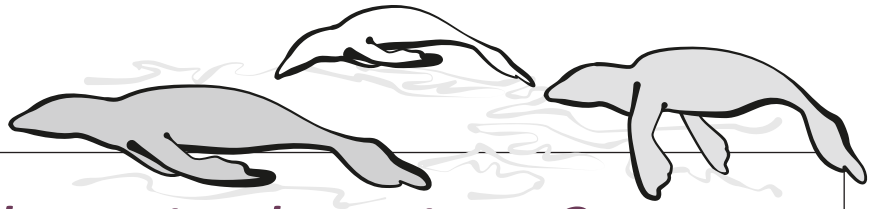
LESSON SIX



Where do fur seals go in the winter?

Subject Area(s): Life science, geography, reading	**Grade Levels:** K-6	Presentation – 15 minutes Activities – variable

Lesson Topics:	Fur seal migration, traditional knowledge of migration, and current research.	**Focus Questions**	• Why do fur seals leave the rookery? • Where do they go? • How do we know? • Why do we want to know where they go?
Learning Objectives:	Students will: • describe where northern fur seals go in the winter • plot fur seal migration tracks on a map • describe three methods scientists use to track fur seal migration routes	**Key words:**	migrate, satellite tags, tracking instruments, latitude, longitude

ACTIVITY			ALASKA STANDARDS		
		Geography	Science 3–6	Minutes	Grades
Activity 6.1	Where are Fur Seal Rookeries?	A,B		20	3–6
Activity 6.2	Fur Seal Migrations (video)	A, B	SF1.1–1.3	15	K–6
Activity 6.3	Mapping and Fur Seal Migration Track	A, B, F		20–30	K–6

Targeted Alaska Grade Level Expectations (GLEs)

Cultural, Social, Personal Perspectives, and Science

SF1 Students develop an understanding of the interrelationships among individuals, cultures, societies, science, and technology.

History and Nature of Science

SG1 Students develop an understanding that historical perspectives of scientific explanations demonstrate that scientific knowledge changes over time, building on prior knowledge.

SG3 Students develop an understanding that scientific knowledge is ongoing and subject to change as new evidence becomes available through experimental and/or observational confirmation(s).

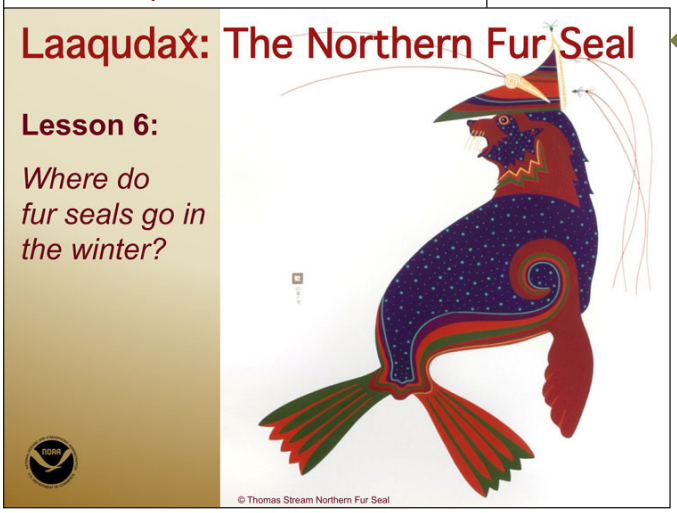
SG4 Students develop an understanding that advancements in science depend on curiosity, creativity, imagination, and a broad knowledge base.

Geography Content Standards

A A student should be able to make and use maps, globes, and graphs to gather, analyze, and report spatial (geographic) information.

B A student should be able to utilize, analyze, and explain information about the human and physical features of places and regions.

F A student should be able to use geography to understand the world by interpreting the past, knowing the present, and preparing for the future.



Lesson 6 provides an overview of the winter migration of fur seals, where different age groups of seals go, what traditional knowledge, archaeology and current science can tell us about fur seal migration, and what we can learn from the information.

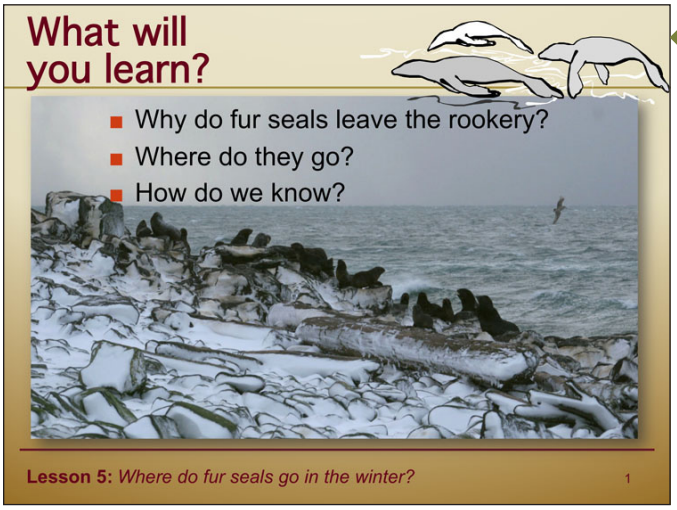
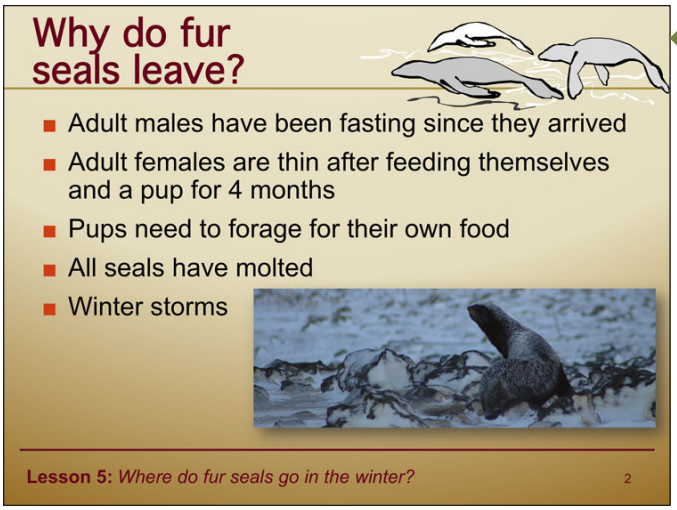


Photo: Jeremy Sterling, NMML/AFSC/NMFS/NOAA



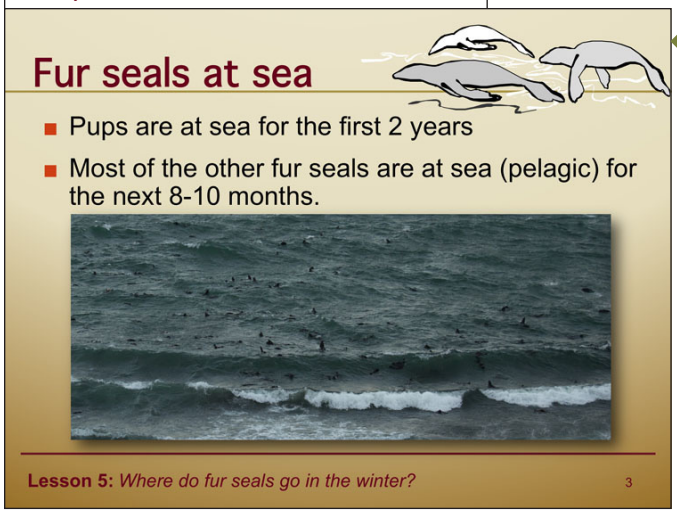
Northern fur seals use the winter months to feed and gain energy reserves for the following summer and the next year's breeding season.

- Adult males do not feed while they are on the rookery defending their territory. Once the males have mated with the last female, they head to sea for the winter.
- Adult females have been feeding themselves and their pups for about 4 months.
- Pups actually wean themselves. They stop nursing just before heading out to sea. Once at sea pups have to learn how to forage for food on their own. The pups that learn how to forage quickly will survive the best. Most pups are at sea for 18-20 months before returning to the Pribilofs.

All fur seals must come to land to molt (shed old fur and grow new fur).

The Pribilof Islands are often surrounded by ice in the winter and spring, making the rookeries inaccessible to the seals.

Photo: Jeremy Sterling, NMML/AFSC/NMFS/NOAA

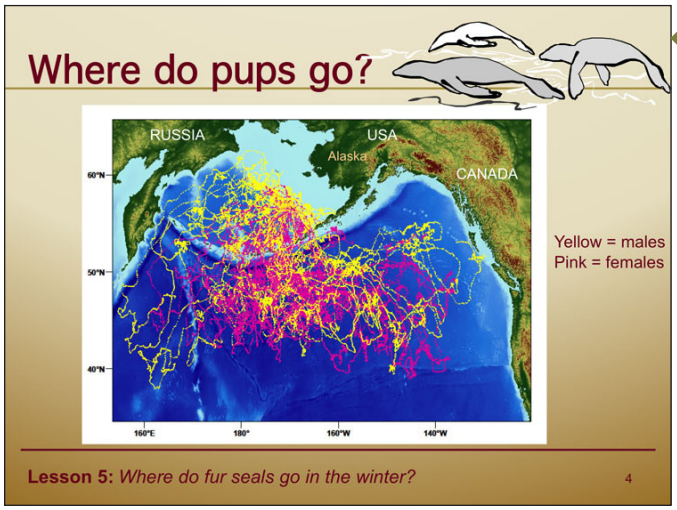


The pups who have just weaned and are headed to sea for the first time will stay at sea for 18-20 months, and return to the rookery as a 2-year-old.

Some of these juveniles will come to shore during that time but not many.

All other fur seals stay at sea for eight to ten months until the following spring/summer when they return to the rookery.

Photo: northern fur seals playing in the surf at Reef Rookery, St. Paul Island, Alaska; Lisa Hiruki-Raring, NMML/AFSC/NMFS/NOAA



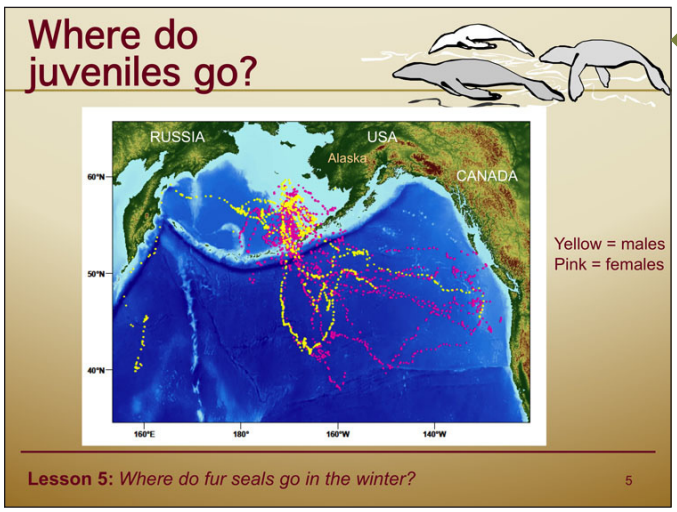
Scientists at NOAA have been tagging pups for years trying to figure out where they go in the winter. The next four slides display geographical data collected by satellite tags placed on northern fur seals by NOAA scientists. Almost all of the animals headed south of the Aleutian Islands.

Slide 1: Pups

Pups leave the rookery when they are 4 months old. In their first year, pups' tracks are not very directed. They are at the mercy of the weather much of the time. As the seals get older and stronger, their tracks are more directed. Less than half of the pups who leave the Pribilofs will return. The mortality (death) rate for pups is very high.

See the next three images for tracks of juveniles, adult females, and adult males.

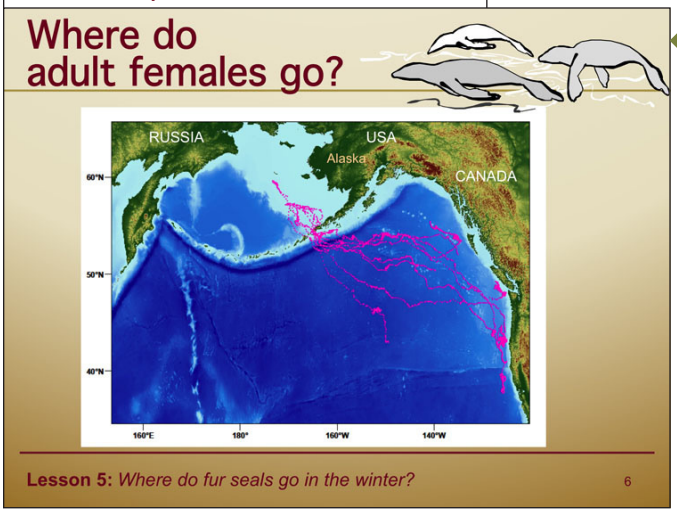
Source: NOAA/NMFS/AFSC/NMML Alaska Ecosystem Program



Slide 2

Juvenile males and females start to become more directed in their winter migrations. Compared to the pups' tracks, the majority of juvenile tracks are headed toward the eastern North Pacific and the west coast of the U.S. (only a selection of tagged seals are displayed on this chart).

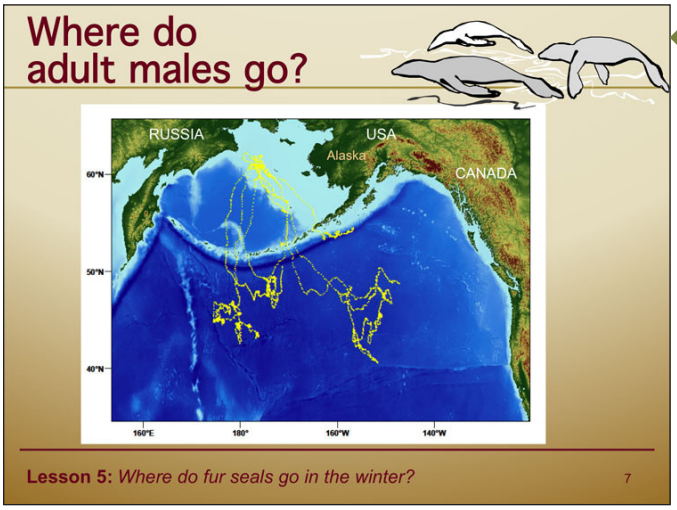
Source: NOAA/NMFS/AFSC/NMML Alaska Ecosystem Program



Slide 3

Adult female fur seals' tracks are very consistent in their movements toward the west coast of North America.

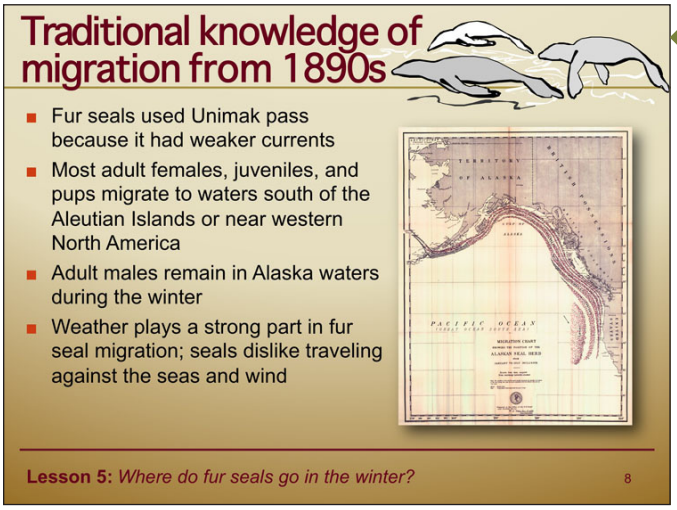
Source: NOAA/NMFS/AFSC/NMML Alaska Ecosystem Program



Slide 4

Adult male winter migrations go more toward the middle of the north Pacific Ocean. Note that the males' migration areas are generally separate from the females' migration areas.

Source: NOAA/NMFS/AFSC/NMML Alaska Ecosystem Program



In the 1890s, Unangam hunters and northwest tribal hunters were interviewed to document their knowledge of the migration routes of northern fur seals. Several patterns emerged from these interviews that have been confirmed by current scientific research.

The term "Alaska waters" in the interviews may simply mean waters that are not coastal to North America.

Sterling AFSC Quarterly Report, July 2011 (http://www.afsc.noaa.gov/Quarterly/jas2011/divrptsNMML1.htm)

Map: Henry Wood Elliott, 1884

Archaeological evidence of migration

- Northern fur seal bones found in middens on the coast of Washington and California
- Evidence that fur seal was a major component of Northwest Coast Indian diet

Lesson 5: *Where do fur seals go in the winter?* 9

Northern fur seal remains have been found in Native American settlements in Washington and California, indicating there has been a reliance on northern fur seals by native people over a wider geographic area than the Aleutian Islands, where Unangan have been hunting fur seals for thousands of years.

Northern fur seal bones were found in middens from the Makah village of Ozette on the coast of Washington when the village was excavated in the 1970s.

A midden is a mound or deposit containing shells, animals bones and other trash that indicate the presence of humans.

Northern fur seal bones have also been found on the Farallon Islands off the California coast.

Many First Nations Tribes of Canada hunted fur seals during the seals' winter migration off the coast of North America.

Source: http://www.washington.edu/news/archive/2044

Michael Etnier, PhD Thesis: http://www.calacademy.org/science_now/archive/academy_research/doug_long.php

Scientific knowledge of migration

- Radio tags tracked fur seals from St. Paul through Unimak Pass

- Satellite tags tracked fur seals south to California and west to Russia
- Recent science confirmed what Unangam hunters knew for hundreds of years

Lesson 5: *Where do fur seals go in the winter?* 10

Current scientific research has confirmed much of the information documented in the 1890s from Unangam hunters.

For many years, the information gathered from Unangam hunters was ignored. Current satellite data has confirmed the Unangam traditional knowledge. Today scientists often work closely with native communities to gather information about traditionally hunted animals.

Photo: NOAA/NMFS/AFSC/NMML

Summary

- Fur seals migrate to find food
- They can migrate as far south as California and as far west as Russia
- Age and sex determine where and how long a fur seal migrates

Lesson 5: *Where do fur seals go in the winter?* 11

Photo: resting northern fur seals, St. Paul Island; Pam Goddard: www.thalassa-education.com

LESSON SIX | SCIENCE/GEOGRAPHY ACTIVITY 6.1 | Grade Level 3–6

Where Are Fur Seal Rookeries?

OBJECTIVE

Students will learn where northern fur seal rookeries are on a map.

TIME REQUIRED

20 minutes

BACKGROUND

Northern fur seals breed at specific locations (rookeries) during the summer. Students will label a map showing the locations of fur seal rookeries in Russia and Alaska and a map showing locations of fur seal rookeries in the United States.

MATERIALS

- Map A (Russia and Alaska) with fur seal rookeries
- Map B (North America) with Pribilof Islands and San Miguel Island labeled

PROCEDURES

- Hand out Map 6.1.1; have the students label the map with the indicated countries, bodies of water, state and city, and rookeries. Students can color the map if desired.
- Hand out Map 6.1.2; have the students label the map with the indicated countries, bodies of water, state and city, and rookeries. Students can color the map if desired.

DISUSSION

Are there any rookeries on the mainland?

No, they are on islands.

What might influence the location of a rookery?

Food availability during the summer, protection from storms and predators.

Why do you think that seals are so far south at San Miguel Island?

The San Miguel Island fur seal rookery was originally started in the late 1950s or early 1960s by pregnant females from the Pribilof Islands who had their pups there instead of returning to the Pribilofs. Scientists discovered the rookery in 1968.

Source: Peterson, R.W., LeBoeuf, B.J. and R.L. Delong 1968. Fur Seals from the Bering Sea breeding in California. Nature 219:899-901.

ACTIVITY 6.1 MAP 6.1.1 Where are fur seal rookeries?

Map A: Russia and Alaska

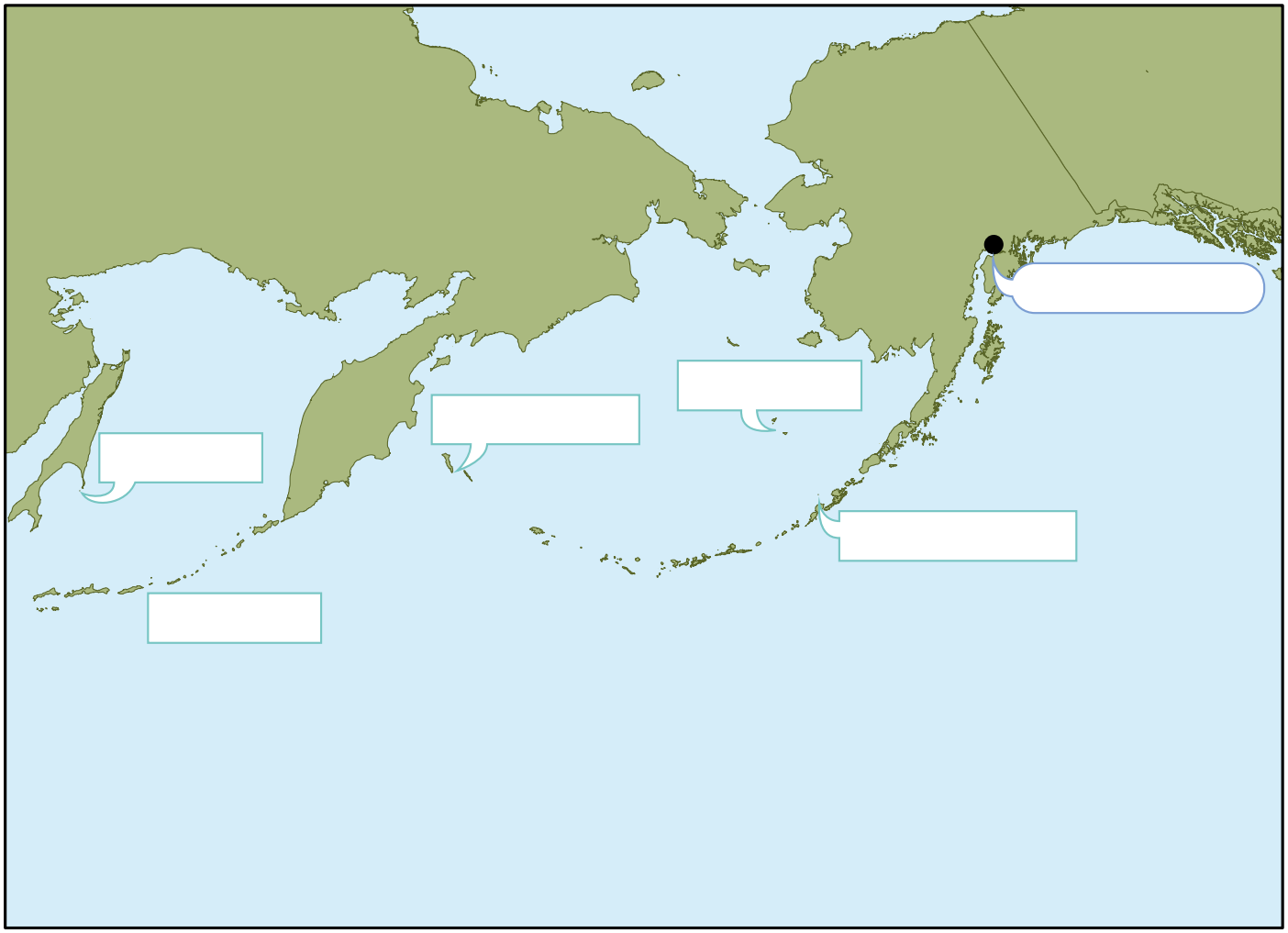
Label the countries:
- Russia
- USA
- Canada

Label the state:
- Alaska

Label the bodies of water:
- Bering Sea
- Pacific Ocean

Label this city as a reference point:
- Anchorage

Label the rookeries (look up the locations in an atlas if you are not sure where the location is):
- Robben Island
- Commander Islands
- Kuril Islands
- Pribilof Islands
- Bogoslof Island



ACTIVITY 6.1 TEACHER KEY 6.1.1 Where are fur seal rookeries?

Map A: Russia and Alaska

Label the countries:
- Russia
- USA
- Canada

Label the state:
- Alaska

Label the bodies of water:
- Bering Sea
- Pacific Ocean

Label this city as a reference point:
- Anchorage

Label the rookeries (look up the locations in an atlas if you are not sure where the location is)**:**
- Robben Island
- Commander Islands
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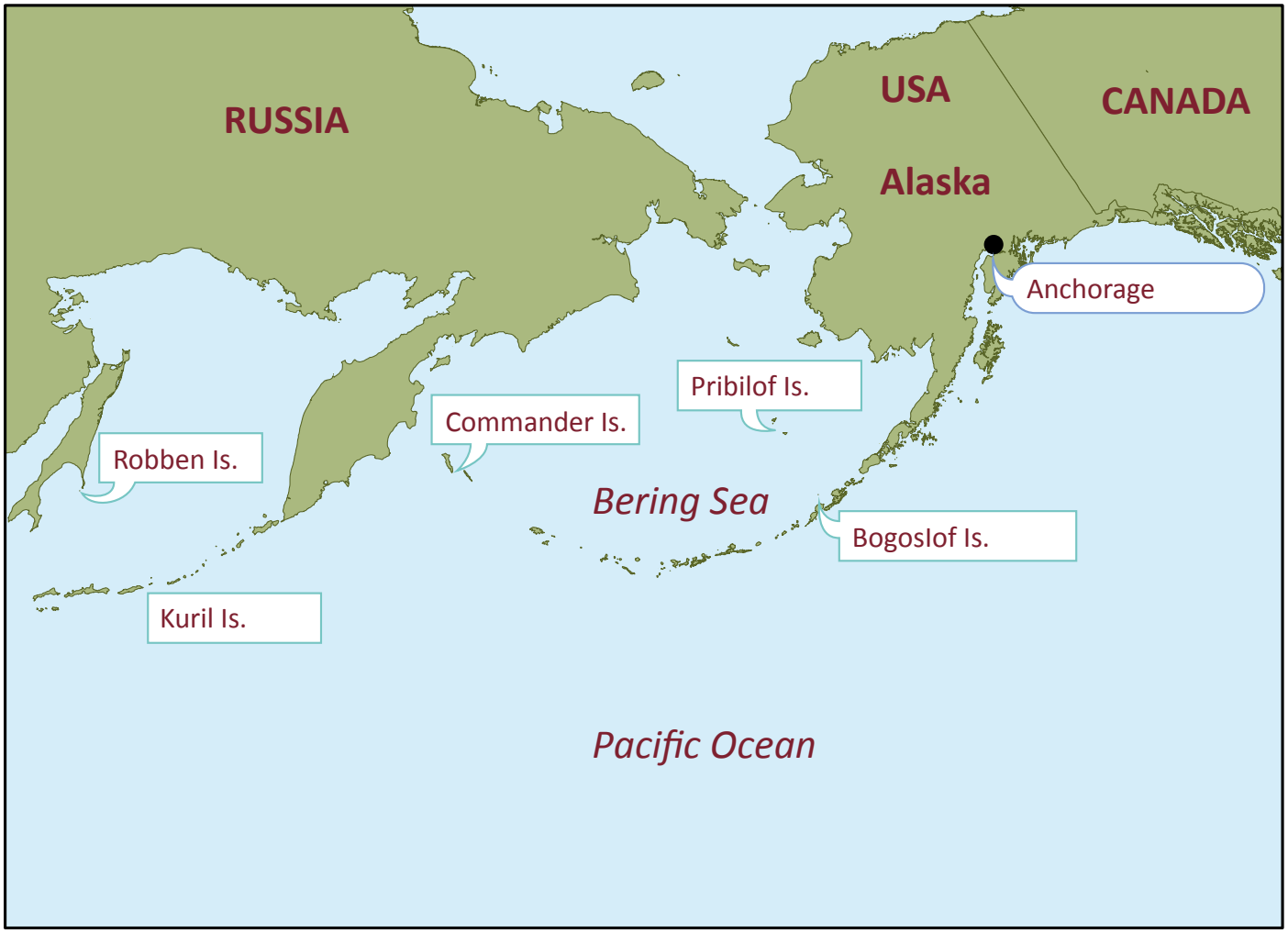
- Bogoslof Island



Map 6.1.2: USA

Using a globe or map as a reference, place the labels listed below on Map B.

The boxes indicate rookeries. Students will use the information presented in this activity to determine the location of the three northern fur seal rookeries located in the United States.

Label the countries:

- USA
- Canada

Label the bodies of water:

- Bering Sea
- Pacific Ocean

Label these states as reference points:

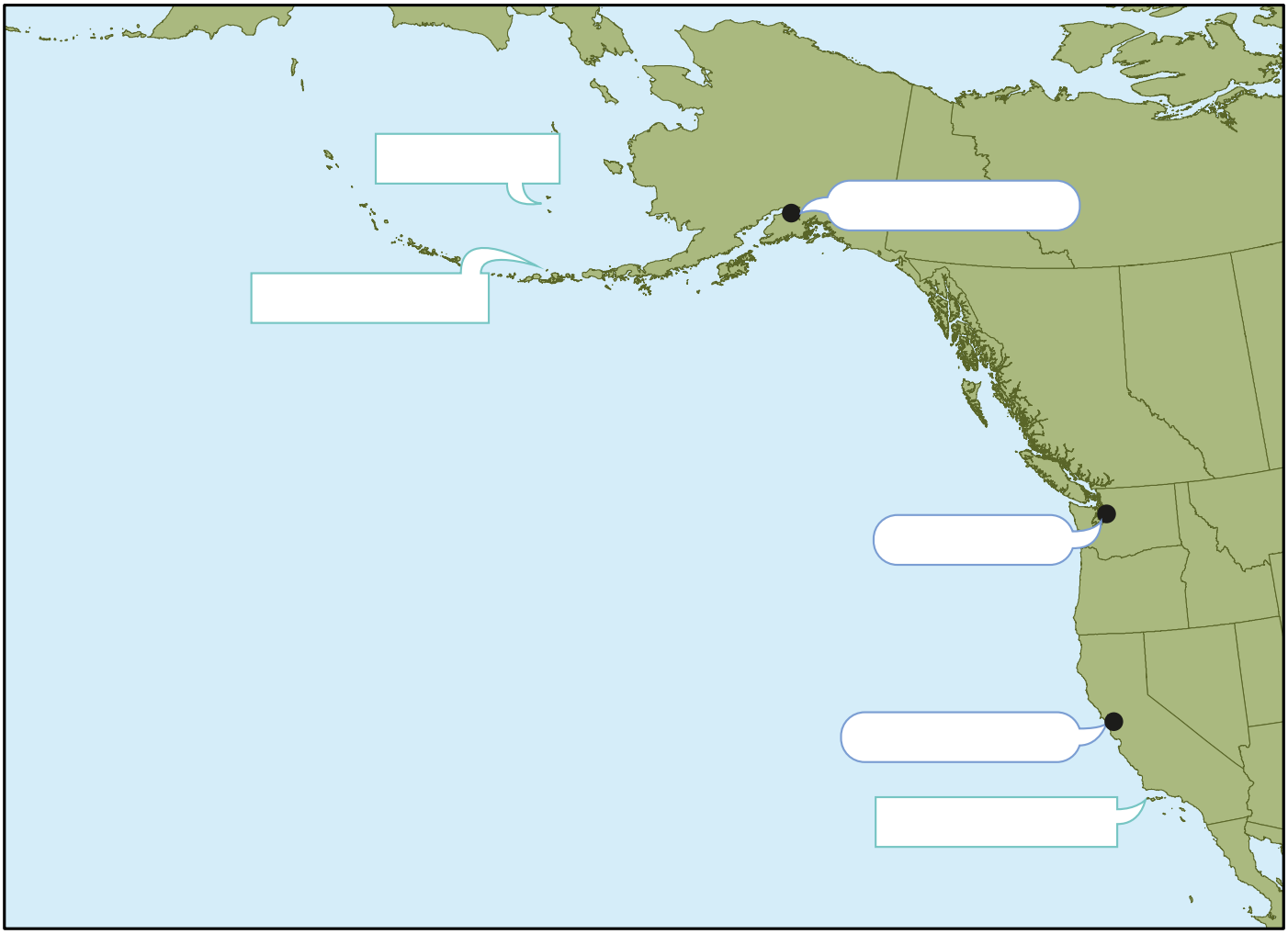
- Alaska
- Washington
- Oregon
- California

Label these cities as reference points:

- Anchorage
- Seattle
- San Francisco

Label the rookeries (look up the locations in an atlas if you are not sure where the location is)**:**

- Pribilof Islands
- Bogoslof Island
- San Miguel Island



ACTIVITY 6.1 TEACHER KEY 6.1.2 Where are fur seal rookeries?

Map 6.1.2: USA

Using a globe or map as a reference, place the labels listed below on Map B.

The boxes indicate rookeries. Students will use the information presented in this activity to determine the location of the three northern fur seal rookeries located in the United States.

Label the countries:
- USA
- Canada

Label the bodies of water:
- Bering Sea
- Pacific Ocean

Label these states as reference points:
- Alaska
- Washington
- Oregon
- California

Label these cities as reference points:
- Anchorage
- Seattle
- San Francisco

Label the rookeries (look up the locations in an atlas if you are not sure where the location is)**:**
- Pribilof Islands
- Bogoslof Island
- San Miguel Island

LESSON SIX | SCIENCE/WRITING ACTIVITY 6.2 | Grade Level K–6

Fur Seal Migrations

OBJECTIVE

Students will observe a visual presentation of fur seal migrations and discuss, as a class, information gained by watching the 3 minute video.

TIME REQUIRED

15 minutes

BACKGROUND

Every year, northern fur seals migrate thousands of miles round-trip from their summer breeding grounds on the Pribilof Islands in the Bering Sea. Learn how NOAA scientists track these seals on their incredible migrations, and where the seals go during the winter months.

MATERIALS

Fur Seal Migrations video - http://www.youtube.com/watch?v=qI0yzIrEJ4M (approximately 3 minutes)

PROCEDURES

Watch "Fur Seal Migrations" two times. The first time, allow the students to just watch the video. The second time, ask the students to think about the following questions.

DISUSSION

- How do scientists find out where the fur seal in the video is going?
- What time of year does the fur seal stay at sea?
- How far does the fur seal travel when it is at sea?
- When does the fur seal return to the Pribilof Islands?
- Why might the fur seal population be declining?

Replay the video if necessary to find the answers. Ask student to write down three things that they learned from the video.

EXPLORE AND EXTEND (5th and 6th grades)

Using Google Earth

- Calculate how many miles it is from St. Paul or St. George Island to San Miguel Island.
- Calculate the distance to Ozette, WA, where fur seal bones were found in Native American middens.

LESSON SIX | GEOGRAPHY ACTIVITY 6.3 | Grade Level 4–6

Mapping and Fur Seal Migration Track

OBJECTIVE

Students will become familiar with basic concepts of geography. Students will analyze a northern fur seal migration track.

TIME REQUIRED

20- 30 minutes

BACKGROUND

Geography

Every place on the earth can be described using two numbers, latitude and longitude. In order to accurately pinpoint locations on the surface of the earth, humans created a geographical grid system using lines of latitude and lines of longitude. This grid is attached to two fixed points, the North Pole and the South Pole.

Latitude lines run around the globe parallel to the equator. They measure the distance north and south of the equator.

Longitude lines (or meridians) are arcs running from the North Pole to the South Pole. They measure distances east and west from a base line or prime meridian.

For this lesson, latitude and longitude will be presented in decimal degrees.

Place	Latitude	Longitude
St Paul	57.18° N	170.3° W
St George	56.61° N	169.56° W
San Francisco	37.78° N	122.42° W
Equator	0°	
Greenwich, England		0° (prime meridian)

Migration

All northern fur seals migrate during the winter months. Seals depart the rookeries between August and December (males first, then pups, then females). Fur seals travel to different locations in the winter depending on their age and sex (see PowerPoint Lesson 6, slides 4-7 for maps). Pups must find their own way; neither parent teaches them how to feed or where to feed. Pups that do not find food will die of starvation. Storms, winds, currents and fish abundance all affect where seals go in the winter. Fur seals follow the food, so they seldom move in a straight line. If food is hard to find they will move out of the area. If food is abundant, they will stay in the area.

MATERIALS

- World globe (teacher provided)
- Diagram of Prime Meridian, Arctic Circle, Tropic of Cancer
- Yarn or string (teacher provided)
- Map of adult female fur seal migration track

PROCEDURES – GEOGRAPHY

Orientation

- On the globe, show students latitude and longitude lines.
- Have them find the North Pole, South Pole, and Pribilof Islands.
- Have students find the Arctic Circle and the Tropic of Cancer. What latitude are they?

  Arctic Circle (66.5° N)

  Tropic of Cancer (23.5° N)
- Have students find the equator, Tropic of Capricorn, and Antarctic Circle and determine their latitudes.

Lines of Latitude

1. Cut six pieces of yarn long enough to go around your globe at least once.
2. Assign six students or six groups of students to measure a line of latitude from the list below.
   a. Arctic Circle
   b. Tropic of Cancer
   c. Equator
   d. Tropic of Capricorn
   e. Antarctic Circle
   f. Latitude 57° N (latitude of St Paul Island)
3. Before measuring, predict which line of latitude is the shortest and which is the longest.
4. Compare the lengths of yarn.

Based on the lengths of yarn, answer the following questions.

- Which line of latitude is the longest?
  Equator
- Which line of latitude is the shortest?
  Arctic and Antarctic Circles

- Which lines of latitude are the same?

  Arctic and Antarctic Circles are the same.

  Tropic of Cancer and Tropic of Capricorn are the same.

Lines of Longitude

Using new pieces of yarn, measure the lines of longitude listed below. Lines of longitude are measured from pole to pole. Measure the distance between the North Pole and South Pole for each set of numbers.

Before measuring ask each student to predict which line of longitude they think will be the shortest and which will be the longest.

1. 0° and 180°
2. 169° West and 169° East,
3. 100° East, 100° West

   HINT: They should all be the same.

Label Map

- Have the students work individually or in groups to label Map 6.3.1 based on what they learned from the globe.
- Ask students to label the continents:
  - North America
  - South America
  - Europe
  - Antarctica
  - Asia
  - Africa
  - Australia
- Ask students to label the following geographic features:
  - Arctic Circle
  - Tropic of Cancer
  - Equator
  - Tropic of Capricorn
  - Antarctic Circle
  - Prime Meridian

DISCUSSION

- What was the difference between the lengths of yarn used to measure latitude and longitude?

  The latitude lines were shorter as they neared the poles whereas longitude lines were all the same length. This is because longitude lines are tied to fixed points at the North Pole and South Pole.

PROCEDURES – MAPPING

Using Map 6.3.2 "Adult female fur seal migration", label the map with the United States, Canada, Alaska, Pribilof Islands, and Russia. Connect the dots on the map in order of date to see the migration track of the female seal. Add arrows to show the direction of her movement. Answer the following questions.

DISCUSSION

- How many days did it take the seal to travel from the Pribilof Islands to California?

  139 days

- Where did the female seal end up?

  Use latitude and longitude to determine her endpoint. Check other maps from Activity 6.1.

  The seal's approximate location is 37° N 126° W, just west of Monterey Bay, California (37° N 122° W).

- Do you see any patterns in the fur seal's movements?

  The seal slows down and stays in the same area between January 29 and March 4.

- How many miles do you think the fur seal travelled? Use the Internet to determine the distance between St. Paul Island and Monterey Bay, California.

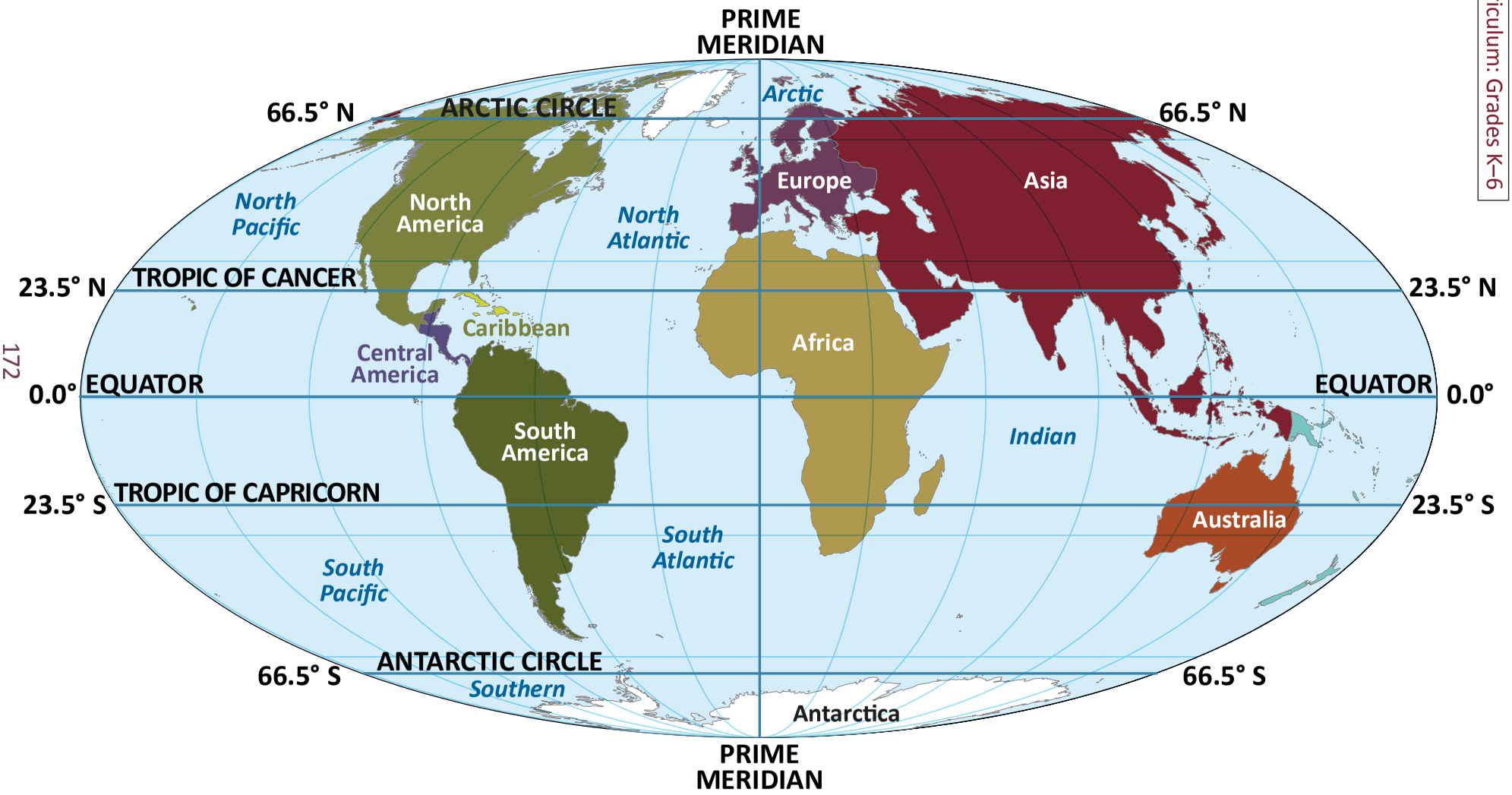
  Roughly 2,600 miles.

EXTENSION

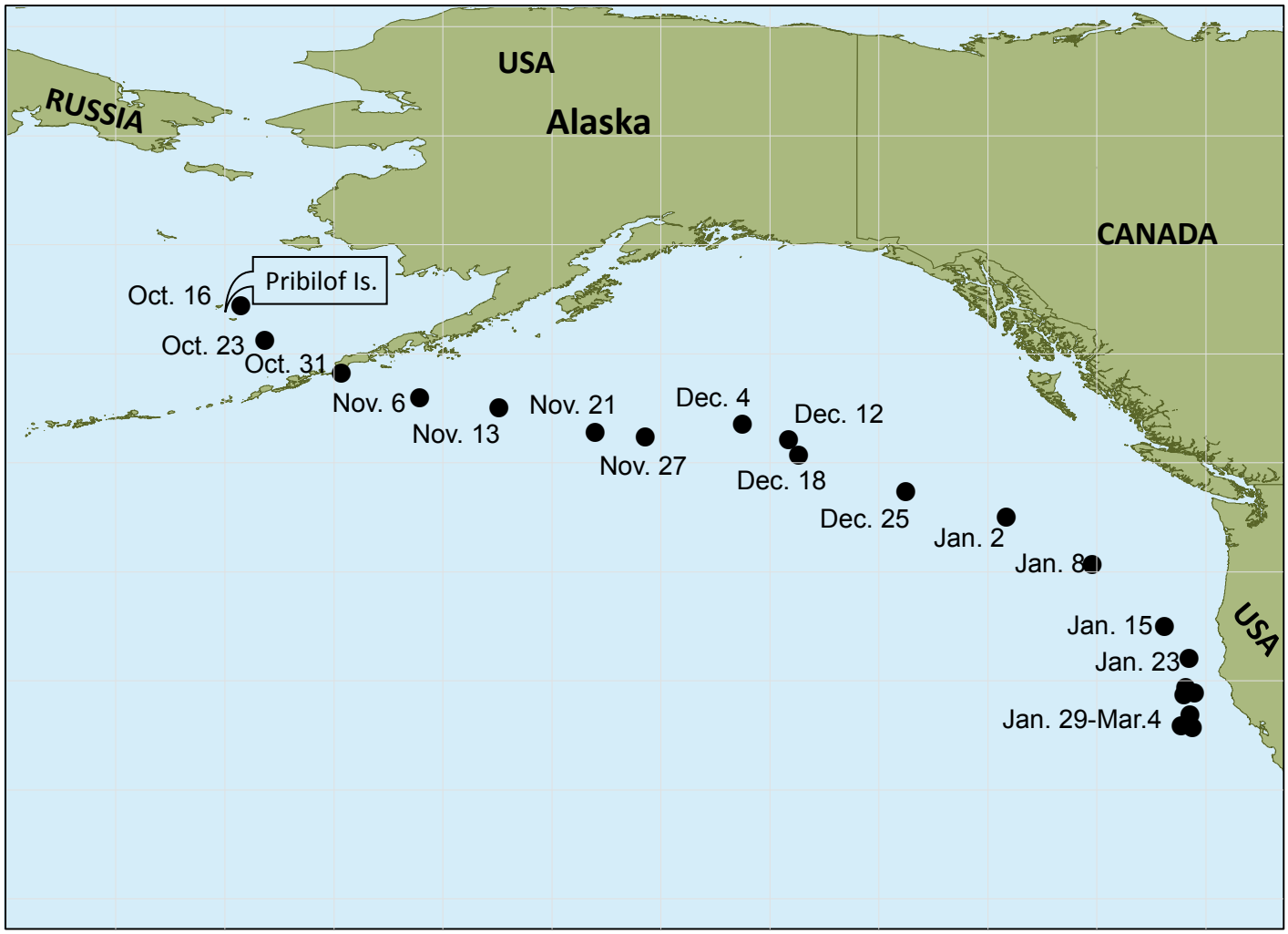
Plot fur seal migration data using information collected from tags. Data are located in the 7–12 curriculum Lesson Six, Activity 6.3.

ACTIVITY 6.3

MAP 6.3.1


PRIME MERIDIAN
66.5° N
ARCTIC CIRCLE
Arctic
North Pacific
North America
North Atlantic
Europe
Asia
23.5° N
TROPIC OF CANCER
Caribbean
Central America
Africa
0.0°
EQUATOR
South America
Indian
23.5° S
TROPIC OF CAPRICORN
Australia
South Atlantic
South Pacific
66.5° S
ANTARCTIC CIRCLE
Southern
Antarctica
PRIME MERIDIAN

ACTIVITY 6.3 MAP 6.3.2 Adult female fur seal migration



ACTIVITY 6.3 TEACHER KEY 6.3.2 Adult female fur seal migration