Lesson #1: Bird Migration

Focus questions

1. Why do birds migrate?
2. What challenges do birds face as they migrate from or to the region of the Arctic National Wildlife Refuge (the Refuge)?
3. In what ways can humans impact the migration of birds?

What students do in this activity

In pairs or small groups, students play a migration game in which they represent a bird migrating between the region of the Refuge and to the Pacific Northwest. The paths of two bird species in two seasons are followed: the southbound fall migration of **brants** and the northbound spring migration of **white-crowned sparrows**. In the simulated migration, the students will encounter resources and challenges that migrating birds face, both human and natural. Students narrate their journey through writing and share their ideas with the rest of the class.

Estimated teaching time

One class

General supplies to complete this lesson plan

- Migration cards (provided on pages 14 – 19)
- Blank Migration Map for Brant and white-crowned Sparrow (provided on page 20)
- Teacher's Reference Map of Migration Localities (provided on page 21)
- Teacher's Background maps of ranges for both species (provided on pages 22 – 23)
- Notepads for student groups to write about their migration, eight total pads (four per bird species)
- Atlas or access to maps showing specific locations mentioned in migration routes

Learning goals

Students will:

1. Learn to relate the challenges and resources of migration to a bird that is native to their home region.
2. Learn to differentiate between human and natural challenges to migration.
3. Learn to illustrate the basic geography of the northwestern portion of North America, including: Alaska; British Columbia, Canada; and Washington.

Advance preparation

Photocopy the migration cards. Cut them out and arrange each bird's migration cards face-down in a line either on a long stretch of floor or across tabletops. Display maps at end of lesson that show the route of the birds' migrations. Photocopy blank migration routes sheet (page 20).

Introducing the activity

1. Introduce the class to a few of the birds that inhabit both the Refuge and the Pacific Northwest. (See Background material on page 10 – 11 for more information.)
2. Ask the class why birds migrate. Birds migrate to obtain food, escape predators, breed and avoid extreme seasons of low light and food. (See Background material on page 12 – 13.)

3. Show maps of ranges of brant and white-crowned sparrow.

Facilitating the activity

1. Divide class into pairs or small groups. There should be eight teams.

2. Explain the rules of the game.
   a. Each pair or group will experience a different migration created by chance.
   b. Half of the class will be spring-migrating white-crowned sparrows, and the other half will be fall-migrating brants.
   c. Each bird team will begin at the same position, choosing one of the "Setting the Stage" cards, which describe the variables of where, when, who and weather. For each round, teams will choose to move forward two, three or four spaces; because they can't see what is written on the cards, they can pick the numbers themselves.
   d. At their next space, the team will pick up the corresponding card and read about the next leg of their journey.
   e. Teams should take turns moving. More than one team can land on one card.
   f. Teams may land on a card that instructs them to skip their next turn. The reason will be clear in the card.
   g. They should continue until they reach an "Ending" card, at which time they should leave the migration pathway.
   h. Not every team will necessarily complete their migration.
   i. Teams should not interfere with other migrating teams.
   j. When all teams have reached an ending card, the game is over.

3. Teams should elect a recorder to write down each step of the migration, including observations, weather, geographical features, resources and challenges. The recorder can also mark on the map where their bird landed each time. (Not all landing points have specific location, so only mark known spots.)

4. Teams should also elect a spokesperson to narrate the migration to the rest of the class.

5. If teams of three are used, the third member can be the reader of each card to the team or the planner, who decides ahead of time how many steps the group should take in the next round.

Summarizing and reflecting

1. Have each reader share the group's journey. At the end of all the readings, have the class make a list of all the resources and challenges they faced on their migration.

2. Ask if there are other resources and challenges that might be involved in migration.

3. We most often associate migration with birds, but what about the migrations of other kinds of animals? Do people migrate?

Extensions

1. Have students select a bird (or other animal) species to research and write a paper on concerning its migration. Students could be separated into different geographical regions of North America to show the interconnections that migrations promote. Create a class map showing migration routes.

2. The migration game represents both fall and spring migrations. Have students research differences between these migrations. Do birds travel differently in the two seasons? Are food resources, timing cues, obstacles and weather patterns different?

Background on Migratory Bird Species

Brant — *Branta bernicla*

Smaller and darker than Canada geese, brants winter in Washington state's coastal waters and in Puget Sound. They summer in the Arctic region of Alaska and Canada, making shallow, bowl-shaped nests lined with down. Brants mate for life and show strong fidelity to their birth site. Females usually give birth to three to five eggs, which hatch in about three weeks. The young can leave the nest immediately and fledge within 40 to 50 days. Like other species of geese, adults migrate with the young the first year.

Their primary food is eelgrass, a grass-like flowering plant found in coastal areas from Greenland to Florida. Because of this preference for eelgrass, brants orient their migratory lives around good eelgrass habitat, such as Izembek Lagoon on the Alaska Peninsula, a major staging area for the birds. They find good eelgrass meadows throughout the Arctic coastline and in Baja California, where most brants overwinter. They also eat native grasses, sedges, mosses and forbs, and now take advantage of fertilized grasslands in western Europe and eastern North America.

Predators on adults and juveniles include bald and golden eagles, snowy owls, parasitic jaegers, Arctic foxes, wolverines and coyotes. Adult brants will actively protect nests. Hunting is also an important factor in brant mortality; there is a limited hunting season in Washington state in January, with a limit of two birds per day.

Brants are one of the last waterfowl to arrive in the Refuge, usually the last week of May. Up to 1,000 pairs nest in the area. They leave by early September, flying northwest then south around the coast of Alaska to Izembek Lagoon before heading straight across the Pacific Ocean to the west coast.

White-crowned sparrow — *Zonotrichia leucophrys*

Widespread and generally abundant, white-crowned sparrows have been described as the "best studied songbird." They are easy to identify, with their distinctive black and white striped head. Five subspecies include year-round residents, short-distance migrants and birds that migrate from Alaska to Washington state. Three of the subspecies inhabit Washington. Some live in cities and some migrate north. Migrating flocks typically number fewer than eight individuals, although they may fly with other bird species.

Breeding habitat is characterized by grass, bare foraging ground and dense shrubs or trees, which offer protection and nest sites. Summer diet is primarily arthropods (e.g. insects and spiders), whereas in winter they eat seeds, buds, fruits, grass and arthropods. They catch insects both on the ground and in the air.

Females build a small cup-shaped nest of grass, twigs, bark and needles on the ground or a in low shrub. They typically lay three to seven eggs, which hatch within two weeks. Both males and females feed the young, although they will stop feeding to induce the young to leave the nest.

White-crowned sparrows use a variety of environmental cues to migrate. During nighttime flight, they appear to obtain information from star patterns. Moon and city lights reflected by cloud cover may negatively affect stellar orientation skills. There is also some evidence that they migrate via magnetic orientation but do not use land features except when close to home range or nesting territory. Fall and spring migrations take about 60 and 35 days, respectively, traveling 65 to 75 miles per day. One banded bird, however, flew more than 300 miles in one night.

Other migratory birds

The following list contains birds that migrate between the Refuge and Washington state, either passing through or overwintering. (From Defenders of Wildlife Web site)

See also naturesound.org/anwr_birds_from_washington_state.htm for another list and one that includes links to calls the birds make.

Red-throated Loon	*Gavia stellata*
Pacific Loon	*Gavia pacifica*
Yellow-billed Loon	*Gavia adamsii*
Trumpeter Swan	*Cygnus buccinator*
Canada Goose	*Branta canadensis*
Green-winged Teal	*Anas crecca*
Mallard	*Anas platyrhynchos*
Northern Pintail	*Anas acuta*
Lesser Scaup	*Aythya affinis*
Long-tailed Duck	*Clangula hyemalis*
Red-breasted Merganser	*Mergus serrator*
Rough-legged Hawk	*Buteo lagopus*
Golden Eagle	*Aquila chrysaetos*
Merlin	*Falco columbarius*
Peregrine Falcon	*Falco peregrinus*
Semipalmated Plover	*Charadrius semipalmatus*
Wandering Tattler	*Heteroscelus incanus*
Ruddy Turnstone	*Arenaria interpres*
Sanderling	*Calidris alba*
Red Phalarope	*Phalaropus fulicaria*
Red-necked Phalarope	*Phalaropus lobatus*
Glaucous Gull	*Larus hyperboreus*
Snowy Owl	*Nyctea scandiaca*
Horned Lark	*Eremophila alpestris*
American Tree Sparrow	*Spizella arborea*
Savannah sparrow	*Passerculus sandwichensis*
Lapland Longspur	*Calcarius lapponicus*
Common Redpoll	*Carduelis flammea*

References

For detailed information about brants and white-crowned sparrows, consult the following Web site and documents (both available at the University of Washington libraries).

Chilton, G., M. C. Baker, C. D. Barrentine and M. A. Cunningham. 1995. "White-crowned sparrow (Zonotrichia leucophrys)." In "The Birds of North America, No. 183" (A. Poole and F. Gill, eds.). The Academy of Natural Sciences, Philadelphia, and The American Ornithologists' Union, Washington, D.C.

birdsbybent.netfirms.com/ch91-100/wcsparrow.html — A detailed account of the white-crowned sparrow.

Reed, A., D. H. Ward, D. V. Derksen and J. S. Sedinger. 1998. "Brant (Branta bernicla)." In "The Birds of North America, No. 337" (A. Poole and F. Gill, eds.). The Birds of North America, Inc., Philadelphia, PA.

padillabay.gov/brant/index.html — Site of the International Brant Monitoring Project. Includes background on brants, Web links and additional activities.

Also see the Additional Resources section at end of this packet for more Web sites.

Hows and Whys of Migration

As summer spreads across the Arctic National Wildlife Refuge, it brings a fantastic movement of animals. Millions of birds, such as snow geese and surf scoters, that paddled around local waterways leave their winter homes and travel north to the Arctic. The 125,000-member Porcupine caribou herd moves north over 400 miles to the Coastal Plain, while moose migrate south out of the Refuge to their summer breeding grounds in Canada.

Although birds are often the most evident migrators, animals as small as pinhead-sized spiders and as large as bowhead whales migrate by land, sea or water. The Refuge is blessed with migrants, particularly birds. Of note are **Arctic terns**, which migrate 25,000 miles per year from the Antarctic to the Arctic; **Baird's sandpipers**, a 1.3-ounce bird that spends part of the year at 12,000-foot-high lakes in Peru; and **tundra swans**, 2,000 of which winter at the Skagit River delta.

Migration can be defined as cyclical change of habitat oriented toward exploiting optimal environmental conditions. Basically animals move between two locations to take advantage of better habitats.

Humans have pondered the hows and whys of migration for thousands of years. Early observers understood little about the seasonal movement of animals; for example, many people believed that swallows hibernated in mud at the bottom of lakes. One "person of learning," as he called himself, even wrote that animals overwintered on the moon.

Modern scientists now have a much better understanding of the whys and hows of migration, although many questions of how animals navigate still remain unresolved. Three different, but somewhat interrelated, factors force animals to leave one prime habitat for another.

Temperature extremes can threaten an animal's survival. Few birds that breed in the Refuge can withstand the cold of winter, so they move south for warmer weather. In contrast, some animals cannot endure the heat of summer and escape by migrating a handful of miles out of a valley and up into the mountains.

Food often has seasonal availability forcing animals to travel and find optimal resources. Birds that overwinter in the tropics, especially insect feeders, abandon the north when insect populations drop. Caribou move north to Arctic coastal plains to take advantage of the abundant shrubs and grasses, and polar bears roam the ice to hunt ringed seals.

Some animals require a specific environment for laying eggs or giving birth to young. Salmon only deposit eggs in their birth stream and the Porcupine caribou herd prefer to give birth on the coastal plain. These migrations may last as little as a year or may take many years to complete.

The other half of the why and how question is harder to answer. Animals use olfactory, celestial and magnetic factors to navigate during migration. Researchers are still trying to determine how the information is used by animals.

Salmon are probably the best known, odor-based migrant. Studies indicate that young salmon are imprinted with the odor of their birth stream. During their lives, salmon may travel thousands of miles from their home stream to the ocean and back again. When they return to breed and die, they sniff their way home by detecting chemical clues in the water.

Animals also navigate by the sun and stars. Some can derive compass directions from the sun. Birds even wander randomly on overcast days and reorient when the sun appears again. Nighttime migrants, on the other hand, find a compass direction by monitoring the stars. Again, overcast skies can lead to migratory misdirection.

The third means of animal navigation is the most recently discovered. Over the last few decades, scientists have discovered that numerous animals

contain microscopic crystals of magnetite, an iron-based mineral, within their bodies. These animals use magnetite to detect subtle changes in the total intensity and/or inclination of the earth's magnetic field, which allows the animal to determine direction and to form a navigational map. Magnetite occurs in animals such as monarch butterflies, bats, birds and salmon.

Migration makes us cognizant that the planet is a relatively small place of interconnected ecosystems. We often like to think of birds that we see in our own region as "our" birds, which migrate somewhere else for a time. If we consider that these birds may spend, say, only four months in our state and eight months away, then we might think of them as inherently nonnative animals that visit us only when conditions are favorable. As such, we should be concerned with conservation across these animals' migration routes and not just in our state.

Migration Cards

Teacher's Note:

On the following sets of "Migration Cards," you will see measurements for wingspan for the brants and wing length for the white-crowned sparrows. Wingspan refers to the distance from wing tip to wing tip with wings outspread; wing length refers only to the length from the attachment of the wing at the bird's body to the tip of the wing.

Setting the Stage

Brant One
- Early September
- Mackenzie Delta — Canada
- Healthy Bird
- Male
- Wingspan: 44 inches; weight: 48 ounces
- Weather — Cool and clear

Setting the Stage

Brant Two
- Early September
- Coastal Plain — the Refuge
- Injured, can fly but has wounded foot
- Female
- Wingspan: 44 inches; weight: 55 ounces
- Weather — Cool and clear

Skip First Turn

Setting the Stage

Brant Three
- Early September
- Mackenzie Delta — Canada
- Healthy, 1st year, has not migrated before
- Female
- Wingspan: 44 inches; weight: 48 ounces
- Weather — Cloudy and windy

Setting the Stage

Brant Four
- Early September
- Coastal Plain — the Refuge
- Healthy, but underweight
- Male
- Wingspan: 48 inches; weight: 57 ounces
- Weather — Cloudy

One — Brant

You fly for several hours along the Alaskan coast and find eelgrass to eat and a place to rest.

Two — Brant

You've just flown overnight to the northern coast of Alaska to a favorite spot known as the Kasegaluk Lagoon.

Three — Brant

You're waiting for the winds to die down and you stay put and feed on eelgrass.

Four — Brant

A strong autumn storm hampers your progress around the northwest corner of Alaska. You rest only briefly before being scared up by an Arctic fox.

Five — Brant

After flying for several hours, you search for an eelgrass meadow. Finding none, you dine on less-preferred food, sea lettuce and rockgrass. You see many other birds migrating, including other brants and widgeons.

Skip Turn

Six — Brant

You land along a quiet stretch of shoreline only to be frightened by a low-flying plane. You race away and get little rest.

Seven — Brant

Flying continuously for 10 hours you observe a few caribou and one moose grazing. The weather is clear, and you feel strong.

Eight — Brant

You have been flying for many hours and land at good eelgrass beds at Nanvak Bay. You rest before getting ready to fly to Izembek Lagoon, where you will encounter thousands of other brants.

Nine — Brant

Winds blow you west out to the Aleutian Islands. Tired and hungry, you land in the waters just offshore Unalaska Island to rest. An oil tanker leaks and a small oil spill occurs overnight. With your feathers coated in oil, you succumb to hypothermia and die. Your migration ends here.

Ten — Brant

You are flying and land at the major staging area for brants, Izembek Lagoon, only to be wounded by a mink. You can still fly but must wait a few days to recover. You may see as many as 130,000 Pacific black brant, 62,000 emperor geese, 50,000 Taverner's Canada geese, 300,000 ducks and 80,000 shorebirds.

Skip Turn

Seasons of Life and Land

THE ARCTIC NATIONAL WILDLIFE REFUGE

Eleven — Brant

You continue flying along the western coast of Alaska until you reach Izembek Lagoon, the major staging area for brants. You may see as many as 130,000 Pacific black brant, 62,000 emperor geese, 50,000 Taverner's Canada geese, 300,000 ducks and 80,000 shorebirds.

Twelve — Brant

From Izembek Lagoon, you wait until a storm approaches. You catch the winds and shoot straight across the Pacific. This trip might take you two days of continuous flight. Rest and feed on eelgrass to build your strength.

Thirteen — Brant

Heading across the wide stretch of the Pacific Ocean, you feel the great effort it takes to migrate. You see fishing boats lit up in the middle of the night.

Fourteen — Brant

You have arrived on the northern coast of the Olympic Peninsula. An eelgrass bed you depended on has been filled in for a new resort. You rest, find nothing to eat and must continue your flight. Fortunately, you find another beach with eelgrass on the Peninsula and successfully complete your migration.

Fifteen — Brant

After your two-day flight over the Pacific, you arrive in Puget Sound. Along the coast you see hunters but they do not shoot. You have successfully completed your migration.

Sixteen — Brant

Your six-week long migration ends here. You have arrived at a brant wintering ground along the California coast. The salty air is warm and you see other birds arriving, feeding and resting. You won't need to travel far again until spring, when you return north to the Refuge.

Seventeen — Brant

Your 5 1/2-week long migration ends here. You have arrived at a brant wintering ground in northern California. You settle in to feed on eelgrass and other vegetation, counting yourself lucky to have completed the migration.

Seasons of Life and Land

THE ARCTIC NATIONAL WILDLIFE REFUGE

Setting the Stage

Sparrow One
- April
- Omak, Washington
- Female
- Wing length: 2.5 inches; weight: .84 ounces
- Weather — Cool and clear

Setting the Stage

Sparrow Two
- April
- Omak, Washington
- Male
- Wing length — 2.8 inches; weight — 1.12 ounces
- Weather — Cool and clear

Setting the Stage

Sparrow Three
- April
- Omak, Washington
- Male
- Wing length: 2.4 inches; weight: .75 ounces
- Weather — Cloudy and windy

Setting the Stage

Sparrow Four
- April
- Omak, Washington
- Female
- Wing length: 2.5 inches; weight: .7 ounces
- Weather — Cloudy

One — Sparrow

You fly north, cross the US/Canada border and land in a field outside of Princeton, B.C. You find a good seed source and feed and restore your energy resources.

Two — Sparrow

You fly north across the US/Canada border, up the Okanogan River, and you land near the water in a quiet, grassy area.

Three — Sparrow

You fly north to Princeton, B.C., land in a city park and are chased by a cat. You fly to a tree to escape and find some buds and insects to eat.

Four — Sparrow

You fly north to Kamloops, B.C. You rest for two days eating seeds with other migrating sparrows.

Skip Turn

Seasons of Life and Land

THE ARCTIC NATIONAL WILDLIFE REFUGE

Five — Sparrow

Continue north, flying over fields and forests. A surprise spring storm hits and forces you to land quickly. Fortunately you find a farmer's field, which provides protection. You are forced to stay on the ground for several days.

Skip Turn

Six — Sparrow

You land along an open meadow and see other white-crowned sparrows and Lapland longspurs. You depart with a new group of birds and several are fatter than you are. They lead the group north.

Seven — Sparrow

You land at Williams Lake and are chased by a raccoon. You immediately depart.

Eight — Sparrow

You land along a lake and are feeding on the shoreline when a snowstorm hits. You find some seeds and buds under a spruce tree.

Nine — Sparrow

You land along a roadside and barely escape getting hit by a car driving north to go on a bird watching trip.

Ten — Sparrow

You land at Watson Lake, where you join over 150 white-crowned sparrows feeding in a big field. You remain for several days fattening up to head north.

Eleven — Sparrow

You land at Watson Lake on the Alcan Highway. You drop into a city park but are caught and eaten by a feral cat. Your migration ends here.

Twelve — Sparrow

You continue to fly north as the days get longer. You are moving along at about 50 miles a day, generally making major hops of about 200 miles between big feedings. Typical stopovers last between two and four days with a weight gain of .03 ounce per day.

Thirteen — Sparrow

You fly by the town of Dawson, Yukon Territory, and see remains of the old gold rush along the Klondike River. You are moving along at about 50 miles a day, generally making major hops of about 200 miles between big feedings. Typical stopovers last between two and four days with a weight gain of .03 ounce per day.

Fourteen — Sparrow

You land along the Yukon River, near Ft. Yukon, Alaska. You find good food and other birds. After feeding and resting you continue with a different small group of birds.

Fifteen — Sparrow

You land in a field near Ft. Yukon, Alaska, and decide that you don't need to fly any further north. You see other white-crowned sparrows heading north. If you are a female, you immediately start to build a nest and search for a mate. If you are a male, your only contribution to the family is feeding the young.

Sixteen — Sparrow

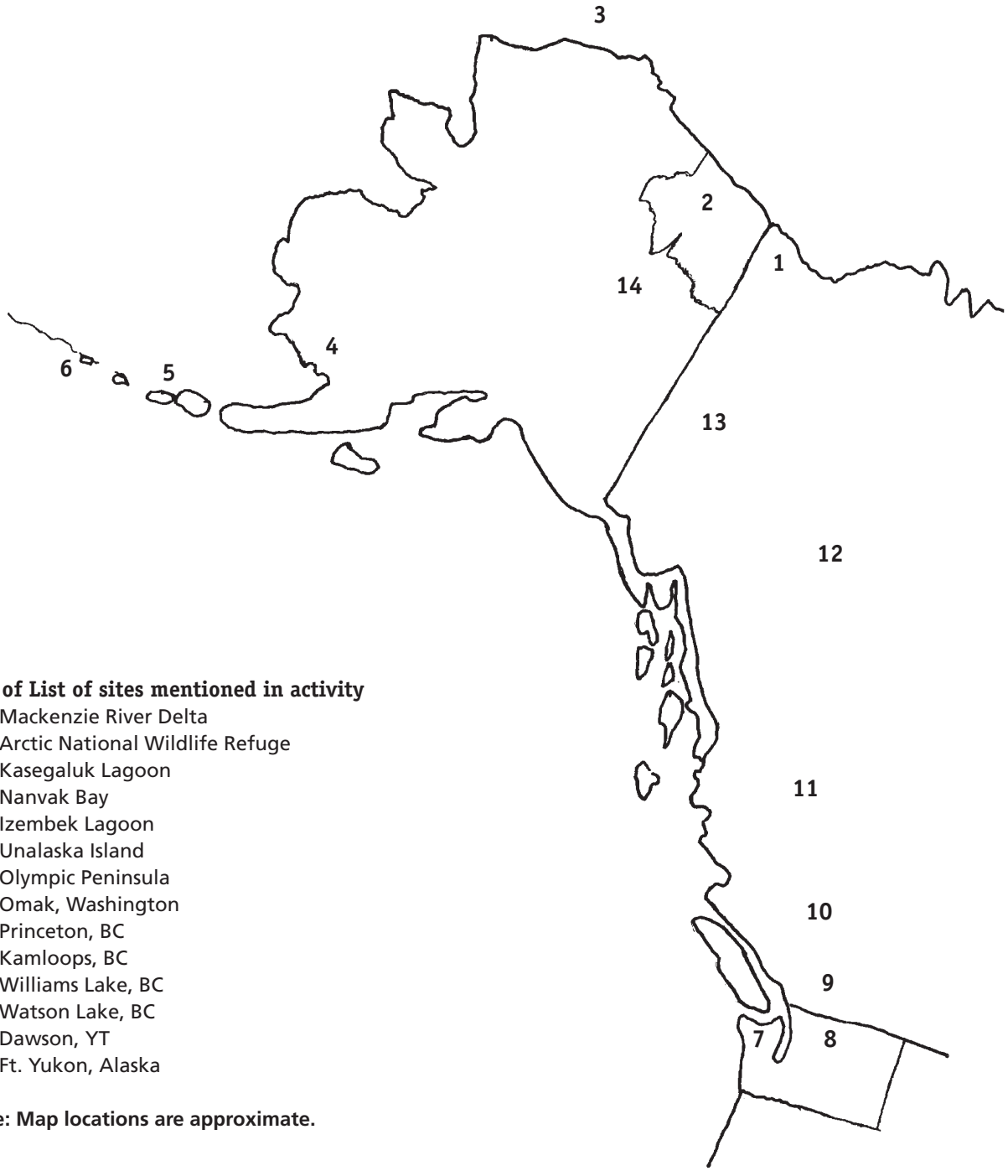
You make it to the Arctic National Wildlife Refuge. You have flown north averaging about 50 miles per day. If you are a female, you immediately start to build a nest and search for a mate. If you are a male, your only contribution to the family is feeding the young.

Seventeen — Sparrow

You make it to the coastal plain after flying up the Mackenzie River. If you are a female, you immediately start to build a nest and search for a mate. If you are a male, your only contribution to the family is feeding the young.

Blank Migration Map for Brant and White-Crowned Sparrow

Teacher's Reference Map of Migration Localities

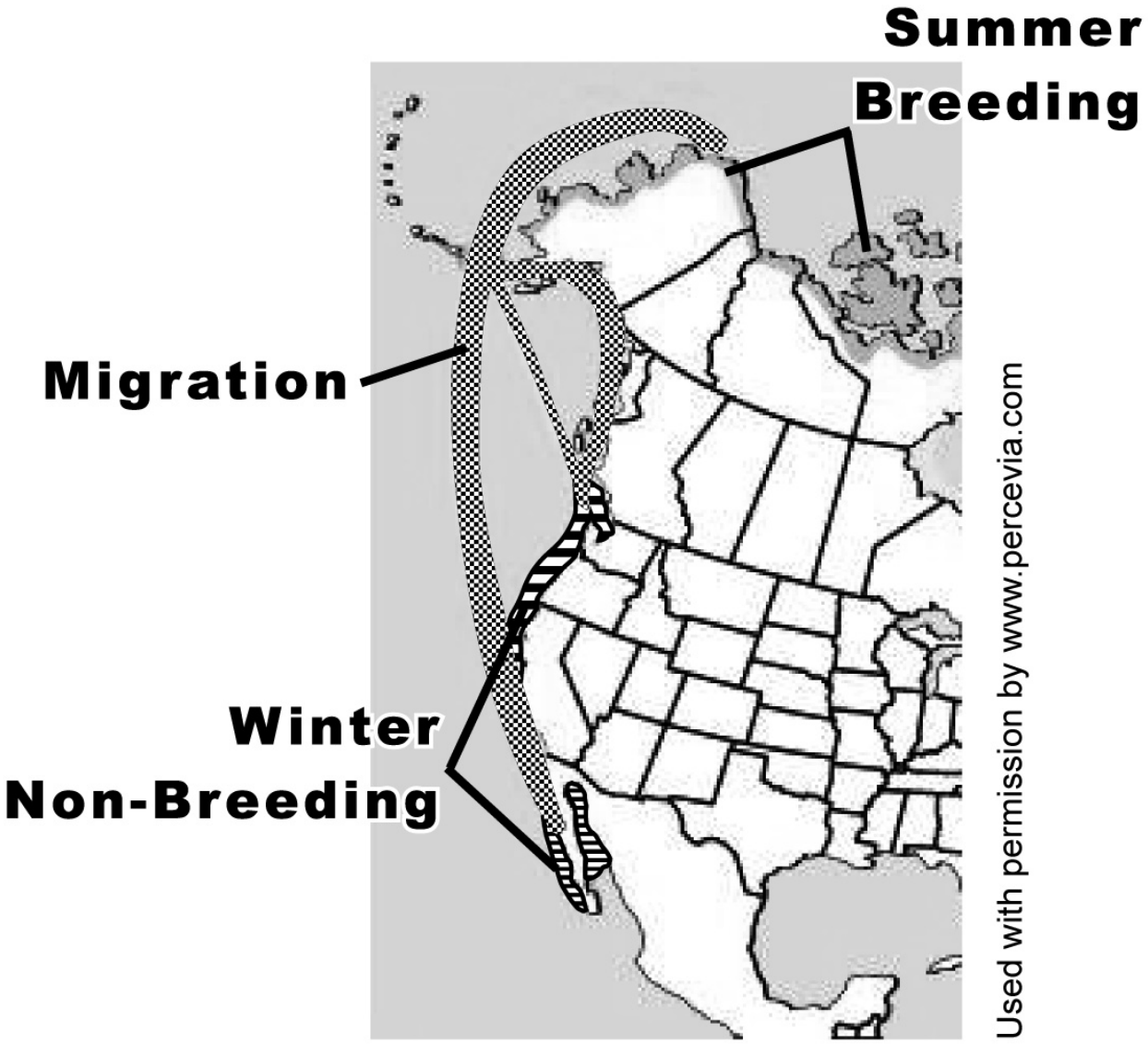


List of List of sites mentioned in activity

1. Mackenzie River Delta
2. Arctic National Wildlife Refuge
3. Kasegaluk Lagoon
4. Nanvak Bay
5. Izembek Lagoon
6. Unalaska Island
7. Olympic Peninsula
8. Omak, Washington
9. Princeton, BC
10. Kamloops, BC
11. Williams Lake, BC
12. Watson Lake, BC
13. Dawson, YT
14. Ft. Yukon, Alaska

Note: Map locations are approximate.

Range Map for Western North America Brant



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Range Map for White-crowned Sparrow

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