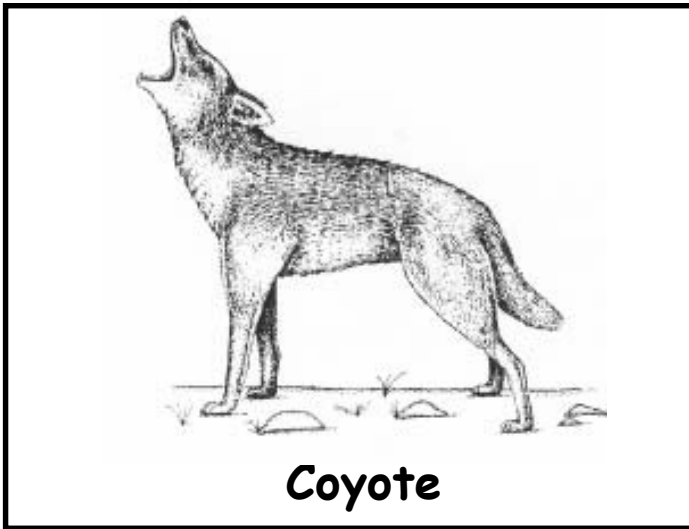
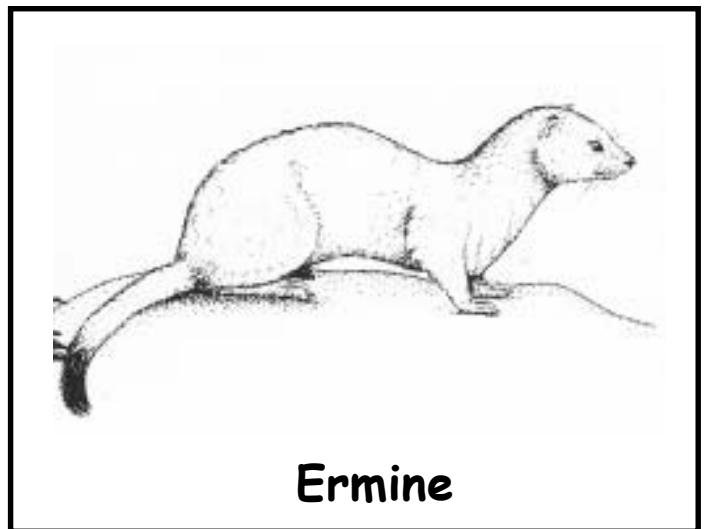
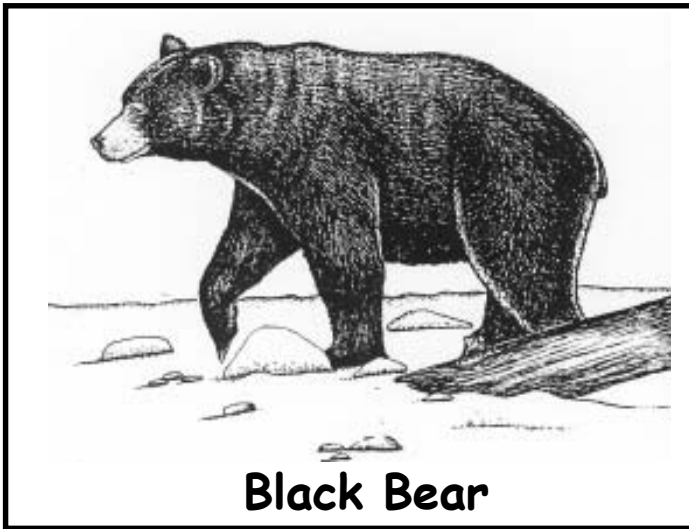
**Traits:** Medium sized goose with black head and neck and white "chin strap" from ear to ear.

**Habitat:** Nests in coastal wetlands; winters in Oregon and Washington.

**Foods:** Grasses, sedges, berries, shoots, roots

**Eaten by:** Foxes, gulls, eagles, humans.

# Wetland Cards



# Wetland Cards

## Ermine

**Traits:** Small, fur-bearing mammal with sharp teeth; turns white in winter, except the tip of its long tail

**Habitat:** Open areas (early successional stages of boreal forest, wetlands, tundra) with water for drinking

**Foods:** Voles, shrews, jumping mice, deer mice, other small mammals; some birds, insects, plants

**Eaten by:** Great horned owls, hawks, red foxes, goshawks

**Gee Whiz:** Ermines are chiefly nocturnal, but they also hunt during the day.

## Black Bear

**Traits:** Large mammal with brown, black, or blue-gray fur; brown muzzle; short claws; sharp teeth

**Habitat:** Forested areas throughout Alaska

**Foods:** Varies seasonally; fresh green vegetation in spring, salmon and berries in fall; some moose calves and deer fawns; also carrion (dead animals)

**Eaten by:** Brown bears, black bears, humans

**Gee Whiz:** Black bears sometimes hibernate in a tree hollow created by fungi and bacteria that decayed the wood

## Mink

**Traits:** Mammals with large canine teeth; a long, slender body; short legs; long, round tail; dense brown fur; feet not webbed

**Habitat:** Streams, lakes, marshes, inlets, estuaries

**Foods:** Muskrats, voles, lemmings,; eggs and young of ducks, geese and shorebirds; fish, frogs, mussels, aquatic insects

**Eaten by:** Hawks, owls, lynx, foxes, coyotes, wolves

**Gee Whiz:** Like all other weasels, mink have an anal scent gland that produces a strong odor.

## Coyote

**Traits:** Doglike mammal with large, sharply pointed ears; long bushy tail; long legs; gray to brown in color

**Habitat:** Open areas, including early successional stages of boreal forest, wetlands, tundra

**Foods:** Hares, voles, lemmings, carrion (dead animals); some marmots, ground squirrels, muskrats, birds, fish, insects

**Eaten by:** Wolves, great horned owls, golden eagles, bears

**Gee Whiz:** Coyotes scavenge scraps from wolf and bear kills of large prey.

## Grebe

**Traits:** Diving bird with a sharp, pointed bill and lobed feet, rarely seen on land or in flight.

**Habitat:** Nests on lakes and estuaries; winters in bays and estuaries along Pacific coast to Mexico.

**Foods:** Fish, crustaceans, insects, other invertebrates.

**Eaten by:** Foxes, eagles, mink, weasels, gulls.

**Gee Whiz:** Grebes eat their own feathers! This is thought to protect their stomachs and intestines from sharp fish bones.

## Greater White-fronted Goose

**Traits:** Medium-sized, grey-brown goose with orange legs and feet, animal (vertebrate).

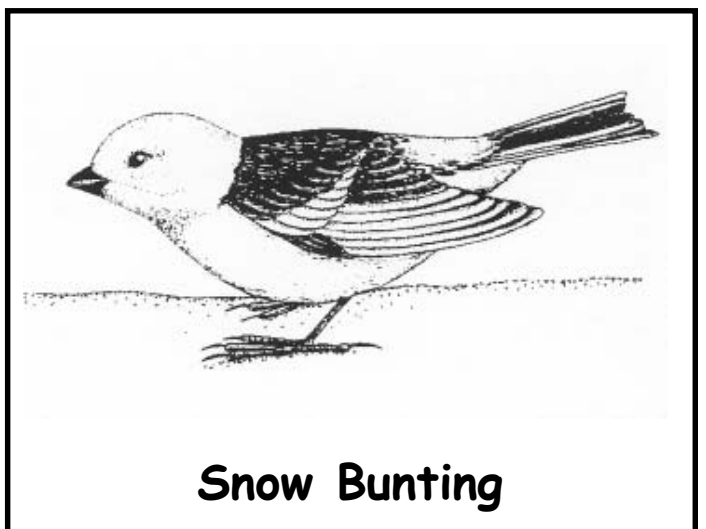
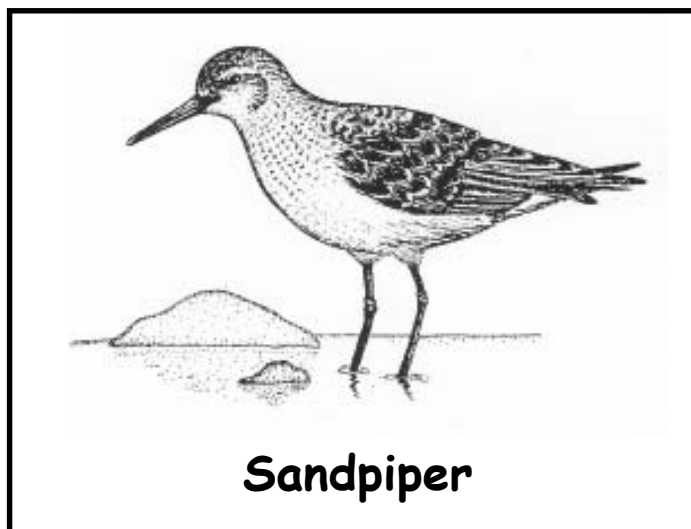
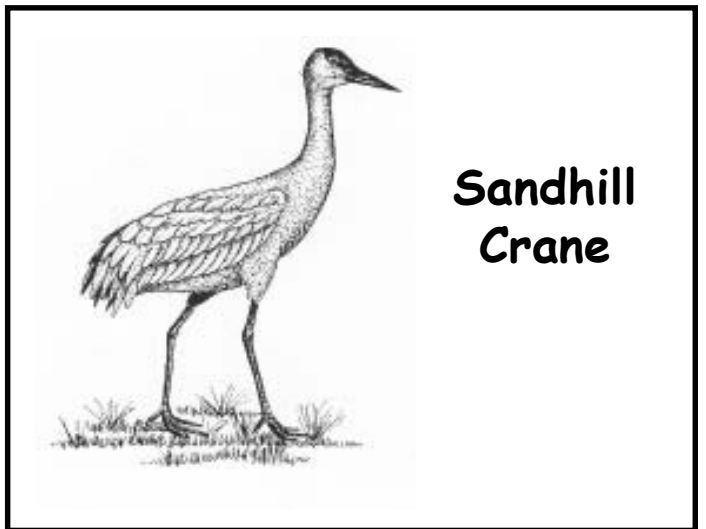
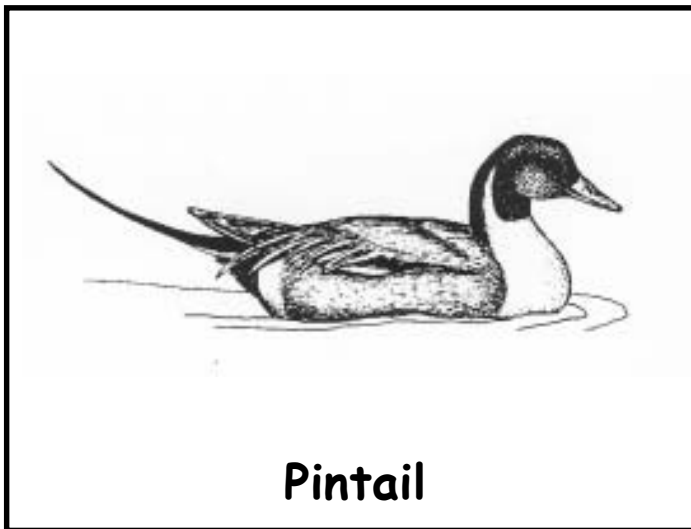
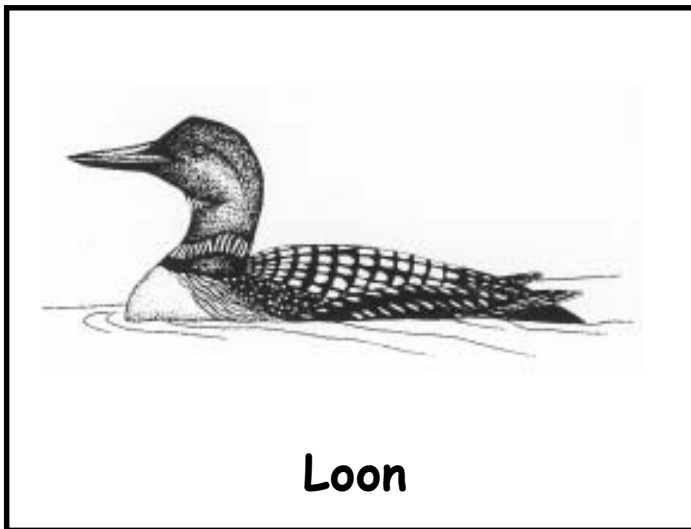
**Habitat:** Nests in wetlands and tundra. Winters in wetlands and agricultural fields in central California.

**Foods:** Grasses, sedges, leaves, berries, seeds, roots of many aquatic plants in summer; seeds of rice, water grass, milo, barley, marsh plants (rushes and cattails) in winter.

**Eaten by:** Foxes, gulls, jaegers, ravens, humans.

**Gee Whiz:** White fronts are also called "speckle-bellies" because of the dark brown bars on their undersides.

# Wetland Cards



# Wetland Cards

## Northwestern Crow

**Traits:** Medium-sized black bird with a square tail and heavy bill  
**Habitat:** Coastal forests; nests in dense thickets of spruce or hemlock trees. Feeds along the shoreline  
**Foods:** Invertebrates (mussels and limpets), carrion (dead animals), eggs and young birds, small mammals  
**Eaten by:** Great horned owls, goshawks; eggs taken by ravens, jays, squirrels

**Gee Whiz:** Crows open clams and mussels by carrying them aloft and dropping them on rocks below.

## Loon

**Traits:** Diving bird with a sharp, pointed bill and webbed feet; large heavy body; unable to take flight from land, animal (vertebrate).  
**Habitat:** Nests on freshwater lakes. Winters along Pacific coast to Mexico.  
**Foods:** Sticklebacks, sculpins, herring, sandlance, young salmon, rockfish, also eat leeches, snails, shrimp, amphipods, aquatic insects.  
**Eaten by:** Foxes, gulls, jaegers, eagles.

**Gee Whiz:** Loons can dive to depths as great as 240 feet (73 m) and fly as fast as 60 miles (101 km) per hour.

## Sandhill Crane

**Traits:** Large, gray bird with long neck, long legs, long beak; red skin on crown; whitish chin, cheek, and upper throat  
**Habitat:** Lowland tundra, muskeg and river bottoms in summer; migrates to plains and coast of Lower 48 during winter  
**Foods:** Shoots, roots, and seeds of wetland plants; lemmings; voles; insects  
**Eaten by:** Foxes, golden eagles, bald eagles, wolves, humans; eggs eaten by gulls

**Gee Whiz:** Cranes migrate at great heights. Some have been observed at elevations of 13,000 feet (3,962 m)!

## Pintail

**Traits:** A large, slender duck; male has white breast and brown head with a long, pointed tail.  
**Habitat:** Tundra, lakes, ponds, marshes; winters in coastal freshwater wetlands.  
**Foods:** Ninety percent plant foods, including seeds of sedges, grasses, pondweeds, smartweeds, grain; will eat aquatic invertebrates and insects.  
**Eaten by:** Foxes, eagles, minks; young eaten by gulls, jaegers, humans.

**Gee Whiz:** Pintails are the most widely distributed duck in North America.

## Snow Bunting

**Traits:** Small, white bird with long black and white wings  
**Habitat:** Alpine and lowland tundra throughout Alaska in summer; some remain along the coast throughout winter, but most migrate to central plains of the Lower 48  
**Foods:** Seeds and buds of tundra plants, amphipods, crane flies, spiders, beetles  
**Eaten by:** Foxes, weasels, jaegers, short-eared owls, falcons, small hawks

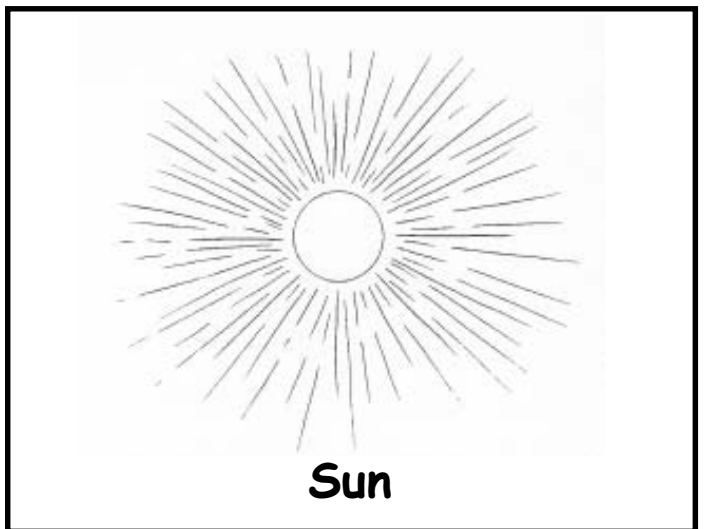
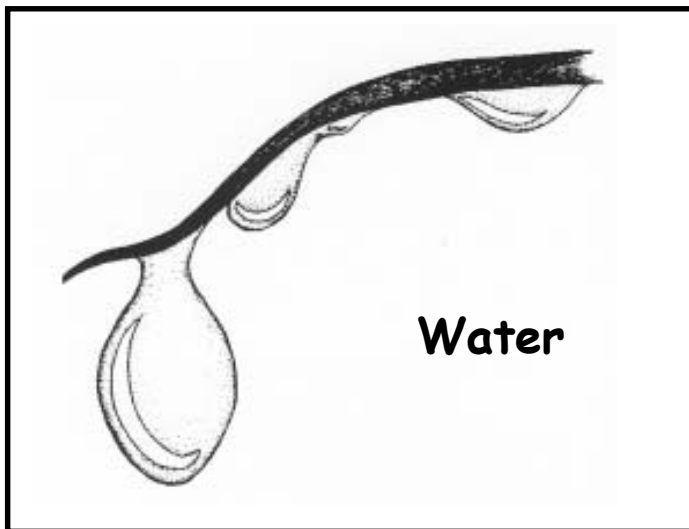
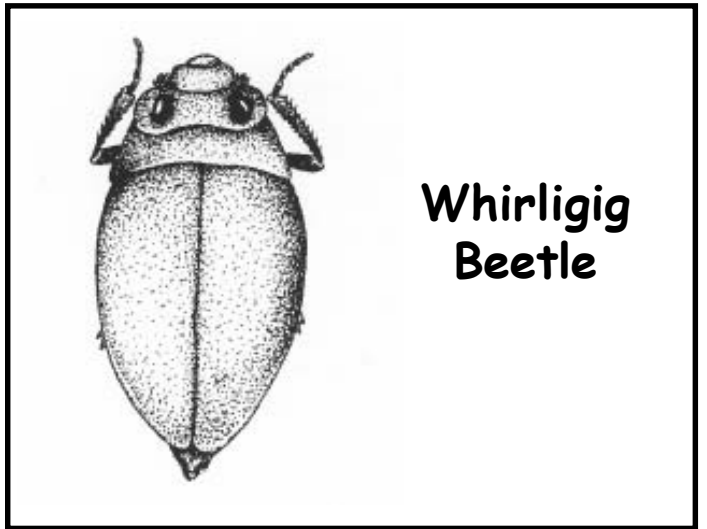
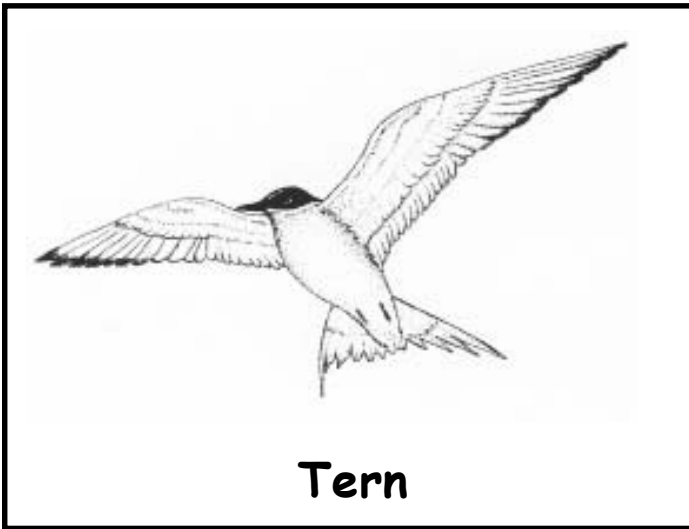
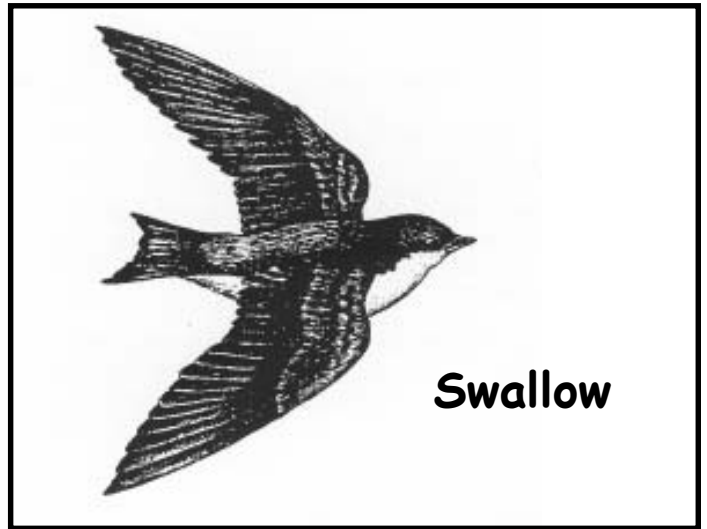
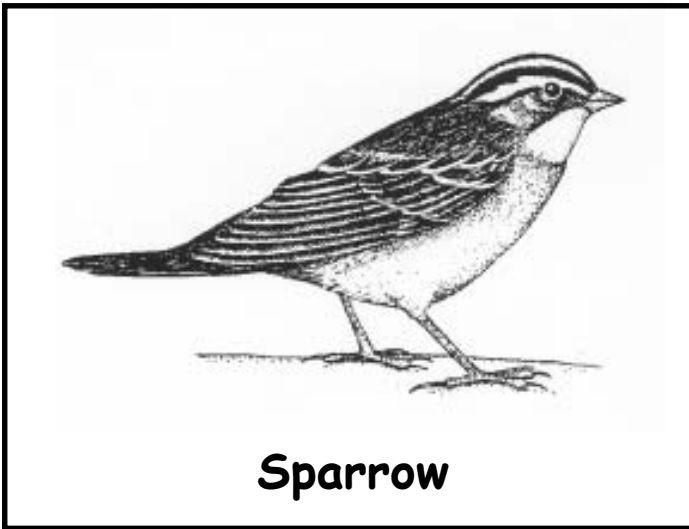
**Gee Whiz:** Snow buntings avoid severe cold by burrowing into the snow. They often nest in buildings and boxes abandoned by humans.

## Sandpiper

**Traits:** Small shorebirds with black legs, long bills, reddish markings on the head  
**Habitat:** Drier tundra; winters along coastal tideflats  
**Foods:** Amphipods, small clams, worms, larvae of crane flies and midges  
**Eaten by:** Foxes, falcons, jaegers, gulls, falcons, owls, weasels

**Gee Whiz:** Some sandpipers fly as far south as Argentina and Chile to spend the winter.

# Wetland Cards



# Wetland Cards

## Swallow

**Traits:** Small bird with a slender body and long, pointed wings; tiny bill; short legs; and small feet; moderately long, forked tail

**Habitat:** Open areas around lakes, ponds and rivers; some species nest in tree cavities

**Foods:** Flying insects (flies and mosquitoes)

**Eaten by:** Hawks, falcons

**Ge Whiz:** Swallows catch almost all their food in flight, sometimes even skimming insects off the surface of ponds and lakes.

## Sparrow

**Traits:** Small birds with stout, cone-shaped bills; majority are brown on the back and light underneath; many have streaks on the breast

**Habitat:** Tall shrub thickets, forest edges, sedge lands, open tundra

**Foods:** Seeds of ground-cover plants and tall shrubs; insects during nesting season

**Eaten by:** Sharp-shinned hawks, falcons, small owls, shrikes; weasels, squirrel, ravens prey on eggs and young

**Ge Whiz:** Sparrows often use hair from moose or feathers from other birds to line their nests.

## Whirligig Beetle

**Traits:** Crustacean (invertebrate animals) with a body compressed side to side; hard shell covers body but not head; uses second set of antennae to swim

**Habitat:** Lakes, ponds and streams.

**Foods:** Filters detritus, protozoans, rotifers, crustaceans, algae, diatoms and other plankton from the water

**Eaten by:** Ducks, shorebirds, diving beetles, other aquatic invertebrates, fish

**Ge Whiz:** Females produce two kinds of eggs; thin-shelled eggs in the summer, which develop without fertilization, and thick-shelled ones in winter, which are fertilized by males.

## Tern

**Traits:** Birds with webbed feet, deeply forked tails, straight bills, and slender bodies

**Habitat:** Wetlands in tundra and forested areas

**Foods:** Small fish

**Eaten by:** Falcons; eggs and young eaten by foxes, weasels, bears, gulls, jaegers, ravens

**Ge Whiz:** Terns attack any predators that come near their nesting colonies. Other birds nesting near terns colonies benefit from the terms harassment of potential predators.

## Sun

**Traits:** The sun is a dwarf yellow star and a dense ball of gases and dust

**Occurrences:** The sun is located in the center of our solar system, 93 million miles from planet Earth

**Values:** Plants and other producers capture the energy in sunlight and, through photosynthesis, store it in the form of sugar. They use this "stored sunlight energy" to grow and reproduce

**Ge Whiz:** The amount of solar energy striking the earth every day is about 1.5 billion times greater than the amount of electricity generated each year in the United States.

## Water

**Traits:** Water molecules are made of two atoms of hydrogen and one atom of oxygen

**Occurrence:** As a liquid in rain, lakes, rivers, oceans; as a solid in ice, snow; as a gas in clouds, humidity, evaporation; some collects underground in the water table

**Values:** All living things need water for most life processes

**Ge Whiz:** Water cycles continuously from clouds to rain or snow to plants, rivers, lakes, and oceans, then back to clouds. Today we are using the same "recycled" water that dinosaurs used thousands of years ago.



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# Slough Scavenger Hunt

## Objectives

Students will become familiar with wetland species and their habitat requirements. Students will learn to look for species in their habitat zones.

## Concept

By looking for various species of plants and animals students will learn about plant and animal adaptations and habitat zones in the slough and the lake ecosystems.

## Materials

- ◆ Scavenger Hunt Sheet
- ◆ Clipboards
- ◆ Pencils

## Introduction

Review the zones of the slough. Ask students to visually scan the area for clues about why certain plants and/or animals are found in a particular area. Discuss diversity of flora and fauna. Tell the students that they will be doing a scavenger hunt for plants and animals so that they can have a record of the diversity of plants and animals in the area. Data collected through the scavenger hunt will be used by CACS to record seasonal changes and develop a species list.

## Procedure

Hand out the Scavenger Hunt Worksheet to teams of students. Throughout the field experience encourage the students to record their observations on the scavenger hunt sheet. Discuss findings during your wrap-up discussion. Collect data sheets.



# Slough Species Check List

Name: \_\_\_\_\_

Grade: \_\_\_\_\_

School: \_\_\_\_\_

Date: \_\_\_\_\_

Time: \_\_\_\_\_

Temperature: \_\_\_\_\_

Cloud Cover: \_\_\_\_\_

Weather Conditions: \_\_\_\_\_

---

## **Birds and Animals**

### Birds

#### Waterfowl:

- Sandhill Crane
- Greater White-fronted Goose
- Canada Goose
- Mallard
- Green-winged teal
- Northern pintail
- Goldeneye
- Other

#### Raptors:

- Bald eagle
- Merlin
- Peregrine falcon

#### Shorebirds:

- Western sandpiper
- Yellowlegs
- Short-billed dowitcher
- Dunlin
- Whimbrel
- Other:

#### Misc.:

- Northwestern crow
- Common raven
- Black-billed magpie
- Belted kingfisher
- Glaucous-winged gull
- Other:

#### Mammals or mammal sign:

- Moose
- Black bear
- Coyote
- Ermine
- Mink
- Red-backed vole

#### Invertebrates:

- Baltic macoma
- Amphipod
- Crab larvae
- Polychaete worm

## **Plants**

### Adjacent Upland

- Willow
- Alder
- Kenai/paper birch
- Bluejoint reedgrass
- beach rye grass

### High Marsh Zone

- Sedges
  - Lyngbye
  - Ramenskii
- Silverweed

### Low Marsh Zone

- Alkali grass - puccinellia
- Arrowgrass
- Goosetongue
- Saltwort
- Glasswort
- Orach

### Salt Pan

### Fish:

- Sculpin
- Stickleback
- Sand lance
- Dolly varden (high tide)
- Salmon (high tide)
- Flounder

# Slough Scavenger Hunt Worksheet

Name: \_\_\_\_\_

Date: \_\_\_\_\_ Grade: \_\_\_\_\_

School: \_\_\_\_\_

Time: \_\_\_\_\_ Air Temperature: \_\_\_\_\_

Weather Conditions: \_\_\_\_\_

2 Different kinds of birds: 1. \_\_\_\_\_  
2. \_\_\_\_\_

2 kinds of marsh plants from the high marsh  
1. \_\_\_\_\_ 2. \_\_\_\_\_

2 kinds of marsh plants from the low marsh  
1. \_\_\_\_\_ 2. \_\_\_\_\_

An animal track \_\_\_\_\_

Something that changes \_\_\_\_\_

Something slimy \_\_\_\_\_

3 unique smells \_\_\_\_\_

2 different mud dwellers \_\_\_\_\_

Signs of human influence \_\_\_\_\_  garbage



# Investigating Water Animals

## Objectives:

Students will identify the environmental parameters that effect living things in the local freshwater ecosystem and they will recognize and identify some macroinvertebrates. Students will predict where water animals can be found in the environment.

## Concept:

Living things have special adaptations for surviving in different habitats. Understanding habitat needs allows one to predict where to find certain organisms.

## Materials:

For each station:

- ◆ Small aquarium
- ◆ 4 nets
- ◆ 3–4 collecting containers
- ◆ 3–4 plastic spoons
- ◆ 4 hand lenses
- ◆ 1 laminated macroinvertebrate identification sheet
- ◆ Water animals data sheet

## Introduction

When we think of animals in the water, we think mostly of fish or mammals such as otters and beavers. However, ponds, streams, rivers and wetlands are rich with animal life that we seldom see. Each wet area in Alaska erupts with young invertebrates (animals such as worms and insects that have no backbone) each spring as ice thaws. These invertebrates are an extremely important food source for many of the fish that other animals eat (including humans).

Many of the easily recognizable flying insects in Alaska such as mosquitoes and dragonflies, lay their eggs in water. Larvae and pupae develop from these

eggs and carry on complex food web relationships.

This water investigation encourages students to explore their local water environments for creatures that form essential links in the food chains of their local water ecosystem. Students will also become aware of the value of wetlands as rich areas of life that provide many benefits to the larger ecosystem.

## Procedure:

Divide class into groups of three to five students. Each group will find an exploration station set up on the dock of Beluga Lake. Allow students to pick whatever tool they wish for collecting, remind them of behavioral expectations and encourage exploration. Students can scoop water into their plastic aquariums or use their fish nets to scoop from various levels of water near their exploration station and look for fish, insect larvae, worms, or other creatures. Students should explore their area for a minimum of 15 minutes. Encourage an informal science-based inquiry process as they are discovering creatures.

Once students have a collection of fish, insect larvae, worms and other creatures have them identify as many animals as they can and record the invertebrates that they see on the Macroinvertebrate Data Sheet. Check field guides to help identify insect larvae and other invertebrates.

At the station on the north side of the dock, use the “core sampler” to examine animals that live in sediments. Have groups push the can down into the bottom of the stream or pond then pull it up. Sort through the sample for invertebrates. Describe and record creatures on the Macroinvertebrate Data Sheet under “Core Sample”.



## Investigating Water Animals continued...

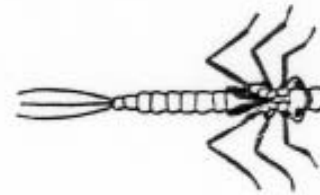
One station will conduct water quality sampling using the kit provided. Students should record the data for their station on the Water Quality Data Sheet.

Ask the "experts" to gather their temporary aquariums and collection containers and prepare a presentation to the rest of the groups regarding what they have found out about their type of invertebrate and plants that are in the area.

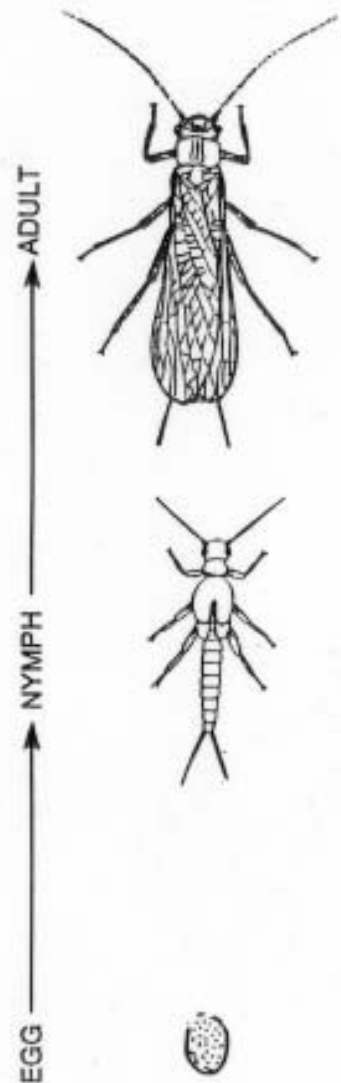
Request that the students prepare individual drawings of their favorite invertebrate. Beside the drawing, students should write a description of how it moves, what adaptations they think it has, etc. and the name of the creature if they know it. Include these drawings in the presentation. Discuss with students any similarities they found among their water critters. Identify any features that have helped water critters to adapt to their environment. Discuss the nonliving environment of water animals, focusing on elements critical to their survival. Ask students to think about how human activity might affect this nonliving environment.

### Evaluation:

Complete the Macroinvertebrates Data Sheet, and describe where water animals can be found in their local environment. During a group wrap-up discussion, have the students identify some local water animals and describe their role in an ecosystem. Students should also be able to describe the environmental parameters such, as water temperature and depth, and salinity, critical to the survival of water animals, and how these can be affected by human activity.



INCOMPLETE METAMORPHOSIS OF A STONEFLY



# Macroinvertebrate Data Sheet

## Beluga Lake Site

### Observation Data

Name: \_\_\_\_\_

School/Group: \_\_\_\_\_ Date: \_\_\_\_\_ Time: \_\_\_\_\_

Weather:  Clear  Cloudy  Rain  Drizzle  Snow  Sleet  Other: \_\_\_\_\_

Comments: \_\_\_\_\_

### Water Quality - Qualitative Observations

#### H2O Appearance

- Scum/foam
- Muddy/silty
- Clear
- Cloudy
- Oily sheen
- Other: \_\_\_\_\_
- Trash: \_\_\_\_\_

#### Adjacent water Color

- Orange to red
- Yellowish
- Brown/black
- Greenish
- None- clean
- Other: \_\_\_\_\_

#### Odor

- Sewage
- Rotten egg
- Petroleum/
- fuel
- None
- Other: \_\_\_\_\_

### Water Quality - Quantitative Observations

Air Temperature \_\_\_\_\_ °C \_\_\_\_\_ °F

Water Temperature \_\_\_\_\_ °C \_\_\_\_\_ °F

Water Depth \_\_\_\_\_ cm

Salinity \_\_\_\_\_ ppm

### Macroinvertebrate Sampling Data

#### Macroinvertebrate Sampling Data

Major Group	Total no. in sample	Total no. in core sample
Mayflies (E) <i>Ephemeroptera</i>		
Stoneflies (P) <i>Plecoptera</i>		
Caddisflies (T) <i>Trichoptera</i>		
<b>EPT richness total (A)</b>		

Non-EPT Organisms	Total no. in sample
Midges	
Craneflies	
Blackflies	
Aquatic mites	
Beetles	
Dragonflies	
Damselflies	
Scuds	
Snails	
Clams/mussels/Worms	
Leeches	
Flatworms	
Other	
<b>Non-EPT richness total (B)</b>	
<b>Total no. organisms (Density)</b>	
<b>A + B</b>	

Other organisms: Fish \_\_\_\_\_

# BELUGA LAKE AQUATIC INVERTEBRATES



**DAMSEFLY**



**MAYFLY**



**DRAGONFLY**



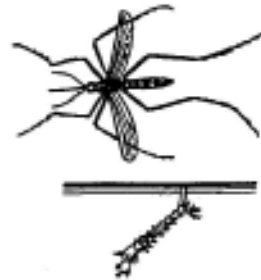
**CADDISFLY**



**BLACKFLY**



**MIDGE**



**MOSQUITO**



**WATER STRIDER**



**WATER BOATMAN**



**COPEPOD**



**FAIRY SHRIMP**



**AMPHIPOD**



**WHIRLIGIG BEETLE**



**CLAM**



**WATER FLEA**



**DIVING BEETLE**



**SNAIL**



**LEECH**



# Teacher Packet PRE & POST ACTIVITIES





# Make a Wetland Model

## Objectives:

Students will describe two functions of wetlands and gain an understanding of the environmental factors of life in aquatic systems.

## Concepts

Wetlands have many functions, one of which is to store water and serve as a filter. The flow of water in a wetland is related to the slope of the land.

## Materials for each group:

- ◆ large roasting pan
- ◆ modeling clay
- ◆ florists' foam or large sponge or small piece of indoor/outdoor carpet
- ◆ pitcher of clear water
- ◆ pitcher of muddy water
- ◆ model-building materials such as: tree needles, twigs, grass, moss, plants, cotton swabs, tooth picks, pipe cleaners, cardboard, glue, scissors, paint, markers, etc.

## Procedure:

Students will be building a wetland model, perform an experiment, make observations, and generalize that wetlands store water and trap particles. This lesson is divided into two sessions. The first session involves the making of a wetland model, the second session involves doing experiments with the wetland model to explore wetland functions.

### Procedure for Session I:

Make your own wetland model ahead of time or make one along with the class. Divide the class into small groups. Give each group a pan, florist foam (or sponge or carpet), and other wetland model-building materials. Have students build a wetland model using the instructions provided.

### Procedure for Session II

Begin the lesson by using guided imagery of a wetland hike or by asking students about walking in a bog (muskeg) or on the tundra after spring thaw. What did it feel like? (*Soggy, spongy*).

Tell students that you are going to simulate a rainstorm by slowly pouring water onto your model. Have students describe what happens (*some of the water is slowed down by the "wetland" carpeting, and the excess slowly flows in the body of water*).

Now remove the "wetland" and water. Pour the same amount of water on the model the same way as before and have students describe what they observe. (*The water should fill the body of water much more quickly than before. The wetland serves as a buffer because it collects water and slows the water flow. This slowing process helps reduce flooding and helps prevent soil erosion*).

Have students try the same procedure with their model except they will be using muddy water. The muddy water represents silty flood water or pollutants. Each group will hand in one piece of paper with a hypothesis (*what will happen*), procedures (*what we did*), observations (*what we saw*), and conclusion (*why did it happen*).

After students complete their experiment, ask:

What would happen if the wetland was completely paved or filled with gravel? (*Less water would soak in and it would run off faster*).

What if only a small portion of the wetland was paved? (*More water would run off faster than if no paving occurred, but the increase would depend on the degree to which the wetland's ability to absorb or hold water was reduced*).

What could happen to areas downstream if wetlands are filled or paved? (*Increased flooding, increased pollutants in the water, increased sedimentation*



## Make a Wetland Model continued...

depending on the degree of wetland function lost).  
What should people be aware of before paving or filling a wetland? (Wetlands hold water and therefore reduce flooding and filter sediments and pollutants).

### Evaluation:

Present the class with the following situations:

You are at a town meeting where people are discussing whether or not to build a recreation hall on a wetland. Describe two functions of wetlands that should be considered in the decision.

*Adapted from: "Wading Into Wetlands," Ranger Rick's Natuescope. National Wildlife Federation. 1986*

### Directions for making a wetland model:

Wetlands are complicated natural systems that scientists are still learning more about. Scientists do know that wetlands perform important functions that affect other natural systems. They reduce flooding by soaking up excess water, and they filter sediments and pollutants. Some wetlands, at times, may recharge underground water supplies.

Wetlands can serve as water storage areas that reduce flooding by soaking up excess water and slowly releasing it to lakes and streams. Wetlands also act as silt trappers. As flood waters are slowed by wetlands, the excess silt and sediments settle among wetland plants. Wetlands can also act as a filter for pollutants. Plants can take up and use some chemical pollutants that might otherwise contaminate water supplies leading from the wetland.

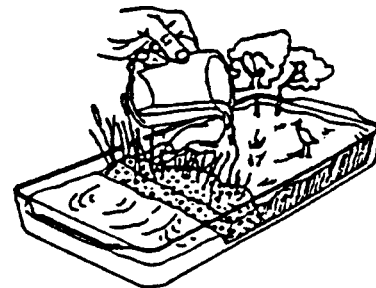
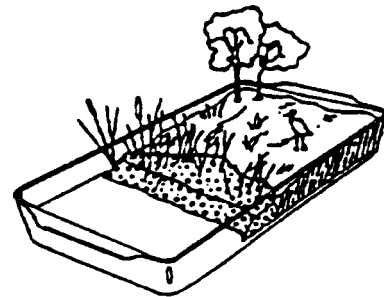
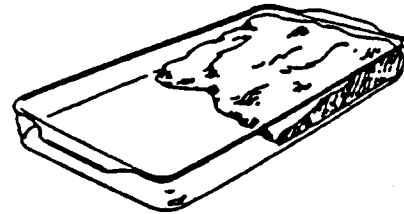
### Directions for making your wetland model:

Spread a sloping layer of modeling clay in half of

the pan to represent land (see diagram). The empty half will represent a body of water.

Make sure the clay is sealed to the pan on the edges. Meandering streams that lead to the body of water may be formed in the clay.

Cut a piece of indoor-outdoor carpeting (or florist foam or sponge) to completely fill the space across the pan along the edge of the clay. This will represent the wetland buffer between dry land and open water. Add plants, animals, etc. using the model-building materials.





# A Wetlands Visit

## Objective:

Students will be able to:

- ❖ Identify many different animals that use wetland habitats

## Concepts:

Wetlands provide habitat for a variety of animals.

## You Will Need:

- ◆ Cast cards
- ◆ Wetlands Visit script

## What to Do:

### Procedures:

Assign students in your class to each of the “parts” in the cast of “A Wetlands Visit.” Their role is to say their line (words in parentheses) whenever their part is mentioned.

Read the story on the following pages aloud, pausing for the sound effects of the cast.

### Cast:

wildlife photographer (say cheese!  
click)  
mallards (quack, quack)  
footsteps (squish, squish)  
Canada geese (honk, honk)  
water (gurgle, gurgle)  
mosquitos (buzzzzz)  
beaver (slap!)  
water strider (move arms silently like a  
water strider)  
moose (clomp, clomp, clomp)





## A Wetlands Visit Script:

We wanted to get up early for our hike to the Beluga Wetlands in Homer. My friend was determined to become a **wildlife photographer** (*say cheese! click*). At the crack of 10:00am., we headed out. As we got close to our destination, we heard the faint sound of **mallards** (*quack, quack*) getting closer. We walked quietly, but we could still hear the sound of our own **footsteps** (*squish, squish*) in the grasses and wet ground. Overhead, a huge flock of **Canada geese** (*honk, honk*) could be heard calling noisily. When we reached the Beluga Wetlands, we sat quietly at the edge where we were hidden by the willows and alders. We sat as quietly as possible and listened carefully. At first, all we heard was the **water** (*gurgle, gurgle*) gurgling. The **wildlife photographer** (*say cheese! click*) readied her camera. The **mosquitos** (*buzzzzz*) soon found us and distracted our attention away from a **beaver** (*slap!*) that was quietly swimming our way. I turned by head and saw small waves of **water** (*gurgle, gurgle*) rippling in the quiet, deep pool on the other side. The **beaver** (*slap!*) seemed to suddenly notice our presence and its broad, flat tail slapped the **water** (*gurgle, gurgle*). At the same time, the **wildlife photographer** (*say cheese! click*) missed an incredible photo opportunity while doing some slapping of her own. The **mosquitos** (*buzzzzz*) were getting ferocious!

The **water** (*gurgle, gurgle*) continued to keep us company and the sound of the **beaver** (*slap!*) seemed long gone. I was doing my best to keep quiet by the **wildlife photographer** (*say cheese! click*) was unwrapping a noisy piece of candy. I glanced down at the **water** (*gurgle, gurgle*) and noticed a **water strider** (*strider motions*) skating on top of the **water** (*gurgle, gurgle*).

I was wondering how it could accomplish such a feat. The **water strider** (*strider motions*) just kept moving across the **water** (*gurgle, gurgle*). **Water striders** (*strider motions*) look rather silly, I think.

The **wildlife photographer** (*say cheese! click*) was getting impatient by now and started to get up just as a flock of **mallards** (*quack, quack*) flew by. The **mallards** (*quack, quack*) were startled by the sudden movement that veered out of camera range. The **mosquitos** (*buzzzzz*) were really getting out of hand now. My friend slumped down dejectedly and her camera lens fell in the **water** (*gurgle, gurgle*) below. As she was retrieving the lens, I notice a big **moose** (*clomp, clomp, clomp*) walking towards us. The **moose** (*clomp, clomp, clomp*) was slurping down plants and **water** (*gurgle, gurgle*). I grabbed the arm of the **wildlife photographer** (*say cheese! click*) to get her attention and startled the **water strider** (*strider motions*) she was attempting to photograph. The **moose** (*clomp, clomp, clomp*) munched on some willows. My friend, after finally finding her lens cap, shouted, "I found it!"

The **moose** (*clomp, clomp, clomp*) lumbered out of the **water** (*gurgle, gurgle*) and trundled off into the bushes before the **wildlife photographer** (*say cheese! click*) could focus for a picture. The **beaver** (*slap!*) that had ventured by again ducked underwater in search of more quiet surroundings.

The **water** (*gurgle, gurgle*) kept us its music as we decided to follow our **footsteps** (*squish, squish*) home. We walked as quietly as possible to try for another chance to photograph some wildlife. Only our **footsteps** (*squish, squish*) betrayed our presence. When we turned around to look behind us, we saw the sunset. The sun was low on the horizon and the sky was glowing pink and gold. High overhead we heard the flock of **Canada geese** (*honk, honk*). I slipped my friend's camera out of her backpack, held it up and said to the mighty **wildlife photographer** (*say cheese! click*).

# How Wetland Functions Benefit Humans

\* Provided by Beluga Slough Wetlands    \*\*Provided by Beluga Lake Wetlands

Wetland Function(s)	Benefits to Humans	Economic Benefits
<b>FISH &amp; WILDLIFE HABITAT</b>	*,**Hunting - food, recreation **Fishing - food, recreation *,**Trapping - furs *,**Wildlife Photography *,**Viewing/Enjoyment *,**Scientific Study	Hunting & Fishing Guiding Industry Subsistence Economy Commercial Fishing Industry Tourism Industry Recreational Equipment Industry
<b>HYDROLOGY</b>		
Groundwater Recharge Groundwater Discharge	**Dependable water supplies	Business or industrial use of water Savings on wells and transportaiton of water
Maintain Stream Flows	Dilution and transport of pollutants	Less expensive sewage treatment Maintenance of fisheries
Flood Storage	**Safe, dry sites for homes and commercial development Recreation/Open Space	Savings in flood insurance damage costs, public services
<b>WATER QUALITY</b>		
	Water supplies suitable for drinking water Swimming	Business or industrial use of water requiring high-quality water, e.g. mariculture, seafood processing Savings in water treatment for domestic use Savings in disease control and treatment
Sedimentaion	*,**Aesthetics (streams, reservoirs)	
Erosion Protection	*,**Absence can result in property damage	Avoids cost of erosion control structures
Nutrient Transformation	Purification of polluted water	Less expensive treatment of pollutants
<b>WETLAND PLANTS</b>	Provide foods (e.g. berries, greens) and medicines	Subsistence economy



## *Benefits of Wetland Functions*

The following table provides examples of benefits to humans and economic benefits that can be used as a reference to lead activities and discussions for *Wetland Worth* and *Where Do You Draw the Line?*

While all wetlands have one or more of these functions to some degree, it is rare that a wetland will have all of the possible functions and benefits humans in all possible ways. People who regulate human uses that could disturb wetland functions try to assess the relative degree of the function present and how a proposed change in the wetland (for example, diverting water by using ditches, or placing fill materials in the wetland) will diminish the function. They also consider ways to minimize the loss of functions and to restore wetlands whose function has been impaired by human actions.

A regulator would take into account the value of the wetland as habitat for fish and wildlife when assessing its function as habitat. All wetlands do not have the same value as habitat from the standpoint of individual fish or wildlife species. The habitat requirements of each species differ. Because of these differences, the overall diversity of the species supported by a specific type of wetland or specific wetland can vary considerably. Some wetlands support an astonishing variety of species and others support only a few species. This relativity of value for various wetland functions is important background for the issues that arise in relation to decisions to alter wetlands or leave them in their natural state.



# Wetland Worth

## Objective

Students will understand the economic values of wetlands by using objects from commercial, recreational and subsistence users of wetlands to develop a role play.

## Concepts:

People use wetlands in ways that provide economic benefits.

## Materials

- ◆ “Artifacts” (can be labeled with numbers) – can of clam chowder, commercial and sport fishing lure, shotgun shell, camera lens or film, woven basket, blueberry muffin or jar of jam, trap, smoked salmon, binoculars, field guide for birds or wetland plants, book of nature poetry, old Pepsi can (to show inappropriate use of wetlands – it still hasn’t biodegraded!), sport fishing or hunting license, duck stamp, brochure of outfitter that uses wetlands, etc.
- ◆ paper
- ◆ pencil

## Introduction:

Wetlands are important economically to a large and diverse population of Alaskans. Economics involves the use and exchange of money or materials. Generally, economic uses can be categorized into three different types: commercial, recreational, and subsistence. Commercial uses involve the exchange of money, for example, the sale of fish to a cannery or the sale of wetland animal furs such as beaver. Recreational uses imply enjoyment, but they also involve an economic exchange when people buy fishing gear for sport fishing or cameras for wildlife



photography and bring back items for sale or exchange. Subsistence use may involve little exchange of money and the plants, fish and wildlife harvested are not sold. But the harvested resources may be traded, bartered, or given as gifts in a complex traditional system of exchange. Fishing, hunting, trapping, photography, basket making, and berry picking are just some of the activities that generate money or products for families, guides, or public agencies.

## Procedure:

Students will work in groups to examine a collection of “artifacts”. They will create a role play or short story that explains how their “artifacts” were used in wetland areas by these “primitive” people.

1. Explain to students that this is the year 2100. They are fortunate today in that a local archaeologist has left some artifacts recovered from the nearby (name of local) wetland for students to examine. (The principal or a willing teacher may want to role play the archaeologist). Explain that students must handle each artifact carefully to try and figure out how the artifact is related to human use of the wetlands that would result in it being there.





## Wetland Worth *continued...*

2. Divide students into groups of three to five (depending on the number of students and artifacts). Give each group a chance to reach into the artifact box for two artifacts (they should not be able to see them ahead of time). Their assignment is to come up with a role play using their artifact that explains how their artifact relates to human uses of wetlands by “primitive” 21st century people. Set a time limit of ten minutes or so.

3. Each group will do a role play. List the different uses portrayed by the students. Ask if they can think of other wetland uses by humans. See if students can come up with ways to categorize the different uses. Discuss which uses are economic uses, for example, uses that involve the use or exchange of money or materials between people. Define the categories: commercial, recreational, and subsistence. (See background section.) Discuss the value of wetlands. Lead students to discover noneconomic (aesthetic area for inspiration or writing, place to view wildlife, area to be along) as well as economic value (commercial and subsistence fishing and hunting, wildlife photography, subsistence food gathering, guiding, etc.). Discuss whether economics only deals with money or if it includes the material goods a person has.

### Evaluation

Did the role-play or story use the artifacts and address the economic values of wetlands?

### Extension

1. Have students think about what kind of information they would want future generations to know about wetlands. What are some important aspects of wetlands that they would want to express and how would they relate it? Have students create items related to wetlands to include in a time capsule that will be opened 20 years from now.

2. Use similar items used for the time capsule to make a collage.

# Where Do You Draw the Line?

## Objectives

Students will form opinions about issues and explain their reasons for making choices and understand that different circumstances can change their opinions or actions.

## Procedure:

Students listen to a statement, decide their opinion about it, then place themselves on a line according to their opinion.

## Introduction

The purpose of this activity is to encourage students to obtain information before forming an opinion. Teacher should stress that there is no right or wrong opinion about these questions. Opinions based on logic, emotions, or philosophy are valid, as long as they are not based on incorrect information. This activity is carefully written so that individual students will never be evaluated based on their opinions.

## Materials

- ◆ masking tape (15-20')
- ◆ "Strongly Agree" card
- ◆ "Strongly Disagree" card

## Procedure

1. Place a long masking tape line on the floor (approximately 15 feet long). Put one card at one end, the other at the other end of the tape line. Read the first item on the list of statements. Students are to place themselves along the masking tape line according to their personal opinion of the statement. If they strongly agree with the statement, they stand closest to the "Strongly Agree" card, if they strongly disagree, they stand closest to the "Strongly disagree" card. Students who have no opinion, or are somewhere in between a strong feeling and a neutral one can place themselves accordingly along the line. After students stand along the line, they should explain their reasons for standing where they are.

Encourage discussion among students. Remember: there are no "right" or "wrong" answers in this game, unless opinions are based on misinformation.

2. The following statements include "warmup" examples and examples concerning the environment for which there is a diversity of opinion. If the majority of students have similar opinions about a statement, using variations of each statement will help them become aware that opinions are seldom "black or white" and that specific situations and circumstances can cause people to modify their opinions.

For example:

Basketball is more fun than volleyball.

Variation: The basket ball court is outside, the volleyball court is inside, and it's -30 degrees F.

Cookies are better than ice cream.

Variation #1: A chocolate ship cookie is better than vanilla ice cream.

Variation #2: A fig Newton is better than chocolate ice cream. If you're lost and starving in the wilderness in interior Alaska, and it's 80 degrees F, would you rather have cookies or ice cream?

Ask the students to think of situations that would cause them to change their opinions.

Note: Some of the sample statements will be relevant to students living in urban environments in Alaska and some are relevant to Bush living. Choose the statements which are most familiar to your students and about which they are likely to have a range of opinions.





## Statements:

Basketball is more fun than volleyball.

Cars are better than snowmobiles.

Moose are better than horses.

Cookies are better than ice cream.

Playing basketball is more fun than playing baseball.

Three-wheelers are better than snowmobiles.

Bicycles are better than cars.

Hunting is fun.

Watching birds is fun.

Walking in a wetland is fun.

Walking in a wetland is interesting.

People should never build roads across wetlands.

## Variations:

People should be allowed to build an airport in wetlands if that's the safest place to land planes.

People should be allowed to build an airport in wetlands if it would cost a lot more to build it somewhere else.

Ponds are better than muskegs.

Floods are always bad for wildlife.

Pollution should be stopped no matter how much it costs.

From: Project WILD, 1987. Western Regional Environmental Education Council.





# Shrinking Habitat

## Objective:

Students will describe some effects of human development of land areas on plants and animals previously living in the area and evaluate the importance of suitable habitat for wildlife. Students will also recognize that loss of habitat is generally considered to be the most critical problem worldwide facing wildlife today and that habitat loss influences wildlife populations, especially migratory bird populations.

## Concept:

Shrinking habitats are a major factor in population decline and disturbance to plant and animal life.

## You Will Need:

- ◆ green and blue construction paper
- ◆ classroom desks, tables, or chairs
- ◆ five or six large bedsheets or blankets for a student group of about 25

## Introduction:

Throughout the world, wildlife habitat is being lost. People use land in a variety of ways and some human needs and desires for uses of land compete with the needs of wildlife. For example, whenever an area of land is settled and homes are built or an area is plowed to grow a crop, some animals lose areas of cover and frequently their sources of food and water. Larger animals that may depend upon smaller animals can lose a portion of their source of food and may need to move to another area. Some animals are sensitive to the presence of humans and associated noise and may leave an area although their food and water sources are not directly affected.

This process is happening in large and small ecosystems worldwide. For example, in the lower 48 states, many wetlands have been filled and drained for agriculture. When wetlands are filled, a wide variety of plants and animals such as geese and other water birds, reptiles, amphibians, and crustaceans are lost. Some animals move to new habitat, but most animals cannot. Longtime residents of Alaska may have observed these changes in wildlife habits and habitats following growth of their community.

Migrating birds from Alaska depend upon wetlands for wintering areas in states and countries along the Pacific, Atlantic, Central, and Mississippi Flyways. Over 50 percent of the wetlands in the continental United States have been destroyed by draining, filling, dredging, and pollution. Wetlands in Alaska are also vulnerable to land uses that eliminate wildlife habitat.


In Anchorage, Juneau, and Fairbanks, and in areas where oil, gas, minerals, or timber harvest is occurring, significant wetland acreage is lost annually. Alaska still has many wetlands, but their values must be protected so that we keep healthy wildlife populations.

## Procedures:

Students simulate some of the potential impacts of land development on wildlife and their habitat in a physically active game.

1. Review with the students the elements necessary for a habitat (food, water, cover, and space arranged suitably for the particular animal). If the students have the background, use specific migratory wetland animal examples in your discussion. After some discussion to make sure that the elements of habitat are clearly in mind, tell the students that in this activity






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# Shrinking Habitat Shrinking Habitat

they will be simulating wildlife in its habitat

2. Divide the students into four groups: herbivores, carnivores, vegetation (shrubs, grasses, etc.), and people who will be the village or subdivision planners. If the students are not familiar with the terms “herbivore” and “carnivore,” provide them with working definitions of those terms (herbivore, a plant-eating animal; carnivore, a meat-eating animal; and although not needed for this activity, omnivore, and animal that eats both plants and animals). Plan for three times as many herbivores as carnivores with a small number of village or subdivision planners in proportion to the other two groups. The numbers (amount) of vegetation may vary. For example, two planners, three carnivores, nine herbivores, and eleven bushes (vegetation) may be used.

3. Establish a large area (either in the classroom with tables, chairs, and desks moved to the sides of the room or outside) that can be used to simulate the wildlife habitat area before development. The village or subdivision developers are to stay on the sidelines at this time, observing the undeveloped land and its wildlife inhabitants. They may be meeting on their own, nearby, to make plans for development. In fact, they can make their entrance rather suddenly once the wildlife habitat has been established, simulating the arrival of heavy construction equipment. This is the situation the developers are considering: the village or subdivision has to be moved because the river is changing and the old site floods every spring. The site selected was chosen because it is near the water but had high, dry places for buildings and roads. It was also selected for its access to wood and to wildlife for hunting and fishing.

4. Provide each “herbivore” with  
 Two desks or chairs to use as “cover” (or string or hula hoops)  
 Three pieces of green construction paper to represent food

One piece of blue construction paper to represent water

Some of the vegetation (portrayed by students)

Provide each “carnivore” with:

One desk or chair to use as a “den” (or string or hula hoop)

Space equivalent to that used by three herbivores

Three herbivores as a potential food source portrayed by students

One piece of blue construction paper to represent water

Some of the vegetation (portrayed by students)

5. Ask the “herbivores” to arrange the food, water, and cover including the students who are “vegetation” in a space to represent their habitat. Once the herbivores have arranged their habitat, ask the “carnivores” to move into the area to establish their lairs and water sources, keeping an eye on the herbivores as possible food sources. For added interest, suggest that the students identify what particular kind of animal they are, and role play its characteristics. (This phase takes about ten minutes, with the developers planning while the herbivores and carnivores arrange their habitat.)

6. Once all the animals are established in their habitats, it is time for the developers to enter the picture. They may use three to seven minutes to construct their development, explaining their actions as they make them. They are restricted in how much space they can use. They may use the space equivalent to that used by three herbivores. The developers may use the sheets and blankets to build their development. They may remove bushes (represented by students), cover (represented by desk), food and water.





## Shrinking Habitat continued...

of one large area, or vice-versa, with what effects? Would it have reduced negative consequences for wildlife if they put the development in a different area of the habitat? Rather than negative consequences, were there positive consequences? If so, what were they? How were they achieved? Ask the students to consider and discuss what seemed realistic about the activity, and what did not. For example, sometimes development enhances the areas for some kinds of wildlife. Often, however, it will not be the same kinds of wildlife that were in the area before development. Planners and developers can sometimes add to the vegetation in an area, creating additional cover and food for some kinds of wildlife and making water sources available under some conditions, if there is insufficient water in the area.

8. Ask the students to summarize some of the possible impacts on wildlife from human activities like development of land areas along with the benefits of the activities for humans. Are there places in your community where wildlife habitat has been lost by human development? Are there places where wildlife habitat has been enhanced by human activity? What alternatives, if any, are there to development of previously undeveloped areas? What tradeoffs are involved: for example, in developing vacant areas within communities rather than undeveloped areas outside communities? If development does take place, what kinds of actions can people take to minimize the negative consequences for wildlife, vegetation, and other elements of the environment? What about possible economic costs? Social costs? Ecological costs? Aesthetic costs? Discuss loss of habitat as something that is affecting wildlife all over the planet. Ask the students to summarize the importance of suitable habitat for wildlife. Discuss the students' concerns and recommendations.

### Extensions.

1. Conduct this activity twice, with the students trading roles the second time. While the former wildlife becomes developers, they might try to produce a development plan that would benefit the areas for people and wildlife. The activity can also be conducted to show differences between developing the entire area – with likely loss of all wildlife in the area – to developing only part of the area with some wildlife likely to survive.
2. Ask students to complete the following sentence, and discuss their response: “If I were going to build a house for my family in a previously undeveloped area, I would...”
3. Invite a village elder or a person who has lived in your community for a long time to describe changes that have occurred in your community and any changes in the wildlife around the community.

#### Reference

Adapted from “Shrinking Habitat”. Project WILD, 1987. Western Regional Environmental Education Council.





# Science Standards

AK State Content Standards															National Science Standards					
Monitoring Activity	A			B			C			D			Standards							
	12	14	15	1	2	3	4	6	2	3	4	5	1	3	A	C	E	F		
Beluga Slough Activities																				
Wetland Metaphors	*									*						*	*	*		
Wetland Cards	*	*														*	*	*		
Slough Scavenger Hunt	*	*		*	*											*	*	*		
Beluga Lake Activities																				
Investigating Water Animals	*	*		*	*			*							*	*				
Pre-Field Trip Activities																				
Make A Wetland Model	*	*		*	*			*					*			*	*	*		
A Wetlands Visit	*																			
Post-Trip Activities																				
Wetland Worth	*	*								*	*	*	*	*		*	*	*		
Where Do You Draw the Line?	*	*								*	*	*	*	*		*	*	*		
Shrinking Habitat	*															*	*	*		

*Alaska Content Standards Addressed:*

*Content Standard A: A Student should understand scientific facts, concepts, principles and theories.*

**A12** distinguish the patterns of similarity and differences in the living world in order to understand the diversity of life and understand the theories that describe the importance of diversity for species and ecosystems (Diversity)

**A14** understand the interdependence between living things and their environments; and understand that a small change in a portion of an environment may affect the entire environment (Interdependence)

**A15** use science to understand and describe the local environment (Local Knowledge)

*Content Standard B: A student should possess and understand the skills of scientific inquiry.*

**B1** use the processes of science;

**B2** design and conduct scientific investigations using appropriate instruments

**B3** understand that scientific inquiry often involves different ways of thinking, curiosity, and the exploration of multiple paths

**B4** understand that personal integrity, skepticism, openness to new ideas, creativity, collaborative effort, and logical reasoning are all aspects of scientific inquiry

**B6** employ strict adherence to safety procedures in conducting scientific investigations



# Science Standards continued...

## Alaska Content Standards Addressed:

*Content Standard C: A student should understand the nature and history of science.*

**C2** understand that scientific knowledge is validated by repeated specific experiments that conclude in similar results

**C3** understand that society, culture, history and environment affect the development of scientific knowledge

**C4** understand that some personal and societal beliefs accept nonscientific methods for validating knowledge

**C5** understand that sharing scientific discoveries is important to influencing individuals and society and in advancing scientific knowledge

*Content Standard D: A student should be able to apply scientific knowledge and skills to make reasoned decisions about the use of science and scientific innovations.*

**D1** apply scientific knowledge and skills to understand issues and everyday events

**D3** recommend solutions to everyday problems by applying scientific knowledge and skills

## National Science Standards Addressed:

Content Standards, Grades 5-8:

### *A. Science as Inquiry*

- \* Abilities necessary to do scientific inquiry (K-8)
- \* Understanding about scientific inquiry (K-8)

### *C. Life Science*

- \* The characteristics of organisms (K-4)
- \* Life cycles of organisms (K-4)
- \* Organisms and environments (K-4)
- \* Structure and function in living systems (5-8)
- \* Reproduction and heredity (5-8)
- \* Regulation and behavior (5-8)
- \* Populations and ecosystems (5-8)
- \* Diversity and adaptations of organisms (5-8)

### *E. Science and Technology*

- \* Understanding about science and technology (K-8)
- \* Abilities to distinguish between natural objects and objects made by humans (K-4)
- \* Understandings about science and technology (5-8)

### *F. Science in Personal and Social Perspectives*

- \* Characteristics and changes in populations (K-4)
- \* Types of resources (K-4)
- \* Changes in environments (K-4)
- \* Science and technology in local challenges (K-4)
- \* Populations, resources and environments (5-8)
- \* Science and technology in society (5-8)





# Glossary

**ADAPTATION:** An adjustment or process of adjustment, often hereditary, by which a species or individual improves its condition in relationship to its environment; **A TRICK TO SURVIVAL - A SPECIAL PART FOR A SPECIAL THING.**

**ALGAE:** A type of plant without true stems, roots, and leaves - seaweeds.

**ANAEROBIC:** In the absence of oxygen (vs. aerobic: in the presence of oxygen).

**BRACKISH WATER:** Partially fresh and partially salt water.

**CONSUMER:** An animal that eats plants or other animals.

**DETRITUS:** (dee-TRY-tus) Dead and decaying plant and animal material.

**DECOMPOSER:** An organism that breaks down dead materials such as leaves and animals.

**DIATOMS:** A type of single-celled phytoplankton.

**ECOLOGY:** The science of the relationship between organisms and their environment.

**EDGE EFFECT:** An interacting system comprised of organisms and their environment.

**ESTUARY:** A partially enclosed body of water in which fresh water from a river or stream mixes with salt water of the ocean.

**FILTER FEEDER:** An animal, like a clam or oyster, that filters food from the water.

**FOOD CHAIN:** A chain of organisms which feed successively on each other, e.g. plant (primary producer – herbivore – carnivore).

**FOOD WEB:** Overlapping and connecting food chains.

**HABITAT:** A place where a plant or animal lives.

**INVERTEBRATE:** An animal without a backbone.

**MARSH:** A fresh or salt water wetland formed along flowing and still waters and the adjacent soft, wet, treeless land.

**MIGRATION:** The seasonal movement from one place to another.

**PHOTOSYNTHESIS:** When plants use sunlight to change carbon dioxide and water into food and oxygen.

**PLANKTON:** Tiny plants and animals that float freely in water.

**PHYTOPLANKTON:** Free-floating microscopic plants.

**PRODUCER:** Something that makes its own food, such as a plant.

**SALINITY:** The degree of saltiness, usually referring to water.

**SALT MARSH:** An intertidal wetland that usually forms on sand and mud deposits at river mouths and at the head of protected bays and vegetated with salt-tolerant plants.





**SCAVENGER:** An animal that eats dead and decaying things.

**SLOUGH:** A wet or marshy area.

**TIDELAND:** A shoreline mud flat that is periodically covered by water.

**TRANSITION ZONE:** The intervening area between distinct environments.

**WATERSHED:** All the land area that drains into a body of water.

**WETLAND:** A transitional land between a terrestrial and aquatic system, where the water table is usually at or near the surface; land where saturation with water is the dominant factor determining the nature of the soil development and the types of plant and animal communities living in the soil and on its surface.

**WETLAND FUNCTION:** The function of a wetland as habitat for wildlife and humans.

**WRACK:** The tangled pile of dead plants left on the beach when the tide goes out.

**ZONATION:** The distribution of organisms on biogeographic zones.

**ZOOPLANKTON:** (ZOH-plankton) Freefloating microscopic animals.





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Angel, H. and P. Wolseley. 1982 *The Family Water Naturalist*. Bloomsbury Books, London

### Websites

Macroinvertebrate ecology

Dragonflies: A homepage by John Carsten, with basic information on dragonflies and links to numerous other sites.  
<http://www-marketing.wharton.upenn.edu/~johnc/dragonfly.html>

Freshwater Benthic Ecology and Aquatic Entomology Homepage: A homepage produced in Canada by S.M. Mandaville, with a comprehensive set of links to various sites for critters, biomonitoring and impacts.  
<http://www.chebucto.ns.ca/Science/SWCS/benthos.html>

Nearctica – Natural History – Insects: A site focusing on mayflies, stoneflies, and caddisflies  
<http://www.nearctica.com/nathist/insects/aquatic.htm>

## Identification keys

Guide to Freshwater Invertebrates: A simple guide to the orders of benthic macroinvertebrates, with some ecological information, by Leska Fore.  
<http://www.seanet.com/~leska/Online/Guide.html>

Simple Aquatic Insect Identification: A key to orders of aquatic insects by Los Alamos National Laboratory Science and Education Outreach Office.  
[http://www.education.lanl.gov/RESOURCES/NTEP95/Aquatic\\_Insect\\_ID.html](http://www.education.lanl.gov/RESOURCES/NTEP95/Aquatic_Insect_ID.html)

## Critter pictures

Missouri Stream Team – Macroinvertebrate Pictures: Very nice color photos of a variety of benthic macroinvertebrates. <http://www/mostreamteam.org/macroinv/index.html>



# Appendix 1 -

## Estuary Soup Recipe Card

### *Estuary Soup*

*1 Cup Salt Water*  
*Billions of Phytoplankton*  
*1 Cup Fresh Water*  
*Millions of Zooplankton*  
*Lots of Detritus\*\*\*\*\**

- 1. Pour salt water into a bowl*
  - 2. Slowly add fresh water*
  - 3. Add billions of phytoplankton*
  - 4. Shake in millions of zooplankton*
  - 5. Spice it with detritus*
  - 6. Stir over low heat*
- SERVE!!!!*

