Laaqudax̂: The Northern Fur Seal

ELEMENTARY CURRICULUM

September 2013



Artwork by Thomas Stream

NOAA Fisheries Alaska Fisheries Science Center Alaska Regional Office	Pribilof School District	Central Bering Sea Fishermen's Association	Aleut Community of St. Paul Island Tribal Government

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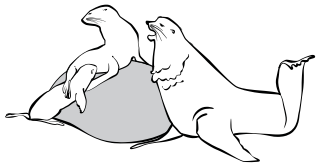
Laaqudax̂ the Northern Fur Seal for grades K-6 was developed by NOAA's National Marine Fisheries Service (NMFS)/ Alaska Fisheries Science Center and Thalassa Education, in partnership with the Pribilof School District, the Aleut Community of St. Paul Island – Tribal Government, the NMFS Alaska Regional Office, and the Central Bering Sea Fishermen's Association. The curriculum was developed by Lisa Hiruki-Raring (NMFS), Pam Goddard (Thalassa Education), Tonia Kushin (St. Paul School) , and Harriet Huber (NMFS). Graphic design and layout was provided by Rebecca White (NMFS).

Pinniped images (Activity 1.6) were used with permission from "Marine Mammals of Alaska" by Kate Wynne. Material in Activities 2.1 and 2.2, adapted from the "Unangam-Based Environmental Education Primer for St. Paul Island, Alaska" (Mierzejek, B., A.D. Lestenkof, and P.A. Zavadil, 2007) are used with permission from the Aleut Community of St. Paul Island – Tribal Government. The map of traditional territories of Alaska Native Cultures (Activity 2.2) is used with permission of the Alaska Native Heritage Center. Readings from "Aleut Images" (Activity 2.4) are used with permission from the State of Alaska, Alaska Pacific University, Alaskool and Dana G. Anderson (Copyright 1980). The "Create a Rookery" activity was developed with Seattle artist Liz Haven. The "Blubber Mitt" activity (Lesson 5, Activity 5.1) is a lesson adapted with permission from the award-winning FOR SEA family of curriculum guides for grades 1-12, available from FOR SEA Institute of Marine Science, Indianola, Washington 98342 (www.forsea.org).

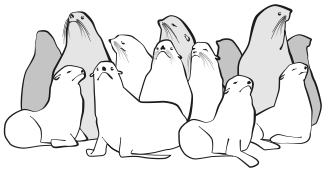
Funding was provided by NOAA's National Marine Fisheries Service (Headquarters office and Alaska Fisheries Science Center) and by the Central Bering Sea Fishermen's Association.

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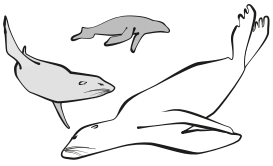
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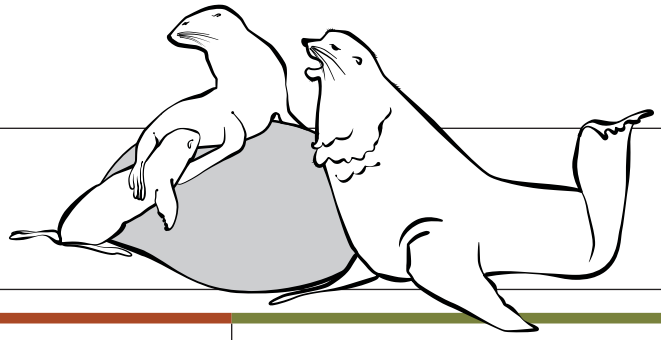
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LESSON ONE

What is a fur seal?



Subject Area(s): Life science	**Grade Levels:** K-6	Presentation – 10 minutes Activities – variable

Lesson Topics:	Pre-Assessment and characteristics of mammals, pinnipeds, and northern fur seals.	**Focus Questions**	• What is a mammal? • What is a pinniped? • What is a fur seal?
Learning Objectives:	Students will: • identify four characteristics of a mammal; • identify the three groups of pinnipeds and list three characteristics of each group	**Key words:**	mammal, pinniped, true seal, eared seal, walrus, phocid, otariid, odobenid, northern fur seal, harbor seal, sea lion

ACTIVITIES		ALASKA STANDARDS						
		Math K–6	Science K–3	Science 4	Science 5	Science 6	Minutes	Grades
Activity 1.1	Know, Wonder, Learn (KWL)						10	K-6
Activity 1.2	Mammals, Marine Mammals, and Pinnipeds	K.CC.4–6 K.MD.3 1.MD.7 2.MD.9–10 3.MD.6 4.MD.6 5.MD.6	SA1.1–1.2 SA2.1 SA3.1 SC1.1–1.2 SC2.1–2.2	SA1.1–1.2 SA2.1 SA3.1 SC2.2	SA1.1 SA2.1 SC2.1–2.2	SA2.1 SC2.1	3x15	K-6
Activity 1.3	Describe a Pinniped		SC1.1–1.2 SC2.1–1.2	SC1.1 SC2.2	SC2.1	SA2.1 SC2.1	20	4-6
Activity 1.4	Walk and Swim Like a Pinniped		SC2.2				10	K-2
Activity 1.5	Venn Diagram of Pinnipeds		SC1.1–1.2 SC2.1–2.2	SC1.1 SC2.2	SC2.1	SA2.1 SC2.1	20	K-6
Activity 1.6	Label the Parts of a Pinniped		SC2.2	SC2.2	SC2.2	SA2.1 SC2.1	10	K-6
Activity 1.7	Fur		SA3.1	SA3.1	SA3.1	SA3.1	10	K-6

Targeted Alaska Grade Level Expectations (GLEs)

Math

CC Counting and Cardinality

MD Measurement and Data

Science

Science as Inquiry and Process

SA1 Students develop an understanding of the processes of science used to investigate problems, design and conduct repeatable scientific investigations, and defend scientific arguments.

SA2 Students develop an understanding that the processes of science require integrity, logical reasoning, skepticism, openness, communication, and peer review.

SA3 Students develop an understanding that culture, local knowledge, history, and interaction with the environment contribute to the development of scientific knowledge, and local applications provide opportunity for understanding scientific concepts and global issues.

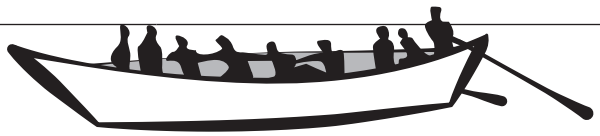
Concepts of Life Science

SC1 Students develop an understanding of how science explains changes in life forms over time, including genetics, heredity, the process of natural selection, and biological evolution.

SC2 Students develop an understanding of the structure, function, behavior, development, life cycles, and diversity of living organisms.

LESSON TWO

Who are the Unangan?



Subject Area(s): Life science, history, cultural	**Grade Levels:** K-6	Presentation – 10 minutes Activities – variable

Lesson Topics:	Unangan historical overview and Unangan relationship to marine mammals	**Focus Questions**	• Who are the Unangan? • What is their relationship to marine mammals?
Learning Objectives:	Students will: • interpret the Unangan literature, describe the geography, and illustrate the differences between Unangan and non-Unanagan clothing.	**Key words:**	Unangan, Pribilof Islands, culture, history

ACTIVITIES		ALASKA STANDARDS			
		Science	History	Minutes	Grades
Activity 2.1	I Am Who I Am	SF1.1–1.3	PPE2,7 ICGP2	40	K–6
Activity 2.2	Where are the Aleutian Islands and the Pribilof Islands?	SF1.1–1.3	PPE1–3 ICGP2	20	K–6
Activity 2.3	Unangam Clothing and Environment	SF1.1–1.3	PPE1–3 ICGP2	20	K–6
Activity 2.4	Essays from "Aleut Images"	SF1.1–1.3	PPE1–3 ICGP2	20	K–3

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.

SF2 Students develop an understanding that some individuals, cultures, and societies use other beliefs and methods in addition to scientific methods to describe and understand the world.

SF3 Students develop an understanding of the importance of recording and validating cultural knowledge.

American History-People, Places, Environment (PPE)

The student demonstrates an understanding of the interaction between people and their physical environment by:

PPE 1 comparing and contrasting geographic regions of Alaska.

PPE 2 using texts/sources to analyze the similarities and differences in the cultural attributes (e.g., language, hunting and gathering practices, art, music/dance, beliefs, worldview), movement, interactions, and settlement of Alaska Native peoples.

PPE 3 using texts/sources to analyze the effect of the historical contributions and/or influences of significant individuals, groups and local, regional, statewide, and/or international organizations.

PPE 7 using texts/sources to explain the political, social, cultural, economic, geographic, and historic characteristics of the student's community or region.

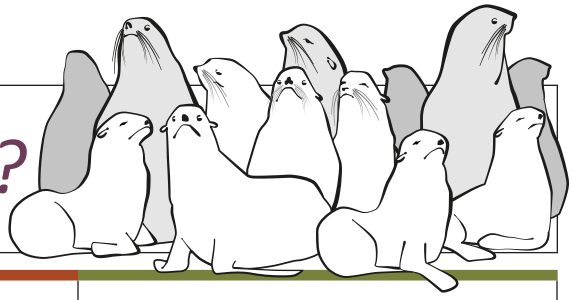
Individual, Citizenship, Governance, Power (ICGP)

The student demonstrates an understanding of the historical rights and responsibilities of Alaskans by:

ICGP 2 using texts/sources to analyze the impacts of the relationships between Alaska Natives and Russians (i.e., Russian Orthodox Church, early fur traders, Russian American Companies, enslavement, and Creoles).

LESSON THREE

What is a fur seal rookery?



Subject Area(s): Life science, genetics, reading	**Grade Levels:** K-6	Presentation – 10–15 minutes Activities – variable

Lesson Topics:	Fur seal rookery structure, location, and seasonal changes.	**Focus Questions**	• What is a fur seal rookery? • What do seals do at the rookery? • How does the rookery change over the season? • Why do we want to know?
Learning Objectives:	Students will: • describe the seasonal timeline of a northern fur seal rookery • describe what fur seals in different age groups do at the rookery	**Key words:**	rookery, haulout, vocalization

ACTIVITIES		ALASKA STANDARDS			
		Math	Science	Minutes	Grades
Activity 3.1	How Many Babies?	K.CC.4–6 K.MD.3 1.MD.7 2.MD.9–10 3.MD.6 4.MD.6 5.MD.6	SC 2	2x15	K–6
Activity 3.2	Rookery Timeline	4.MD.1 5.MD.1	SC2	25	3–6
Activity 3.3	Create a Rookery – Rubber Stamp Making		SC2	50	K–6
Activity 3.4	Find Your Fur Seal Family		SC2	10	K–6
Activity 3.5	Vocalizations in Northern Fur Seals		SC2	10	3–6

Targeted Alaska Grade Level Expectations (GLEs)

Math

CC Counting and Cardinality

MD Measurement and Data

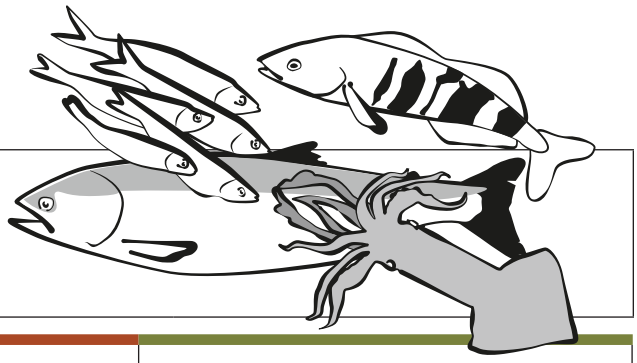
Science

Concepts of Life Science

SC2 Students develop an understanding of the structure, function, behavior, development, life cycles, and diversity of living organisms.

LESSON FOUR

What do fur seals eat?



Subject Area(s): Life science	**Grade Levels:** K-6	Presentation – 10 minutes Activities – variable

Lesson Topics:	Marine mammal and northern fur seal diets, scat and stomach analysis.
Learning Objectives:	Students will: • learn what fur seals eat • identify fur seal scat contents • learn two ways scientists determine what fur seals eat • summarize lunch contents • explain why it is so hard to study what marine mammals eat

Focus Questions	• How do scientists study what fur seals eat if they eat at sea? • Why do we want to know what fur seals eat?
Key words:	diet, prey, ecosystem, scat, food habits

ACTIVITIES		ALASKA STANDARDS			
		Math	Science	Minutes	Grades
Activity 4.1	Make a Food Chain		SC3.2	15	K–2
Activity 4.2	Lunch Box Detective	K.CC.4–6; K.MD.3 1.MD.7 2.MD.9–10 5.MD.4	SA1.1–1.2 SA2.1	15	K–2
Activity 4.3	Scat Detective	K.CC.4–6; K.MD.3 1.MD.7 2.MD.9–10 3.MD.4 3.MD.6 4.MD.6 5.MD.4	(3–6) SA1.1–1.2 SC2.1 SG2.1	30	3–6
Activity 4.4	Microworlds: What do Marine Mammals Eat?			15	K–6

Targeted Alaska Grade Level Expectations (GLEs)

Science as Inquiry and Process

SA1 Students develop an understanding of the processes of science used to investigate problems, design and conduct repeatable scientific investigations, and defend scientific arguments.

SA2 Students develop an understanding that the processes of science require integrity, logical reasoning, skepticism, openness, communication, and peer review.

Concepts of Life Science

SC2 Students develop an understanding of the structure, function, behavior, development, life cycles, and diversity of living organisms.

SC3 Students develop an understanding that all organisms are linked to each other and their physical environments through the transfer and transformation of matter and energy.

Science and Technology

SE1 Students develop an understanding of how scientific knowledge and technology are used in making decisions about issues, innovations, and responses to problems and everyday events.

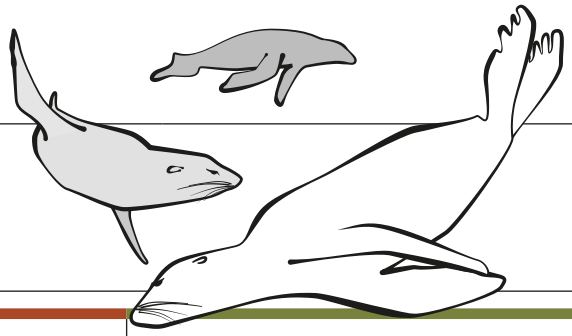
SE2 Students develop an understanding that solving problems involves different ways of thinking, perspectives, and curiosity that lead to the exploration of multiple paths that are analyzed using scientific, technological, and social merits.

History and Nature of Science

SG2 Students develop an understanding that the advancement of scientific knowledge embraces innovation and requires empirical evidence, repeatable investigations, logical arguments, and critical review in striving for the best possible explanations of the natural world.

LESSON FIVE

How do fur seals dive?



Subject Area(s): Life science	**Grade Levels:** K-6	Presentation – 10 minutes Activities – variable

Lesson Topics:	Fur seal diving
Learning Objectives:	Students will: • investigate adaptations of seals to water • compare insulating qualities of air and blubber

Focus Questions	• How are pinnipeds adapted to the water? • How do they dive? • Why do we want to know how deep fur seals dive?
Key words:	blubber, body shape, forage, adaptation

ACTIVITIES		ALASKA STANDARDS				
		Math K–3	Math 4–6	Science 3–6	Minutes	Grades
Activity 5.1	Blubber Mitt	1.MD.7 2.MD.9 3.MD.4, 3.MD.6	4.MD.6 5.MD.4 6.SP.1-5	SA1.1–1.2 SA2.1 SC2.2 SG2.1	10	K–6
Activity 5.2	Waiting to Inhale	3.MD.4 3.MD.6	4.MD.6 5.MD.4 6.SP.1-5	SA1.1–1.2 SA2.1 SC2.2 SG2.1	10	3–6
Activity 5.3	Exhale and Dive	3.MD.4 3.MD.6	4.MD.6 5.MD.4 6.SP.1-5	SA1.1–1.2 SA2.1 SC2.2 SG2.1	10	K–6

NOTE: It works well to set each activity up as a station; divide the class into three groups and have the groups rotate through the stations. Afterwards, the class can discuss their results.

Targeted Alaska Grade Level Expectations (GLEs)

Math

MD Measurement and Data

SP Statistics and Probability

Science

Science as Inquiry and Process

SA1 Students develop an understanding of the processes of science used to investigate problems, design and conduct repeatable scientific investigations, and defend scientific arguments.

SA2 Students develop an understanding that the processes of science require integrity, logical reasoning, skepticism, openness, communication, and peer review.

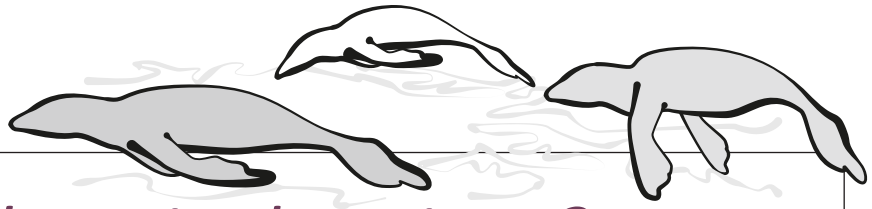
Concepts of Life Science

SC2 Students develop an understanding of the structure, function, behavior, development, life cycles, and diversity of living organisms.

History and Nature of Science

SG2 Students develop an understanding that the advancement of scientific knowledge embraces innovation and requires empirical evidence, repeatable investigations, logical arguments, and critical review in striving for the best possible explanations of the natural world.

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

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

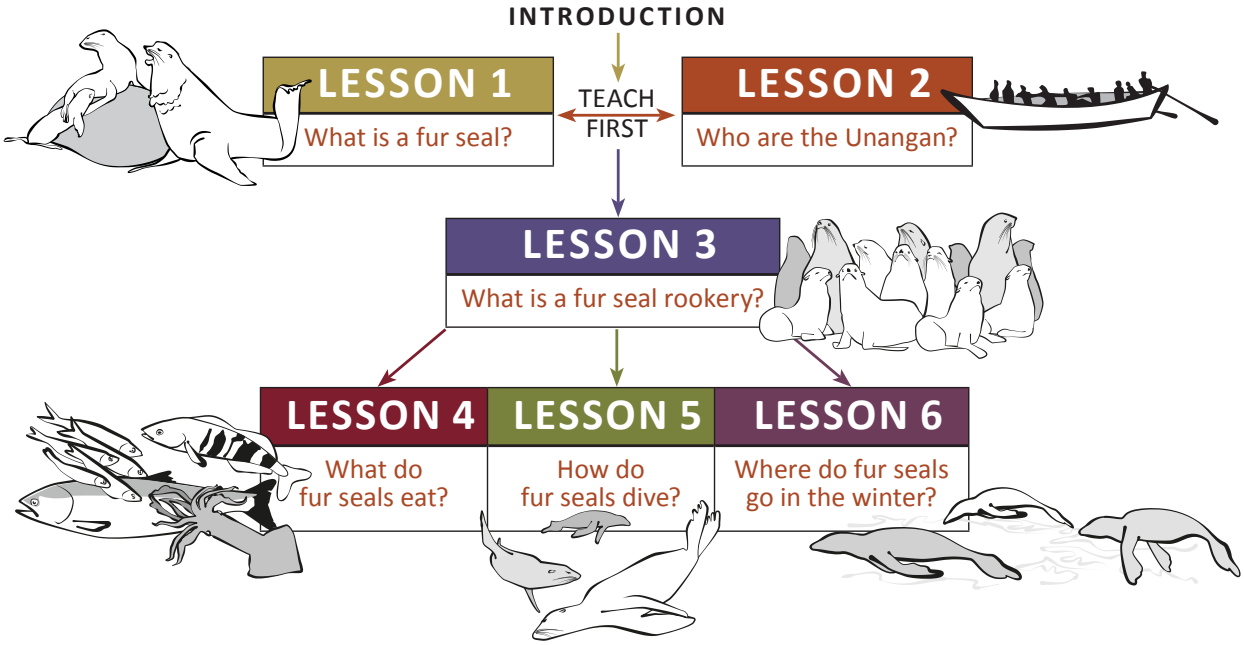
SG1 Students develop an understanding that historical perspectives of scientific explanations demonstrate that scientific knowledge changes over time, building on prior knowledge.

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.

Introduction

Northern fur seals have played an important economic and biological role in the history of Alaska and the United States that is often overlooked. Historically, Alaska was home to over 90% of the world's population of northern fur seals with the majority found on the Pribilof Islands in the Bering Sea. The Unangan (Aleut people) have inhabited Alaska's Aleutian Islands for thousands of years, and their history is intertwined with that of the commercial fur harvest, as forced labor first for Russians and later for Americans. It is a little-known fact that in the twenty years following the United States' 1867 acquisition of the Alaska territory, revenues to the United States Government from the Pribilof Island fur seal harvest paid off the $7.2 million purchase price.



The goal of this integrated curriculum is to increase knowledge of northern fur seals and the Unangan through lessons and activities designed for varying grade levels and teachers with little or no background knowledge. Science, math, language arts, culture, and art have been integrated into lessons that can be adjusted for grades K-6. Teachers with multi-grade classes have the choice to teach the same material at many levels and provide opportunities for older students to work with younger students, encouraging community teaching. The curriculum is designed as a spiral curriculum, where the same content can be revisited over several grades, each time at a higher level of difficulty and in greater depth.

This curriculum accomplishes the following objectives:

- Tell the story of the annual cycle of northern fur seals
- Teach core concepts in fur seal biology
- Increase understanding of the relationship between northern fur seals and Unangam culture
- Develop awareness of the science and research techniques used to study northern fur seals

The term **Aleut** is the Russian word used historically for the people of the Aleutian Islands. Today, people of this region use the words **Unangan** (Eastern dialect) and **Unangas** (Western dialect) to refer to the Aleut people. In this curriculum, we use the terms **Unangan** (noun) **and Unangam** (adjective) for simplicity.

Curriculum Framework

The curriculum consists of six lessons, each with a PowerPoint presentation and accompanying activities for different grade levels. A complementary curriculum is available for grades 7-12. The activities are designed to reinforce and expand the lesson themes, and provide hands-on opportunities for students to investigate and integrate the information they learned.

Lessons

1 What is a fur seal?

2 Who are the Unangan?

3 What is a fur seal rookery?

4 What do fur seals eat?

5 How do fur seals dive?

6 Where do fur seals go in the winter?

Lessons 1, 2, and 3 provide the foundation for the curriculum. It is strongly suggested that teachers at least start with lessons 1 and 2 before proceeding to lessons 3-6. Lesson 3 provides the groundwork for lessons 4, 5, and 6 but does not have to be taught first.

The curriculum is designed to be flexible enough that teachers can pick and choose the order of lessons and activities within a lesson based on their students' grade level and prior knowledge.

How does this material fit the Alaska State Educational Standards?

This curriculum has been specifically designed to meet Alaska State Standards for science, math, reading, writing, history, and cultural standards.

What are assessment methods?

Assessment methods vary with each lesson and activity; any of these methods can be given a point value and entered into a grade book. Methods include:

- Pre and Post test
- Visual representations
- Data analysis
- Geographical display (maps)
- Summary of observations using technical writing
- Verbal presentations
- Creative writing
- Visual arts
- KWL chart (Know, want to know, and learned)

How much time do I need?

Each lesson can be completed in 40-60 minutes if at least one activity is selected. Activities range from 10 to 50 minutes, with most being 15-30 minutes.

Culminating project ideas:

Consider choosing a culminating project that summarizes the knowledge gained from the unit and making it a project that the class works on each week, individually or as a whole. Examples of culminating projects include:

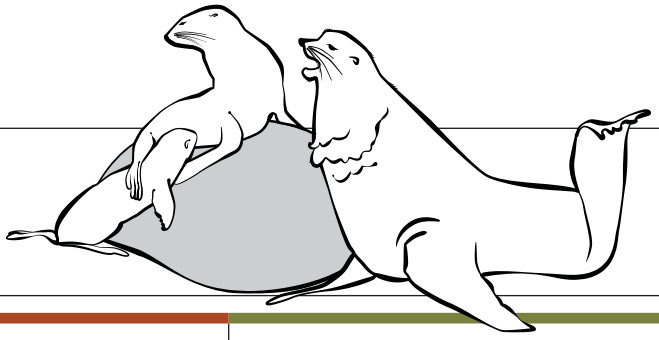
- make your own northern fur seal book incorporating writing and art from each lesson
- make a picture timeline of a rookery
- make an ABC book (Unangan and English) with vocabulary from this unit
- teach what you have learned to someone else (family, another class)
- write a skit or a play about a northern fur seal rookery or migration and act it out for students at your school or make a video
- make a bulletin board display of what you have learned

Northern fur seal Curriculum Overview

Lesson	Topic	Components	Length of Time	Grade Level
		Activities vary by grade level allowing educators to select age-appropriate activities for their class		
1	***What is a fur seal?*** Fur seal classification and physical characteristics	PowerPoint Overview (7 slides) Activity 1.1: Know, Wonder, Learn (chart) Activity 1.2: Mammals, Marine Mammals, and Pinnipeds (worksheets) Activity 1.3: Describe a Pinniped (worksheet) Activity 1.4: Walk and Swim Like a Pinniped (hands on) Activity 1.5: Venn Diagram of Pinnipeds (worksheet) Activity 1.6: Label the Parts of a Pinniped (worksheet) Activity 1.7: Fur (hands on)	 10 min 3x15 min 20 min 10 min 20 min 10 min 10 min	 K-6 K-6 4-6 K-2 K-6 K-6 K-6
2	***Who are the Unangan?*** Basic overview of Unangam history and relationship to fur seals	PowerPoint Overview (10 slides) Activity 2.1: I Am Who I Am (worksheet) Activity 2.2: Where are the Aleutian and the Pribilof Islands? (worksheet) Activity 2.3: Unangam Clothing and Environment (worksheet) Activity 2.4: Essays from "Aleut Images" (read and discuss)	 40 min 20 min 20 min 20 min	 K-6 K-6 K-6 K-3
3	***What is a fur seal rookery?*** Definition of rookery and haulout, where rookeries are, what seals do there, what we can learn	PowerPoint Overview (13 slides) Activity 3.1: How Many Babies? (worksheets) Activity 3.2: Rookery Timeline (hands on) Activity 3.3: Create a Rookery – Rubber Stamp Making (hands on) Activity 3.4: Find Your Fur Seal Family (game) Activity 3.5: Vocalizations in Northern Fur Seals (video clip, discuss)	 2x15 min 25 min 50 min 10 min 10 min	 K-6 3-6 K-6 K-6 3-6
4	***What do fur seals eat?*** Type of food, how do we find out, what can we learn	PowerPoint Overview (8 slides) Activity 4.1: Make a Food Chain (hands on, worksheet) Activity 4.2: Lunch Box Detective (hands on) Activity 4.3: Scat Detectives (hands on) Activity 4.4: Microworlds: What do Marine Mammals Eat? (video)	 15 min 15 min 30 min 15 min	 K-2 K-2 3-6 K-6
5	***How do fur seals dive?*** Adaptation to water, how deep they dive, how do we find out, what can we learn	PowerPoint Overview (10 slides) Activity 5.1: Blubber Mitt (hands on) Activity 5.2: Waiting to Inhale! (investigation) Activity 5.3: Exhale and Dive! (hands on)	 10 min 10 min 10 min	 K-6 3-6 K-6
6	***Where do fur seals go in the winter?*** Why do fur seals leave rookery, where do fur seals of different ages go, how do we know	PowerPoint Overview (10 slides) Activity 6.1: Where are Fur Seal Rookeries? (mapping) Activity 6.2: Fur Seal Migrations (video) Activity 6.3: Mapping and Fur Seal Migration Track (mapping)	 20 min 15 min 20-30 min	 3-6 K-6 3-6

LESSON ONE

What is a fur seal?



Subject Area(s): Life science	Grade Levels: K-6	Presentation – 10 minutes Activities – variable

Lesson Topics:	Pre-Assessment and characteristics of mammals, pinnipeds, and northern fur seals.	**Focus Questions**	• What is a mammal? • What is a pinniped? • What is a fur seal?
Learning Objectives:	Students will: • identify four characteristics of a mammal; • identify the three groups of pinnipeds and list three characteristics of each group	**Key words:**	mammal, pinniped, true seal, eared seal, walrus, phocid, otariid, odobenid, northern fur seal, harbor seal, sea lion

ACTIVITIES		ALASKA STANDARDS						
		Math K–6	Science K–3	Science 4	Science 5	Science 6	Minutes	Grades
Activity 1.1	Know, Wonder, Learn (KWL)						10	K-5
Activity 1.2	Mammals, Marine Mammals, and Pinnipeds	K.CC.4–6 K.MD.3 1.MD.7 2.MD.9–10 3.MD.6 4.MD.6 5.MD.6	SA1.1–1.2 SA2.1 SA3.1 SC1.1–1.2 SC2.1–2.2	SA1.1–1.2 SA2.1 SA3.1 SC2.2	SA1.1 SA2.1 SC2.1–2.2	SA2.1 SC2.1	3x15	K-5
Activity 1.3	Describe a Pinniped		SC1.1–1.2 SC2.1–1.2	SC1.1 SC2.2	SC2.1	SA2.1 SC2.1	20	4-6
Activity 1.4	Walk and Swim Like a Pinniped		SC2.2				10	K-2
Activity 1.5	Venn Diagram of Pinnipeds		SC1.1–1.2 SC2.1–2.2	SC1.1 SC2.2	SC2.1	SA2.1 SC2.1	20	K-6
Activity 1.6	Label the Parts of a Pinniped		SC2.2	SC2.2	SC2.2	SA2.1 SC2.1	10	K-6
Activity 1.7	Fur		SA3.1	SA3.1	SA3.1	SA3.1	10	K-6

Targeted Alaska Grade Level Expectations (GLEs)

Math

CC Counting and Cardinality

MD Measurement and Data

Science

Science as Inquiry and Process

SA1 Students develop an understanding of the processes of science used to investigate problems, design and conduct repeatable scientific investigations, and defend scientific arguments.

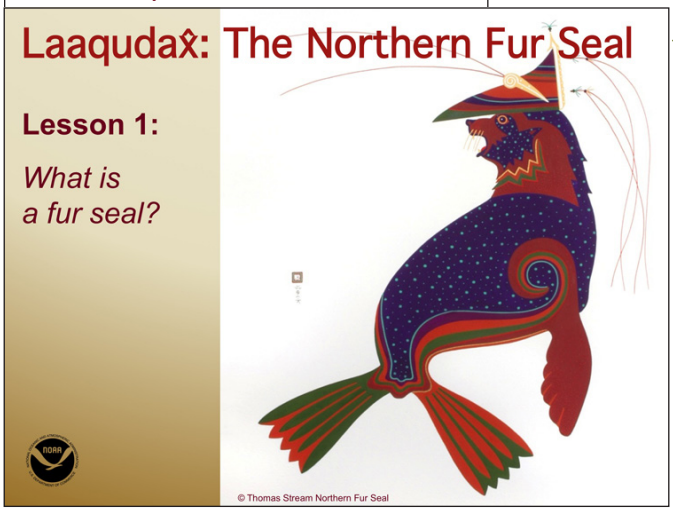
SA2 Students develop an understanding that the processes of science require integrity, logical reasoning, skepticism, openness, communication, and peer review.

SA3 Students develop an understanding that culture, local knowledge, history, and interaction with the environment contribute to the development of scientific knowledge, and local applications provide opportunity for understanding scientific concepts and global issues.

Concepts of Life Science

SC1 Students develop an understanding of how science explains changes in life forms over time, including genetics, heredity, the process of natural selection, and biological evolution.

SC2 Students develop an understanding of the structure, function, behavior, development, life cycles, and diversity of living organisms.



Lesson 1 provides an overview of the characteristics of a mammal, pinniped and northern fur seal.

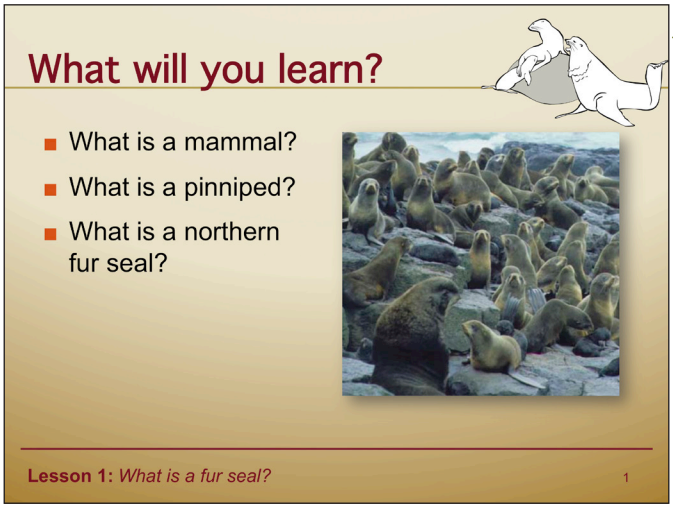
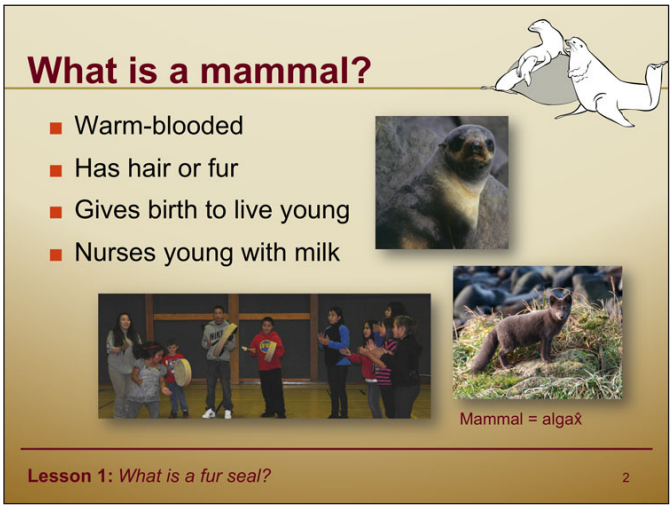


Photo: NMML/AFSC/NMFS/NOAA



These are the characteristics of a mammal.

They are warm-blooded, have hair or fur, and nurse their young with milk.

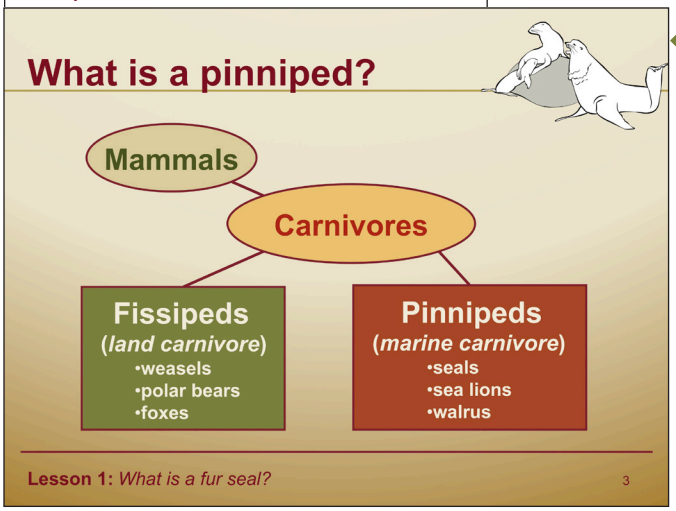
The platypus and echidna (spiny anteater) are the only two mammals that lay eggs.

Marine mammals are mammals that live in marine ecosystems (cetaceans – whales, dolphins, porpoises; pinnipeds – true seals, eared seals, walrus; sirenians – manatees and dugongs; and sea otters). Polar bears and arctic fox are often also counted as marine mammals since they depend largely on the marine environment for their food.

We often get the questions, “Are penguins marine mammals?”

No, penguins are not marine mammals. They are birds that cannot fly but they are not marine mammals.

Photos: fur seal – Rolf Ream, NMML/AFSC/NMFS/NOAA
fox – Pam Goddard, Thalassa
Dancing – Lisa Hiruki-Raring, AFSC/NMFS/NOAA



Within the biological classification of mammals, carnivores are meat-eaters. This group can be broken up into two subgroups, fissipeds (land carnivores) and pinnipeds (marine carnivores).

Fissiped = split foot; Pinniped = fin foot

Fissi = split; Pinni = fin; Ped = foot

Fissipeds or land carnivores include: dogs and related species (e.g. dogs, wolves, coyotes, foxes); raccoons and related species; bears (e.g. polar bears); weasels and related species (e.g. weasels, ferrets, badgers, river otters, sea otters); skunks; cats (e.g. domestic cats, lions, tigers, cougars, lynx); civets and related species; mongooses and related species (e.g. mongoose, meerkat, kusimanse); hyenas and aardwolf

Pinnipeds or marine carnivores include: true seals; fur seals and sea lions (eared seals); walrus



Pinnipeds are divided into three groups: true seals (phocid seals) – these are seals like harbor seals and ringed seals; **eared seals** (otariid seals) – these are fur seals and sea lions; walrus (odobenid)

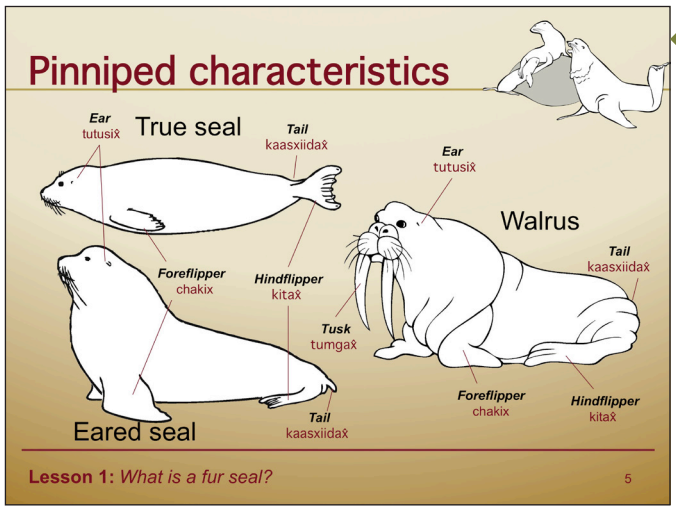
PHOCID, **OTARIID**, and **ODOBENID** are the scientific names for these pinniped groups. Every animal has only one scientific name, but may have several common names (for example, northern fur seals were called "sea bears" in the past, and the Unangan have several names for fur seals: algamiklux̂, laaqudax̂.

We will go through the main characteristics of each group in the next slide.

Unangan Names: True Seal – agdaaĝux̂; Eared Seal – laaqudax̂ (fur seal) & qawax̂ (sea lion); Walrus – amgaadax̂

Most Unangam names refer to a specific type of seal. Examples: Qawax̂ – sea lion; Isux̂ – harbor seal; Iglagayax̂ - ribbon seal

Photos: John Moran, NMML/AFSC/NMFS/NOAA



Things to point out:

Ears – true seals and walrus don't have external ear flaps – they just have a hole in the side of the head. Eared seals have small flaps.

Foreflippers and hindflippers – true seals have short foreflippers, which are mostly used for steering; the hindflippers are used to propel the seal when swimming. Eared seals and walruses have large foreflippers. Eared seals use foreflippers for propulsion when swimming (the animal "flies" through the water), while walruses swim mostly with hindflippers, using foreflippers as rudders.

Locomotion on land – true seals cannot stand on all four flippers because their hindflippers are rotated backwards; when they are on land, they move on their stomach, pulling themselves forward with their foreflippers. Eared seals and walruses can stand on all four flippers and walk when they are on land.

Tail — All three groups have a small tail, even though it may not be visible in this picture.

There are other more subtle differences between the groups (e.g., true seals may have patterns on their fur, like spots, rings or bands, while eared seals and walrus do not).

Source: Figure adapted from Wynne, K. Marine Mammals of Alaska.



Note the pattern on the fur of the true seal (no pattern on eared seal).

True seal has a "torpedo" or sausage shape; eared seal has a long neck in relation to the body.

The true seal in this picture is a harbor seal.

The eared seal is a California sea lion.

Photo: Harriet Huber, NMML/AFSC/NMFS/NOAA



The northern fur seal is one type of eared seal.

Emphasize the size difference between the male and the female (shown in the picture). Males are much larger than females

FEMALES GIVE BIRTH TO ONE PUP EACH YEAR! If the pup dies or is taken for food, the female does not give birth to another pup.

Male fur seals have multiple Unangan names depending on the age of the male. See references for list of Unangan words.

Source for measurements: AFSC/NMML website, Northern Fur Seal page, http://www.afsc.noaa.gov/nmml/species/species_nfs.php

Photo: Chuck Fowler, NMML/AFSC/NMFS/NOAA



The northern fur seal is one type of eared seal.

What is next??

Learn about the Unangan who have known about the fur seals for thousands of years.

Photo: Lisa Hiruki-Raring, AFSC/NMFS/NOAA

ACTIVITY 1.1 CHART Know, Wonder, Learn

Tell me what you **KNOW** about northern fur seals in general	
What do you **WONDER** about northern fur seals	
What have you **LEARNED** about northern fur seals	

LESSON ONE | SCIENCE ACTIVITY 1.2 | Grade Level K-6

Mammals, Marine Mammals, and Pinnipeds

OBJECTIVE

Students will identify physical characteristics of mammals, marine mammals, and pinnipeds.

TIME REQUIRED

Three sections taking 15 minutes each. Works best with groups of six to eight students.

BACKGROUND

Mammals are animals that have hair or fur, nurse their young with milk, give birth to live young, and are warm blooded. Marine mammals are mammals that live in marine (salt water) ecosystems. Marine mammals have all the characteristics of mammals but they live all or much of their lives in the ocean. There are four main groups of marine mammals:

- cetaceans (si-TAY-shens) – whales, dolphins, porpoise
- pinnipeds (PINN-i-peds) – true seals, eared seals, walrus
- sirenians (si-REHN-ee-ans) – manatees and dugongs
- marine fissipeds (FIS-si-peds) – sea otters, polar bears

Pinni-ped = "fin-foot"

Pinnipeds are marine carnivores (meat-eaters) and are divided into three main groups:

- True seals (phocid) – do not have an external ear flap; sausage shaped body, can't stand on all four flippers (crawls on land), swim with hind flippers (example – harbor seal)
- Eared seals (otariid) – have an external ear flap, can walk on all four flippers on land, swim using front flippers for propulsion, have long neck and large flippers (example – Steller sea lion, northern fur seal)
- Walrus (odobenid) – no external ear flap, but can walk on all four flippers on land, swim with hind flippers for propulsion

In this activity, students will go through three exercises:

1. "What is a mammal?" – Discuss characteristics of mammals and sort animals into mammals and non-mammals.
2. "What is a marine mammal?" – Discuss characteristics of marine mammals and sort animals into marine mammals and other mammals.
3. "What is a pinniped?" – Discuss characteristics of pinnipeds and sort pinnipeds into true seals, eared seals, and walruses.

To simplify the activity for younger students, students can sort animals into mammals and non-mammals, then pick out marine mammals and pinnipeds from the pile of mammals.

MATERIALS

- Pictures or clipart of non-mammals, mammals and marine mammals (worksheets 1.2.1-1.2.3). For younger students (K-1), you can use manipulatives – plastic animals, or stuffed animals (a variety of mammals, marine mammals, and non-mammals). For older students, photocopy the worksheets with mammals, marine mammals, and non-mammals, and cut them into individual squares
- Worksheet 1.2.4 a+b, ("What is a mammal?") – these worksheets can be cut to provide two half-sheet worksheets for young students
- Worksheets 1.2.5 a+b, ("What is a marine mammal?")
- Student Worksheets 1.2.6, 1.2.7 ("What is a pinniped?")

PROCEDURES

This series of three activities is great for grades K-1. Students can work individually or in small groups. The activity can be set up as a station facilitated by one teacher, with a group of six to eight students

WHAT IS A MAMMAL?

- Ask students "What is a mammal?"
- Go through the four main characteristics of a mammal and list on the board:

  Has fur or hair

  Most mammals have live babies*

  Nurses young with milk

  Is warm-blooded (body is warm from the inside)

- Platypus and echidna (spiny anteater) are the only mammals that lay eggs.
- Put the Mammal Talking Points 1.2.4 up on the board.

PRODECURES continued

- Using one of the pictures of a mammal, or a stuffed mammal, talk about each of the characteristics. Hold up other pictures of mammals or non-mammals and ask the class if the animal is a mammal or a non-mammal.
- Give each student two to four small pictures (from worksheets 1.2.1 – non-mammals and 1.2.2 – mammals). Ask the students to sort the pictures into groups of mammals and non-mammals.
- Grades K-1 – hand out Worksheet 1.2.4 a or b (this can be cut in half so that you have two small worksheets, 8.5”x5.5” each).
- For worksheet 1.2.4 a or b, ask students to circle the mammals.
- Grades 2-3 – Using a book from the library, students can write a paragraph or short report on a mammal. Reports can include where the animal lives, what time of year it has its babies, how many babies it has, and what it eats.
- Grades 4-6 use stuffed animals or pictures to review characteristics of mammals, marine mammals, and pinnipeds.

WHAT IS A MARINE MAMMAL?

- Ask students “What is a marine mammal?”
  - Marine mammals are mammals that live in salt water.
- Review the four main characteristics of a mammal and list on the board:
  - Has fur or hair
  - Most mammals have live babies
  - Nurses young with milk
  - Warm-blooded (body is warm from the inside)
  - Most marine mammals live in salt water but there are some (Baikal seals, Saimaa seals, Caspian seals, some harbor seals, and river dolphins) that live in freshwater lakes, and marine mammals can go into fresh water.
  - Marine mammals breathe air (unlike fish, which get their oxygen from the water)
  - There are four main groups of marine mammals:
    - Whales, dolphins and porpoise (CETACEANS – “si-TAY-shens”)
    - Seals, sea lions and walrus (PINNIPEDS – “PINN-i-peds”)
    - Manatees and dugongs (SIRENIANS – “si-REHN-ee-ans”)
    - Sea otters, polar bears (Marine FISSIPEDS – "FISS-i-peds")
- Using one of the pictures of a marine mammal, or a stuffed marine mammal, talk about each of the characteristics. Hold up other pictures of marine mammals, fish, or other mammals, and ask the class if the animal is a marine mammal.
- Give each student three to six small pictures (from worksheets 1.2.1 – non-mammals, 1.2.2 – mammals and 1.2.3 – marine mammals). Ask the students to sort the pictures into groups of marine mammals and non-marine mammals. Can also use plastic animals to sort.
- Grades K-1 – hand out Worksheet 1.2.5 a or b (this can be cut in half so that you have two small worksheets, 8.5”x 5.5” each).
  - For worksheet 1.2.5 a or b, ask students to circle the marine mammals.
- Grades 2-3 – Using a book from the library, students can write a paragraph or short report on a marine mammal. Reports can include where the animal lives, what time of year it has its babies, how many babies it has, and what it eats.

WHAT IS A PINNIPED?

- Ask students “What is a pinniped?”
  - Pinniped means “fin-foot” and refers to a group of animals that includes true seals, eared seals and walrus.
- Hand out pictures (or plastic stuffed animals) of true seals, eared seals, and walrus. Ask students to look at their animal and talk about its characteristics. Have students sort themselves into groups based on whether they have a true seal, an eared seal, or a walrus. Go over the characteristics of each group:
  - True seal
    - No external ear flap (just a hole where the ear is)
    - Pulls itself over land on its stomach
    - Swims with hind flippers
  - Eared seal
    - Has external ear flap
    - Can walk on all four flippers on land
    - Swims with front flippers
  - Walrus
    - No ear flap
    - Can walk on all four flippers
    - Swims mostly with hind flippers, steering with front flippers
    - Both males and females have tusks

- Grades K-1 – hand out Worksheet 1.2.6 a or b (this can be cut in half so that you have two small worksheets, 8.5”x5.5” each) and student worksheet 1.2.7 a or b.
  - For worksheet 1.2.6 a or b, ask students to circle the pinnipeds.
  - For worksheet 1.2.7 a or b, ask students to circle the true seals, put squares around the eared seals and count the walrus. Have the students color in the number of boxes for the number of true seals, eared seals and walrus they counted. This activity can also be done in a more hands-on way by giving students pictures of true seals, eared seals, and walruses and making a graph on the white board.
- Grades 2-3 – Students can write a paragraph or short report on a pinniped, using a book from the library. Reports can include where the animal lives, what time of year it has its babies, how many babies it has, and what it eats.
- Grades 4-6 – Students complete worksheet 1.2.8 to review the characteristics of a mammal, marine mammal and pinniped.

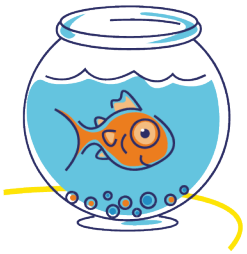
DISCUSSION

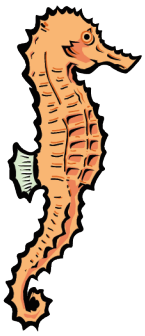
Review the characteristics of mammals, marine mammals, and pinnipeds.

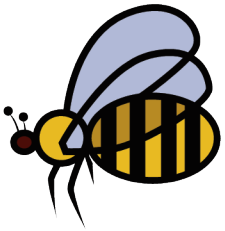
EXTEND AND EXPLORE

For any of the activities, graph the results (e.g. comparing the number of non-mammals to mammals).

ACTIVITY 1.2 WORKSHEET 1.2.1 Non Mammals

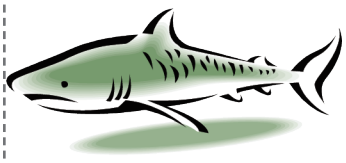


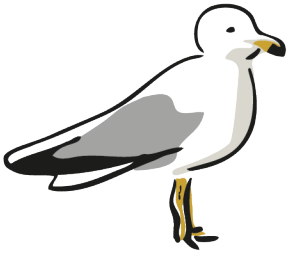
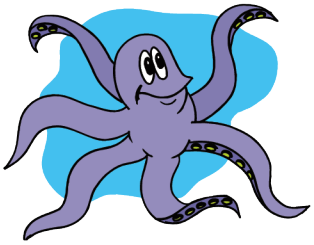


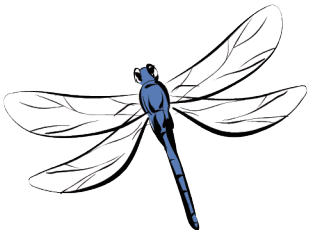
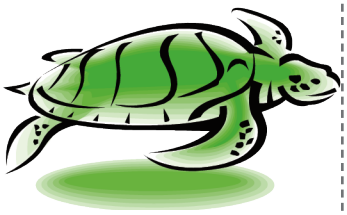
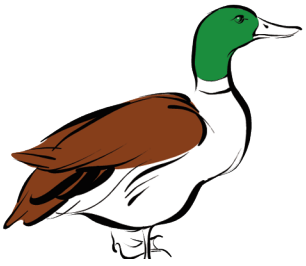





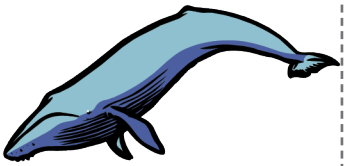




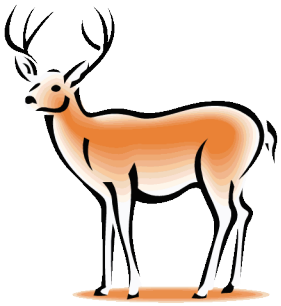



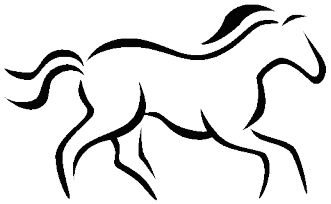
ACTIVITY 1.2 **WORKSHEET 1.2.2** Mammals

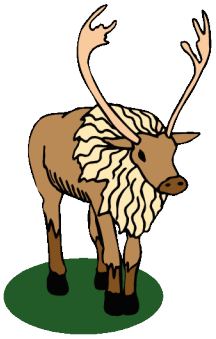
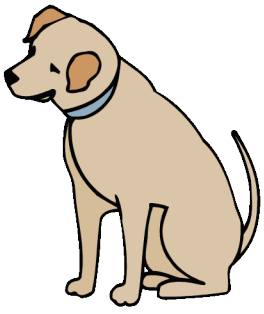





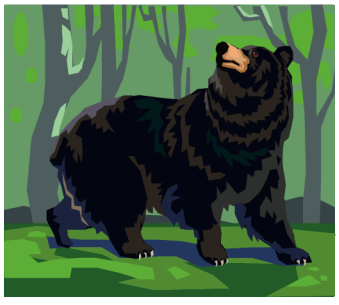



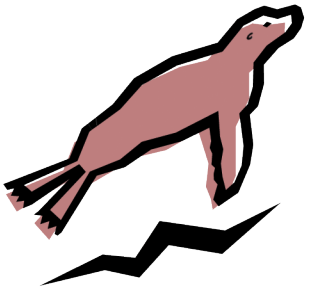










ACTIVITY 1.2 WORKSHEET 1.2.3 Marine Mammals

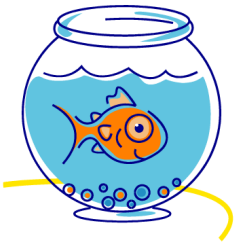
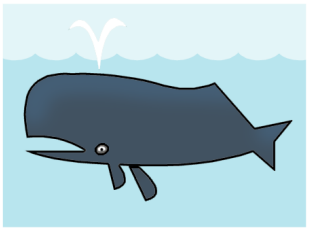


What is a mammal?

- Has fur or hair
- Most mammals have live babies
- Nurses young with milk
- Warm-blooded (body is warm from the inside)

ACTIVITY 1.2 WORKSHEET 1.2.4 a What is a Mammal?

Circle the mammals.



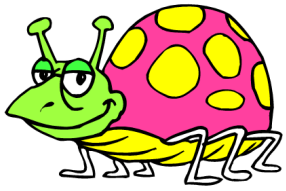
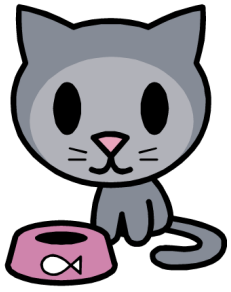
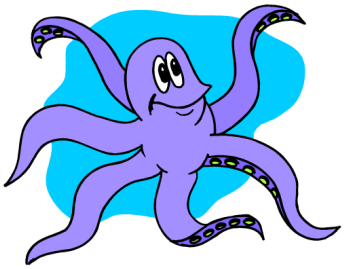




ACTIVITY 1.2 WORKSHEET 1.2.4 b What is a Mammal?

Circle the mammals.



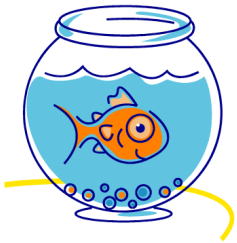
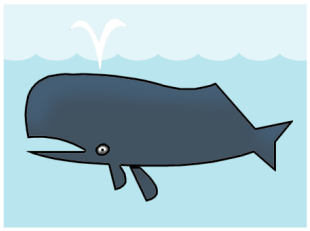


What is a marine mammal?

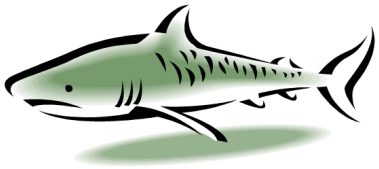
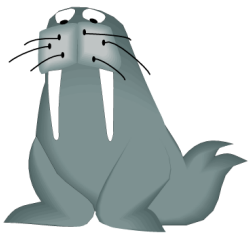
- Most marine mammals live in salt water
- Breathes air
- Has fur or hair
- Has live babies
- Nurses young with milk
- Warm-blooded (body is warm from the inside)

ACTIVITY 1.2 WORKSHEET 1.2.5 a What is a Marine Mammal?

Circle the marine mammals.



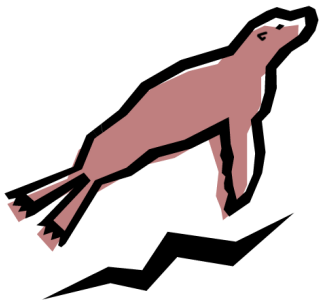
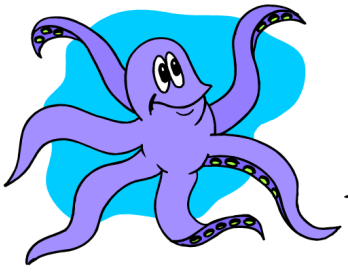




ACTIVITY 1.2 WORKSHEET 1.2.5 b What is a Marine Mammal?

Circle the marine mammals.





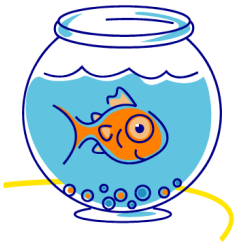
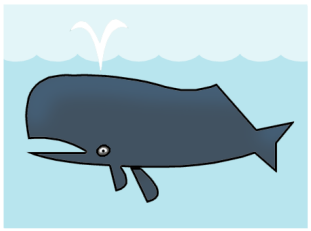





What is a pinniped?

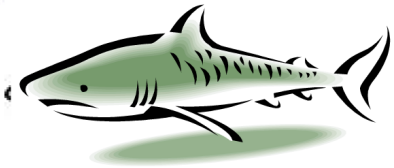
- Pinniped = Fin- foot
- True seal, eared seal, walrus
  - True seal
    - No ear flap
    - Crawls on land
    - Swims with hind flippers
  - Eared seal
    - Ear flap
    - Can walk on all four flippers
    - Swims cswith front flippers
  - Walrus
    - No ear flap
    - Can walk on all four flippers
    - Male and female have big tusks

ACTIVITY 1.2 WORKSHEET 1.2.6a What is a Pinniped?

Circle the pinnipeds.





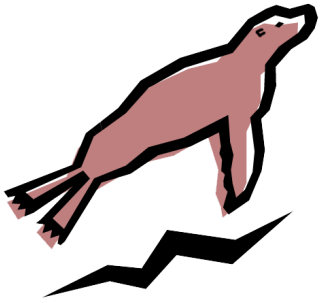
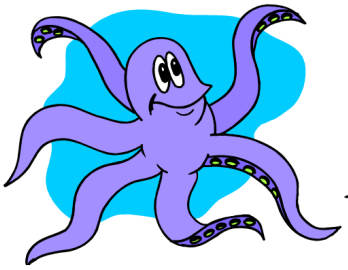


ACTIVITY 1.2 WORKSHEET 1.2.6b What is a Pinniped?

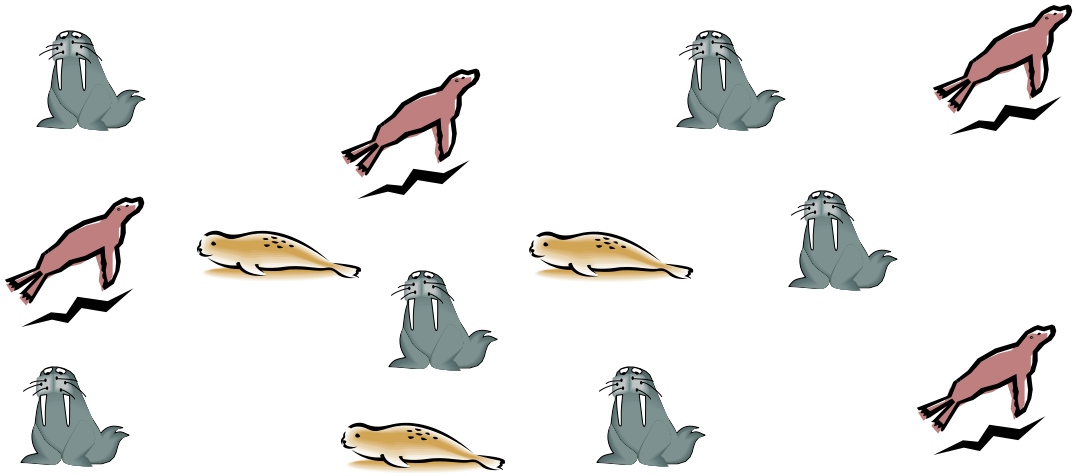
Circle the pinnipeds.



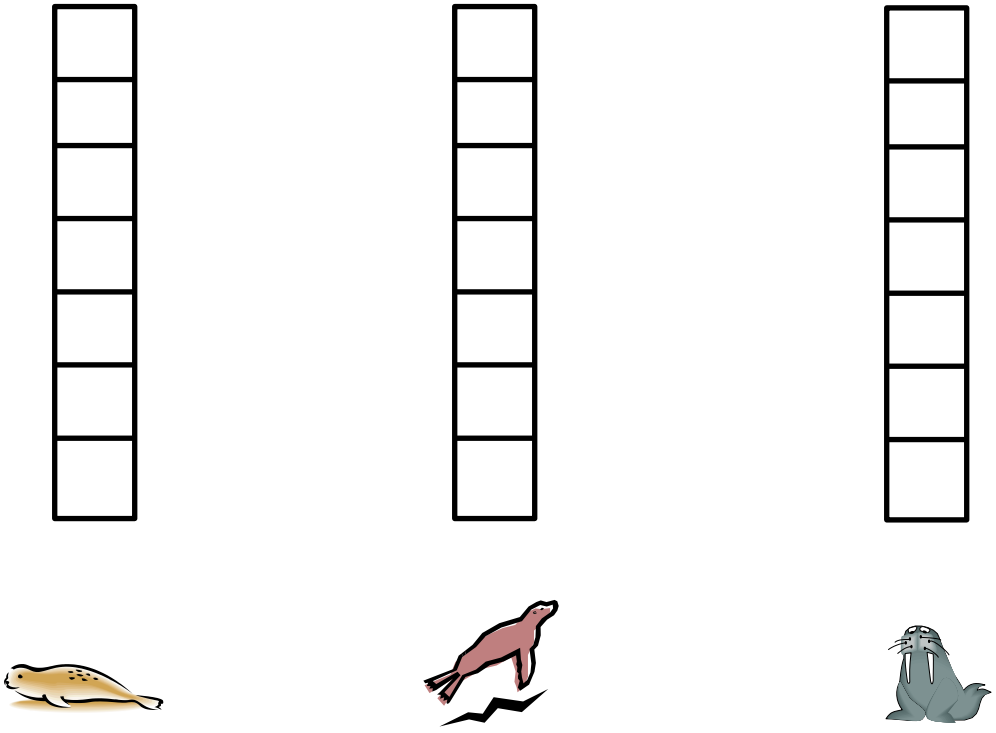



Circle the true seals.
Put squares around the eared seals.
Count the number of walruses.



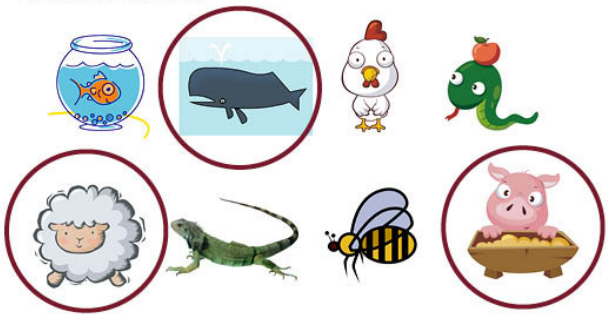
Show how many true seals, eared seals and walruses you found.



ACTIVITY 1.2 TEACHER KEYS

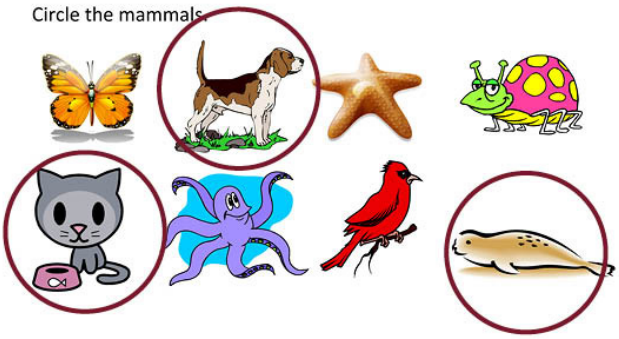
ACTIVITY 1.2 WORKSHEET 1.2.4 a What is a Mammal?

Circle the mammals.



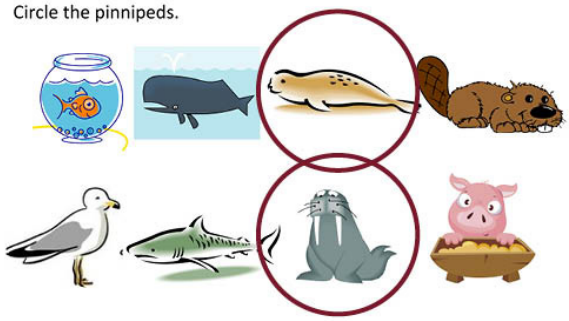
ACTIVITY 1.2 WORKSHEET 1.2.4 b What is a Mammal?

Circle the mammals.



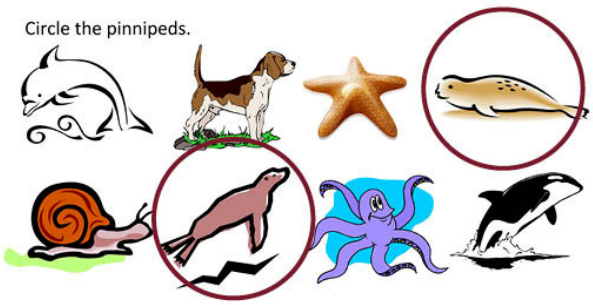
ACTIVITY 1.2 WORKSHEET 1.2.6a What is a Pinniped?

Circle the pinnipeds.



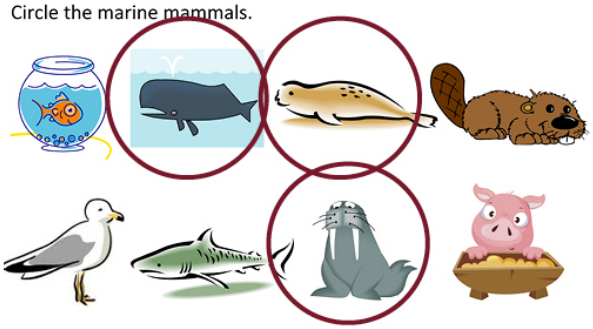
ACTIVITY 1.2 WORKSHEET 1.2.6b What is a Pinniped?

Circle the pinnipeds.



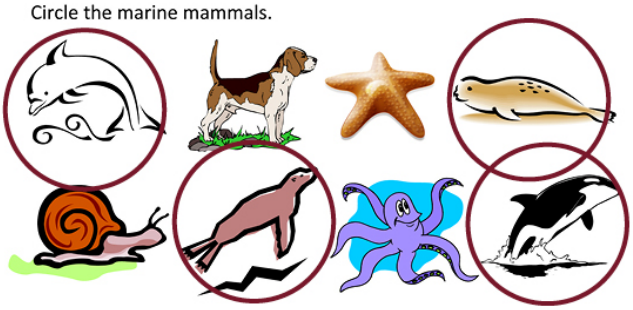
ACTIVITY 1.2 WORKSHEET 1.2.5 a What is a Marine Mammal?

Circle the marine mammals.



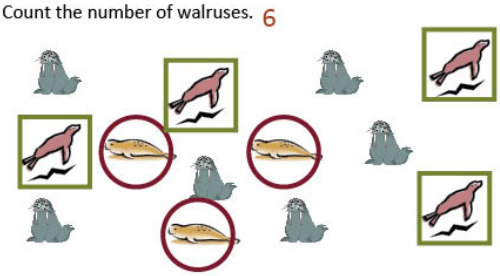
ACTIVITY 1.2 WORKSHEET 1.2.5 b What is a Marine Mammal?

Circle the marine mammals.

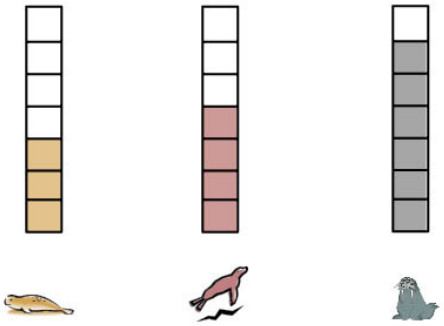


ACTIVITY 1.2 WORKSHEET 1.2.7 Graphing

Circle the true seals.
Put squares around the eared seals.
Count the number of walruses. 6



Show how many true seals, eared seals and walruses you found.



What is a mammal?

There are four characteristics of a mammal.
List as many as you can.

1. _____

2. _____

3. _____

4. _____

Name at least three marine mammals. Note: Penguins are not marine mammals.

1. _____

2. _____

3. _____

Pinnipeds are a type of marine mammal. Name at least three pinnipeds.

1. _____

2. _____

3. _____

What is a mammal? ANSWERS MAY VARY

There are four characteristics of a mammal.
List as many as you can.

1. has hair or fur
2. most mammals have live babies
3. nurses young with milk
4. warm-blooded (body is warm from the inside)

Name at least three marine mammals.

1. northern fur seal
2. orca whale
3. sea otter

Pinnipeds are a type of marine mammal. Name at least three pinnipeds.

1. northern fur seal
2. harbor seal
3. walrus

LESSON ONE | SCIENCE ACTIVITY 1.3 | Grade Level K-6

Describe A Pinniped

OBJECTIVE

Students will identify physical characteristics of different types of pinnipeds in Alaska.

TIME REQUIRED

20 minutes

BACKGROUND

Pinnipeds are separated into three general groups: true seals (phocid); eared seals (otariid); and walruses (odobenid). Students will identify physical characteristics of each type of seal pictured and sort them into common groups.

MATERIALS

- Pictures of northern fur seal, Steller sea lion, harbor seal, and walrus (optional: include pictures of ice-associated seals – ringed, bearded, ribbon, spotted seals)
- Marine mammal reference books (from library) or *Guide to Marine Mammals of Alaska* by Kate Wynne, for older students (grades 4-6)
- T-chart
- List of Unangan names for seals

PROCEDURES

- For younger grades (K-2 or K-3) this activity can be completed as a class. For older grades, divide students into small groups or pairs and give each group a picture of a pinniped. At minimum, northern fur seal, Steller sea lion, harbor seal, and walrus should be used. Use one animal as an example and go through the process with the whole class before they work independently. Depending on the age of the students, you can choose to set up four or five characteristics that they need to describe (e.g. body shape, head shape, length of flippers, presence/absence of ear flaps, standing on all four flippers), or have the students come up with their own categories.
- Tell students to write down physical characteristics that they see for their animal
  - Body shape
  - Length and shape of flippers
  - Shape of head, presence or absence of ear flaps
  - Patterns on fur
  - Whether the animal can stand up on its flippers or lies on its stomach
  - Shape of flippers
  - Any other characteristics they can come up with
- For older students, ask them to use reference books to look up facts about the animal, including length, weight, distribution
- When groups are finished, ask them to present their results to the class. Create a class summary of characteristics
- Have a student from each group stand at the front of the class with a picture of their animal. Ask the class to sort students into groups based on common characteristics of their animal.

DISCUSSION

Review the main characteristics of true seals, eared seals, and walruses.

EXTEND AND EXPLORE

- Ask each group to take the picture of their animal to an elder in the community and ask about the Unangam, non-English, or other traditional name for the animal and any knowledge about the animal.
- Ask students to research the correct format for citing a book. Use *Guide to Marine Mammals of Alaska* as an example.

REFERENCES

Wynne, Kate. Folkens, Pieter. *Guide to Marine Mammals of Alaska*. Alaska Sea Grant Program. Fairbanks, AK: University of Alaska Fairbanks, 2009.

Bergsland, Knut. *Aleut Dictionary*. Fairbanks, AK: University of Alaska Press, 1994.

ACTIVITY 1.3 WORKSHEET 1.3.1 Describe a pinniped: Pictures of true seals

 **Harbor seal**	 **Harbor seal**
 **Spotted seal**	 **Spotted seal**
 **Ribbon seal**	 **Ribbon seal**
 **Ringed seal**	 **Ringed seal**

ACTIVITY 1.3 **WORKSHEET 1.3.2**

Describe a pinniped: Pictures of eared seals



Fur seal (male)



Fur seal (male and female)



Fur seal (female)



Fur seal (female)



Sea lion (male)



Sea lion (male and female)



Sea lion (female and pup)



Sea lion (female)

ACTIVITY 1.3 WORKSHEET 1.3.3 Describe a pinniped: Pictures of walrus

	
Walrus	**Walrus**

ACTIVITY 1.3 **WORKSHEET 1.3.4**

Describe a pinniped: Unangam names of pinnipeds

Note: numbers in parentheses refer to page numbers in the *Aleut Dictionary* (Knut Bergsland). Refer to P. 727 for words for different types of seal, fur seal and sea lion.

Harbor seal

lsux̂ – (214) – harbor seal

Spotted seal

ukutux̂ – (432) – small white hair seal with black spots (shows up in winter, sticks head up and looks around) – possibly spotted seal

Ribbon seal

iglagayax̂ - (179) – ribbon seal

tux̂tux̂ (403) – small kind of seal (comes from north in cold weather), probably ribbon seal

Ringed seal

puchaaskiĝilix (288) – ringed seal

Fur seal

Laaqudax̂ – (254) – fur seal (eastern dialect)

Algamiklux̂ – (52) – fur seal (western dialect)

Laaqudaax̂ - (254) – fur seal pup

Sea lion

Qawax̂ – (313) – Steller sea lion

Walrus

Amgaadax̂ – (64) – walrus

ACTIVITY 1.3 WORKSHEET 1.3.5 Describe a pinniped

Animal Name:	
Characteristic	Description

ACTIVITY 1.3 TEACHER KEY 1.3.5 Describe a pinniped*

Animal Name: Northern fur seal

Characteristic	Description
Body shape	Big and bulky (adult male); long and sleek, with long neck (female, juvenile)
Head shape	Small in comparison to the rest of the body; nose very short and pointed; eyes large. External ear flaps.
Flipper shape	Large foreflippers; fur stops partway down the flipper. Hindflippers can rotate forward under the body so that the fur seal can stand up on all four flippers. Hindflippers are long and narrow and have very very long toes that can be bent. Hindflippers have nails or claws that they use to scratch themselves.
Fur	Fur is dark and thick; on males there is a thicker area of fur on the neck and head. Fur has two layers, a dense underfur and longer guard hairs. Juveniles and females have a silvery-brown coat which is lighter on the underside of the animal, and lighter cream-colored "cheek patches." Male fur color is more uniformly dark brown. Pups have black fur at birth. Pups molt into their first silvery-brown coat by October of their first year.
(example of information that students can get from reference books)	
Length	
Weight	
(can also add in characteristics that you know personally)	
Meat	Darker than sea lion; tastes different than sea lion
Intestine	Used to make waterproof clothing

**** create a key for each seal***

LESSON ONE | SCIENCE ACTIVITY 1.4 | Grade Level K-3

Walk and Swim Like a Pinniped

OBJECTIVE

Students will use their bodies to learn the difference in how seals and fur seals walk and swim by moving themselves.

TIME REQUIRED

10 minutes

BACKGROUND

Fur seals and harbor seals are mammals, marine mammals, and pinnipeds. But fur seals are otariids (eared seals) and harbor seals are phocids (true seals). The characteristics of each group are covered in Activity 1.2 (Mammals, Marine Mammals, and Pinnipeds) but you can review them here:

True seal (phocid):

- No external ear flap (just a hole where the ear is)
- Pulls itself on stomach when on land, using its foreflippers
- Propels itself through water with hind flippers (front flippers are used to steer)

Eared seal (otariid):

- Has external ear flap
- Walks on all four flippers on land
- Swims with front flippers

The shape of the pinniped's body affects the way it moves on land and in the water.

A harbor seal (true seal) has a torpedo-shaped body. Its hind flippers are behind the body (not rotated underneath it) so it cannot stand on all four flippers but instead rests on its stomach when it is on land. A harbor seal uses its hind flippers to propel itself through the water.

A fur seal (eared seal) is able to stand up on four limbs on land. Its flippers are larger and the hind flippers rotate forward under its body. In the water, a fur seal uses its large front flippers to "fly" through the water, pulling its body through the water.

MATERIALS

- Picture of fur seal (standing on land) or a stuffed fur seal toy
- Picture of harbor seal (on land) or a stuffed harbor seal toy

PROCEDURE

Walk Like a Seal

- Show students the pictures of the fur seal and harbor seal, and ask them to describe the differences between the two pinnipeds. Ask them to describe differences in the shape of the body, head, and flippers, and the size of the flippers, and the difference in how the pinnipeds are when they are on land (fur seal is "standing up," harbor seal is "lying down").
- Describe how fur seals can walk on all four flippers, while harbor seals crawl more on their tummies. Tell students that they are going to find out how seals move on land.
- Have students move from one end of the room to the other. In smaller groups or with younger students, you can have the students move in a big circle
- Demonstrate how fur seals move on land (have students walk on hands and knees). Ask the students to go across the room walking like a fur seal.
- Demonstrate how harbor seals move on land (have students lie on their stomach and pull themselves forward with their arms). Ask the students to go across the room moving like a harbor seal.
- You can make a game of this, by saying "harbor seal" or "fur seal" and having them show you how the animals move on land.

Swim Like a Seal

- Show the students the pictures of the fur seal and harbor seal again, and ask them how they think each pinniped swims underwater. Emphasize that the body shape, and the size of the flippers, might give them clues to how they swim.
  - Describe how fur seals use their large foreflippers to "fly" through the water – they pull their body through the water. You can relate this motion to students swimming with their arms underwater. Describe how harbor seals use their hindflippers to propel themselves underwater – they move their hindflippers from side to side to push the body through the water, and use their foreflippers to steer.
  - Demonstrate how fur seals swim underwater (have students walk while using their arms to flap). Ask students to go across the room swimming like a fur seal.

  - Demonstrate how harbor seals swim underwater (here, we have students hold their hands by their sides and take shuffling steps with their feet to show that harbor seals swim with their hind flippers). Ask students to go across the room swimming like a harbor seal.
- You can make a game of this, by saying "harbor seal" or "fur seal" and having them show you how the animals swim underwater.

DISCUSSION

At the end of this activity, gather students around and ask why they think the pinnipeds have different ways of moving on land and underwater.

The way a pinniped moves on land or underwater depends on the pinniped's body shape. Fur seals have larger foreflippers and can rotate the hindflippers under the body to walk on all fours. True seals have small foreflippers and cannot rotate the hindflippers under the body.

Older students can look up facts about pinniped swimming speed on the Internet.

EXTEND AND EXPLORE

Watch video clips of seals swimming.

- On TeacherTube: http://www.teachertube.com/viewVideo.php?video_id=290725
- On YouTube: http://youtu.be/JR2o56tGtuY
- On Vimeo: http://vimeo.com/63205204

LESSON ONE | SCIENCE ACTIVITY 1.5 | Grade Level K-6

Venn Diagram of Pinnipeds

OBJECTIVE

Students will identify similarities and differences of pinnipeds in Alaska.

TIME REQUIRED

20 minutes

BACKGROUND

Pinnipeds are separated into three general groups: true seals (phocid), eared seals (otariid) and walruses (odobenid). This exercise can be done with three specific examples of each group (e.g. harbor seals, fur seals, walrus) or with characteristics of the group as a whole.

MATERIALS

- Class summary from Activity 1.3 – Describe a pinniped
- Venn Diagram chart

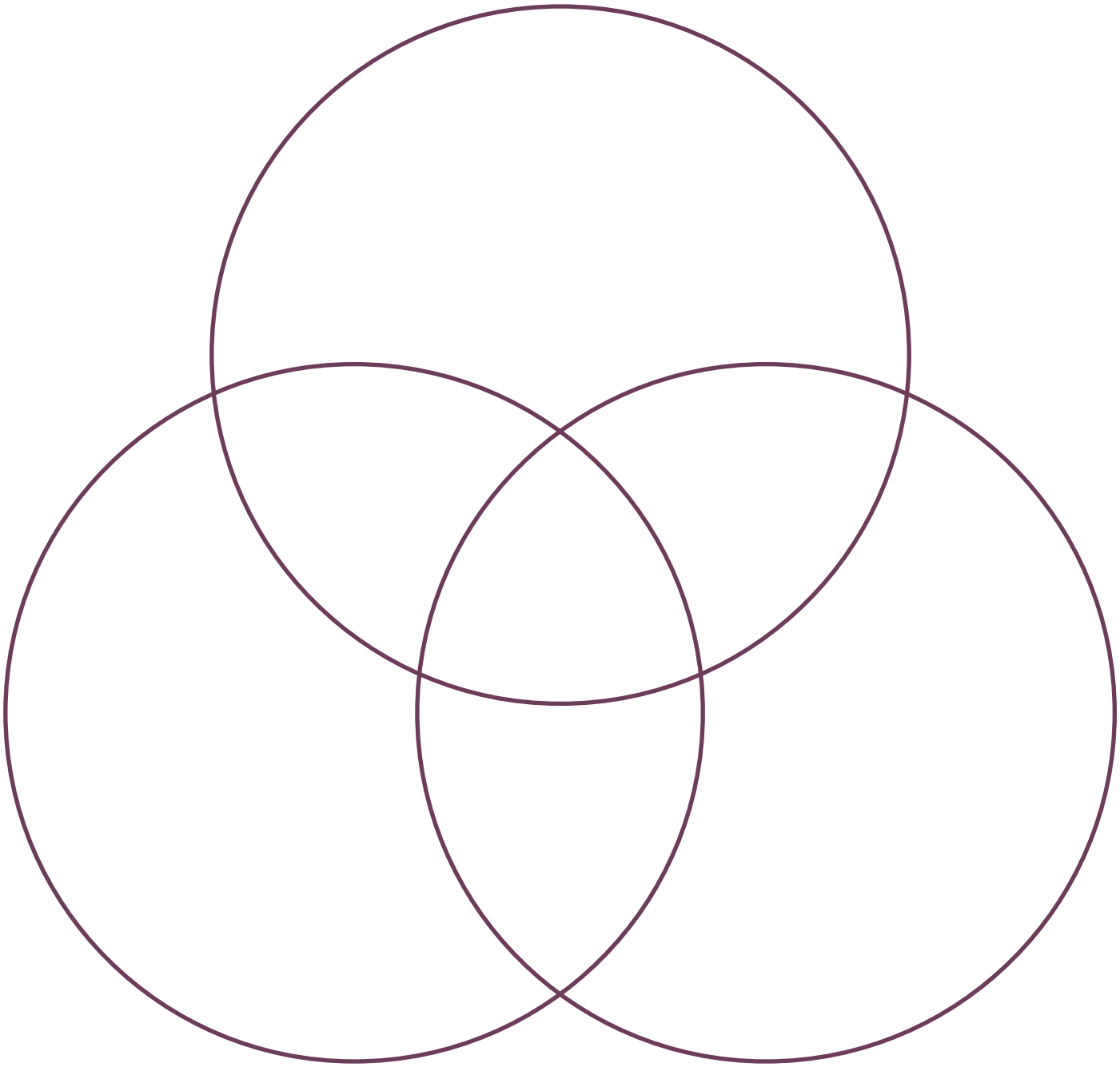
PROCEDURES

- This activity can be used as an assessment by providing the students with the characteristics and asking them to place them in the appropriate area of the Venn Diagram.
- For younger grades (K-2 or K-3) complete Worksheet 1.5.1 as a class. For older grades, the class summary from Worksheet 1.3.5 "Describe a Pinniped" can be handed out or shown on the projection screen.
  - Use descriptions of species from Activity 1.3; choose one eared seal, one true seal, and walrus.
  - Fill in the Venn diagram with the characteristics of the three pinniped groups, showing characteristics that the three groups have in common and characteristics that are unique to each group.

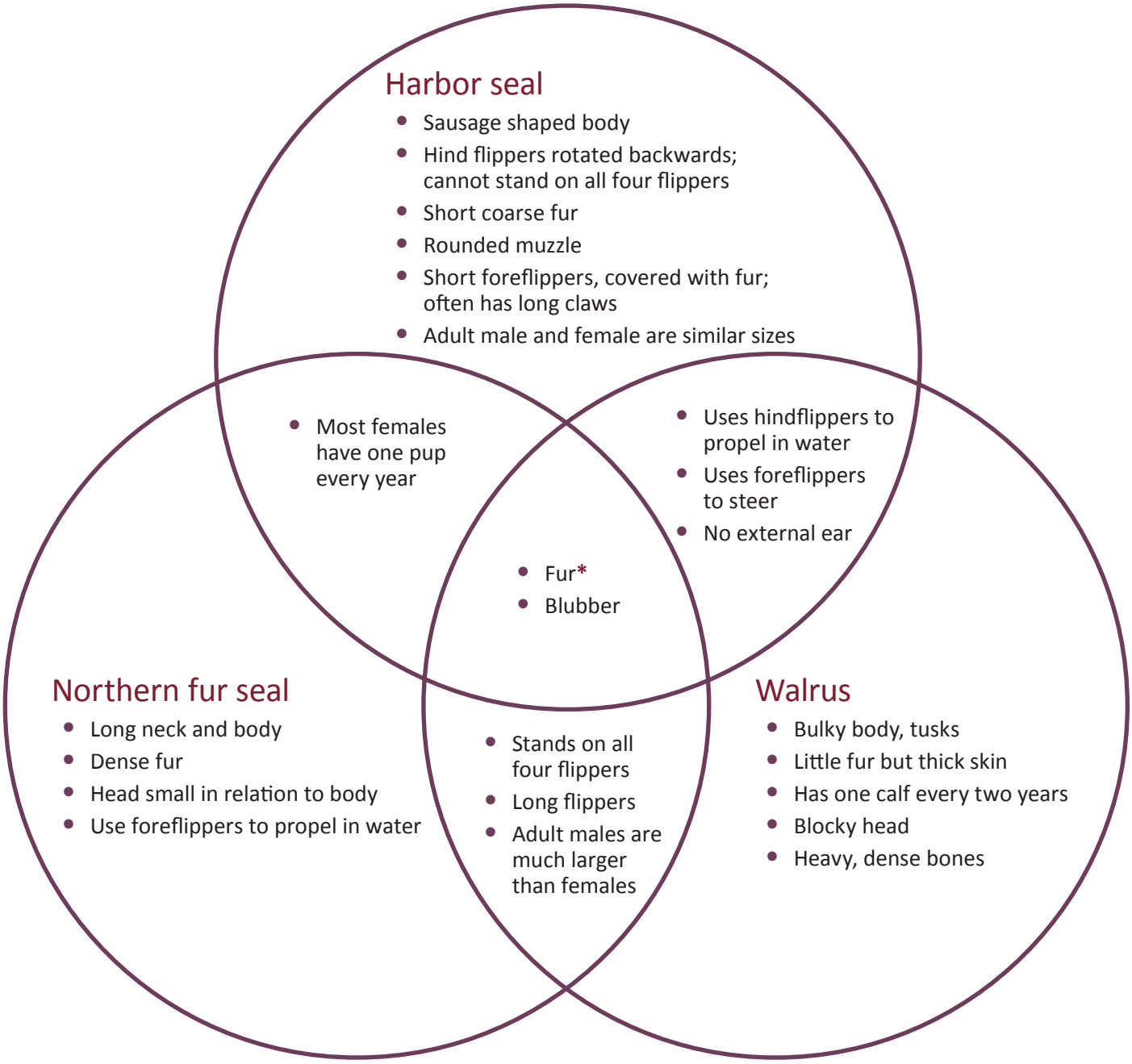
DISCUSSION

Discuss similarities and differences between the three groups of pinnipeds.

ACTIVITY 1.5 WORKSHEET 1.5.1 Venn Diagram



ACTIVITY 1.5 TEACHER KEY 1.5.1 Venn Diagram



Fur: True seals and sea lions have short, coarse fur. Fur seals have two layers of fur, dense underfur and outer guard fur. Walrus have very little fur.

LESSON ONE | SCIENCE ACTIVITY 1.6 | Grade Level K-6

Label the Parts of a Pinniped

OBJECTIVE

Students will learn the parts of a pinniped by labeling a diagram.

TIME REQUIRED

10 minutes

MATERIALS

Worksheet – Label the parts of a pinniped in English or Unangan.

PROCEDURE

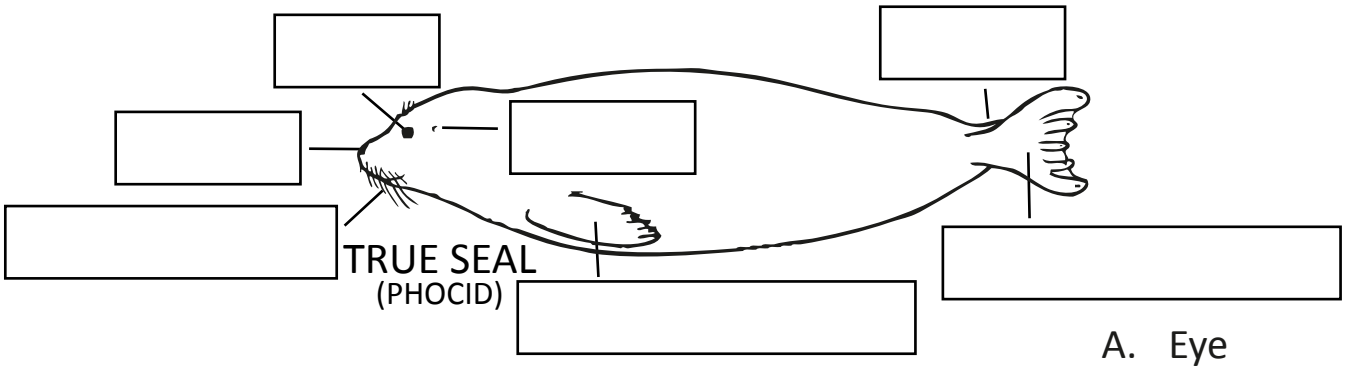
Hand out the worksheet and have students either put the letter corresponding to the body part in the appropriate box or write in the name of the body part.

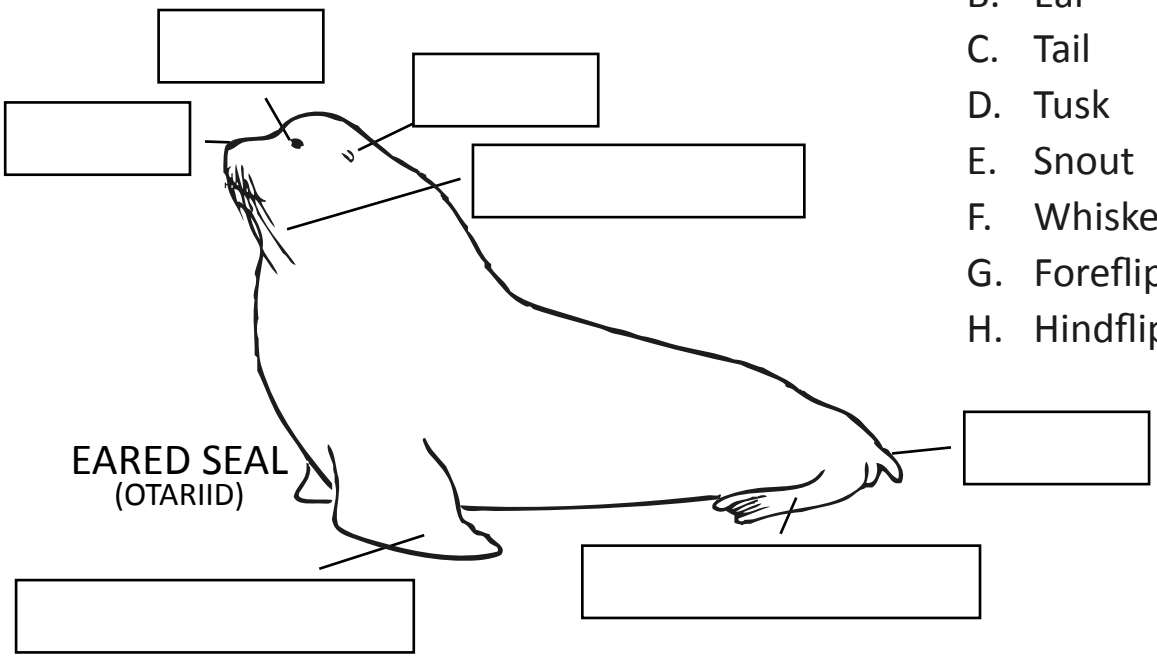
EXPLORE AND EXTEND

Using Worksheet 1.6.1 and the list of Unangam words, have students look up the Unangam names for the body parts (see PowerPoint slide) and write these names in the appropriate boxes.

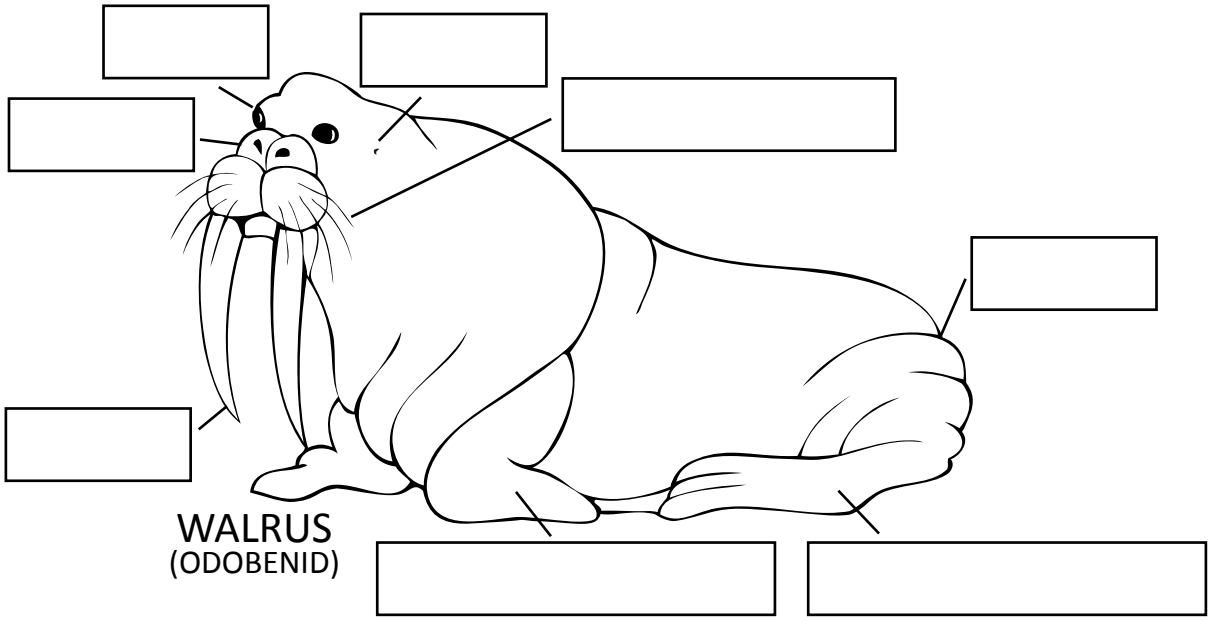
ACTIVITY 1.6 WORKSHEET 1.6.1 Label the parts of a pinniped

Label the parts of the three pinnipeds with the letters corresponding to the name of the body part.

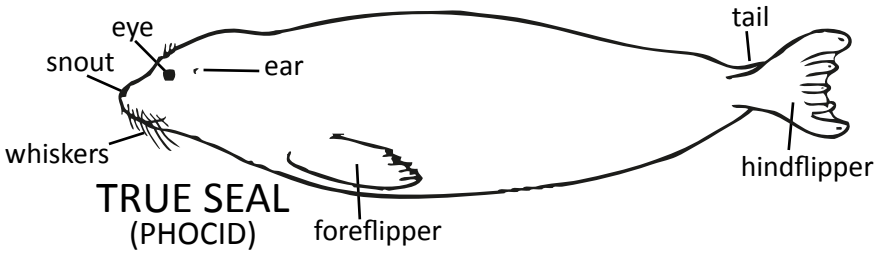




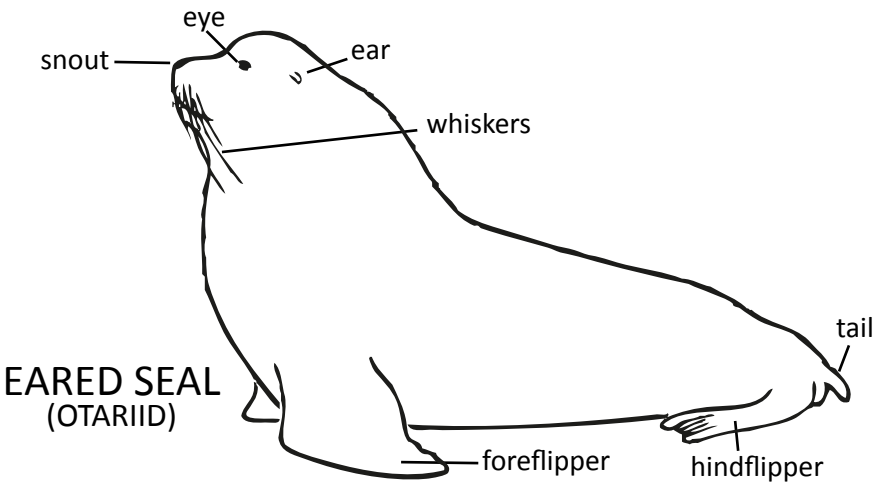
A. Eye
B. Ear
C. Tail
D. Tusk
E. Snout
F. Whiskers
G. Foreflipper
H. Hindflipper

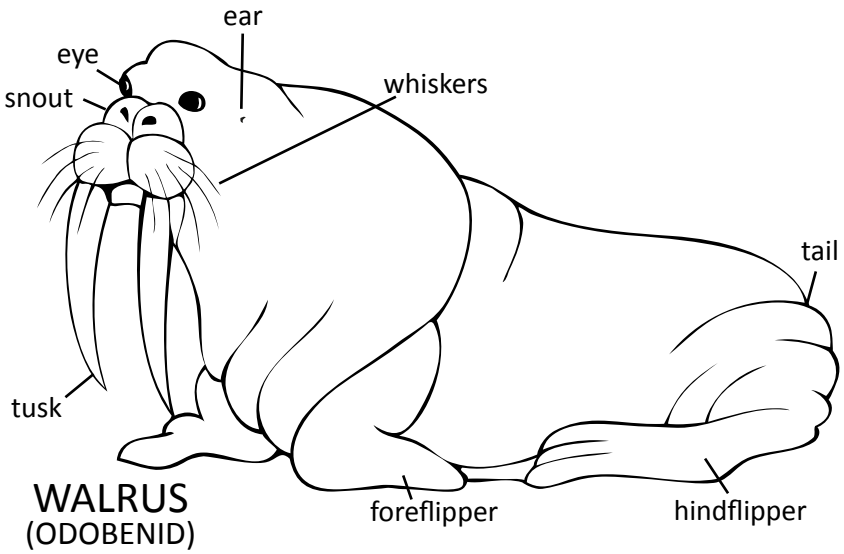


ACTIVITY 1.6 TEACHER KEY 1.6.1 Label the parts of a pinniped



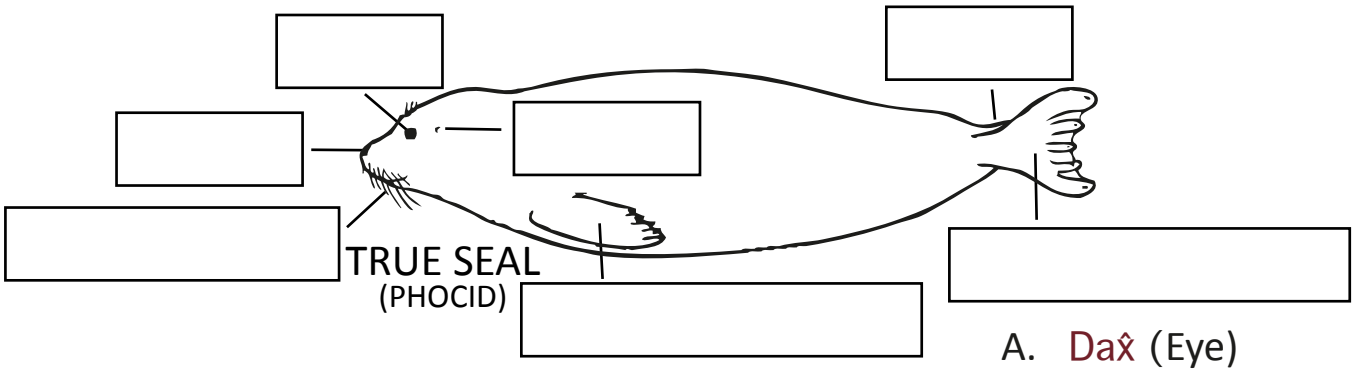
A. Eye
B. Ear
C. Tail
D. Tusk
E. Snout
F. Whiskers
G. Foreflipper
H. Hindflipper



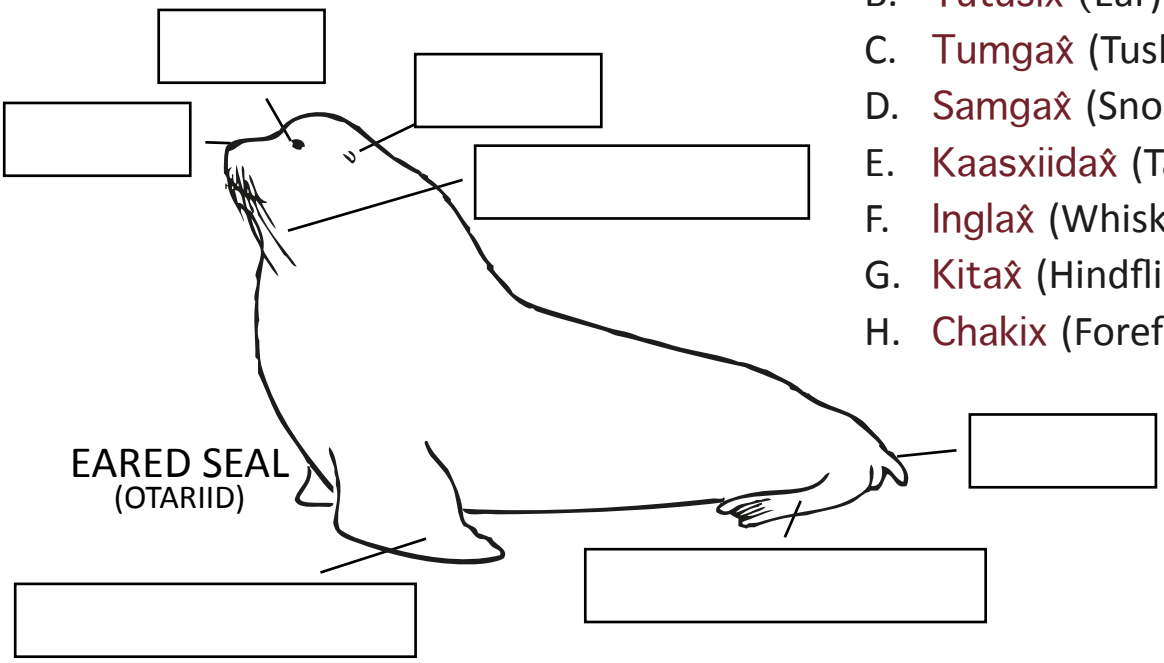


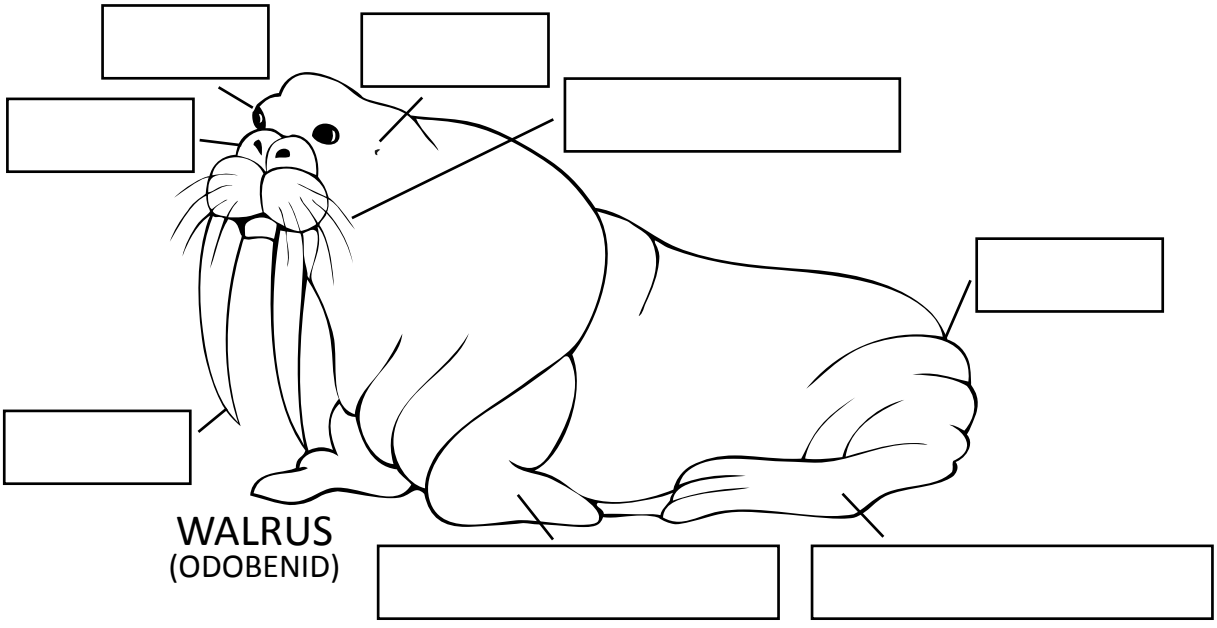
ACTIVITY 1.6 WORKSHEET 1.6.2 Label the parts of a pinniped in Unangan

Label the parts of the three pinnipeds with the letters corresponding to the name of the body part.

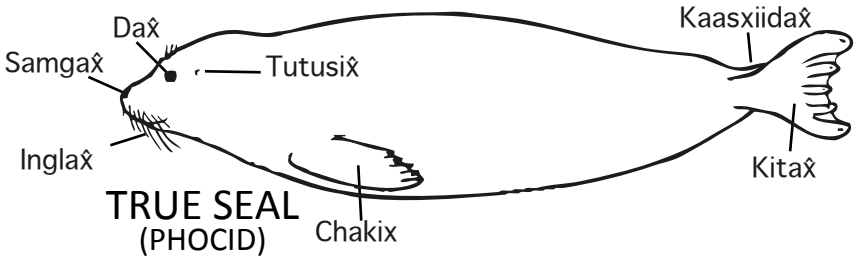


A. Daŷ (Eye)
B. Tutusiŷ (Ear)
C. Tumgaŷ (Tusk)
D. Samgaŷ (Snout)
E. Kaasxiidaŷ (Tail)
F. Inglaŷ (Whiskers)
G. Kitaŷ (Hindflipper)
H. Chakix (Foreflipper)

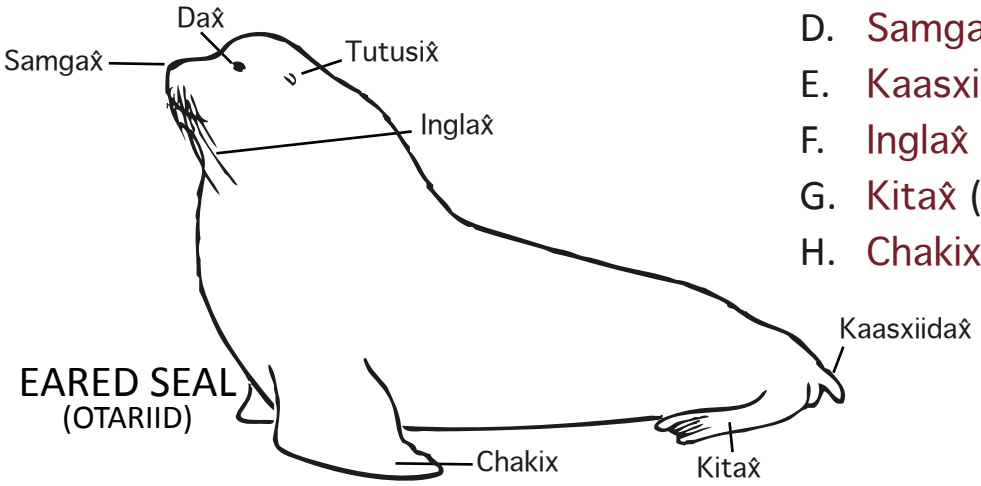


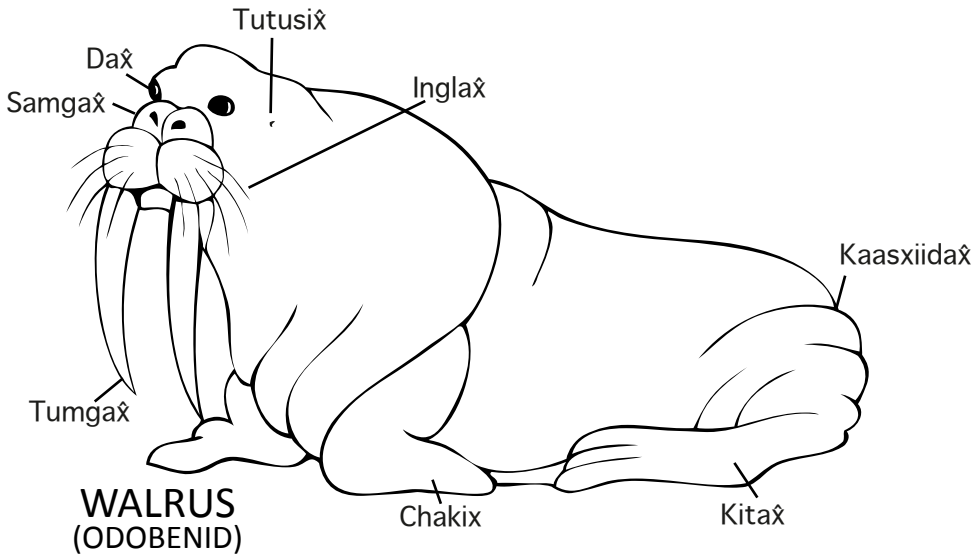


ACTIVITY 1.6 TEACHER KEY 1.6.2 Label the parts of a pinniped in Unangan



A. Dax̂ (Eye)
B. Tutusix̂ (Ear)
C. Tumgax̂ (Tusk)
D. Samgax̂ (Snout)
E. Kaasxiidax̂ (Tail)
F. Inglax̂ (Whiskers)
G. Kitax̂ (Hindflipper)
H. Chakix (Foreflipper)





LESSON ONE | SCIENCE ACTIVITY 1.7 | Grade Level K-6

Fur

OBJECTIVE

Students will learn the structure and uses of fur seal pelage.

TIME REQUIRED

10 minutes

BACKGROUND

Pelage is the fur, hair, or wool of a mammal. The word is often used by the fur industry and scientific community.

All marine mammals in the Bering Sea need to maintain their core body temperatures in frigid waters. Fur seals and otters use air trapped in their thick fur to keep warm; harbor seals use a thick blubber layer under their fur; humans use clothing and shivering.

Russian fur traders discovered the northern fur seal herds on the Pribilof Islands in 1786. Millions of fur seals were harvested by Russia and the United States until the commerical fur harvest ended in 1972 on St. George Island and 1984 on St. Paul Island.

Fur seals have two types of fur: guard hairs (stiff long hairs that protect the underfur) and underfur where warm air is trapped to prevent loss of body heat. Fur seals have 300,000 hairs per square inch; sea otters have 1,000,000 hairs per square inch. Humans have a total of 100,000 hairs on the entire head.

Fur seal pelage became extremely fashionable once a commercially viable process for removing the guard hairs was discovered.

Highly skilled Unangan workers were used by both the Russians and Americans to kill and skin fur seals and then remove the blubber and pack the skins for further processing off the Pribilof Islands. Both St. Paul and St. George housed a processing plant where the following steps took place:

1. Skins were soaked in sea water
2. Blubbered, to remove all blubber from hide
3. Salted, to draw moisture from the pelage
4. Packed in wooden barrels and shipped off island

Furs were processed in factories in London and St. Louis (cleaned, stretched and dried, guard hairs removed, and dyed). The final processed fur was sold at auction to the clothing industry.

MATERIALS

- Natural fur seal pelage
- Processed and dyed fur seal pelage
- Harbor seal pelage (if available)
- Sea otter pelage (if available)
- Other fur found locally (e.g. caribou, fox, wolf, rabbit, raccoon)

PROCEDURES

- Let all of the students touch, explore and handle the pelages.
  - Discuss how the animal kept warm.
  - Discuss how humans keep warm.
- If you have fur seal or sea otter pelage push the guard hairs against the grain to expose the light colored underfur.
  - Discuss the difference between the natural and processed fur.

DISCUSSION

How many layers of fur does the fur seal have?

Two – the guard hair and the underfur

What made the fur so desirable?

Once the guard hair was removed the underfur was very soft, dense, and warm.

EXPLORE AND EXTEND

If harbor seal and otter pelts are available, compare their fur to the northern fur seal fur.

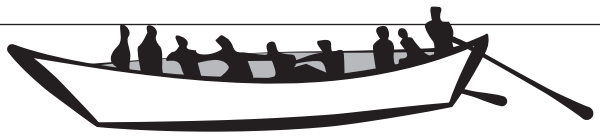
- Discuss which pelage belongs to which animal
- Discuss the unique properties of each pelage and how the fur keeps the animal warm

  Sea otters and fur seals trap air in the underfur.

  Harbor seals have blubber under their fur.
- View videos from *The Pribilof Island: Preserving the Legacy* regarding blubbering: http://docs.lib.noaa.gov/noaa_documents/NOS/ORR/TM_NOS_ORR/TM_NOS-ORR_17/HTML/Pribilof_html/Pages/pribilof_video_gallery.htm

LESSON TWO

Who are the Unangan?



Subject Area(s): Life science, history, cultural	**Grade Levels:** K-6	Presentation – 10 minutes Activities – variable

Lesson Topics:	Unangan historical overview and Unangan relationship to marine mammals	**Focus Questions**	• Who are the Unangan? • What is their relationship to marine mammals?
Learning Objectives:	Students will: • interpret the Unangan literature, describe the geography, and illustrate the differences between Unangan and non-Unanagan clothing.	**Key words:**	Unangan, Pribilof Islands, culture, history

ACTIVITIES		ALASKA STANDARDS			
		Science	History	Minutes	Grades
Activity 2.1	I Am Who I Am	SF1.1–1.3	PPE2,7 ICGP2	40	K–6
Activity 2.2	Where are the Aleutian Islands and the Pribilof Islands?	SF1.1–1.3	PPE1–3 ICGP2	20	K–6
Activity 2.3	Unangam Clothing and Environment	SF1.1–1.3	PPE1–3 ICGP2	20	K–6
Activity 2.4	Aleut Stories (Images)	SF1.1–1.3	PPE1–3 ICGP2	20	K–3

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.

SF2 Students develop an understanding that some individuals, cultures, and societies use other beliefs and methods in addition to scientific methods to describe and understand the world.

SF3 Students develop an understanding of the importance of recording and validating cultural knowledge.

American History-People, Places, Environment (PPE)

The student demonstrates an understanding of the interaction between people and their physical environment by:

PPE 1 comparing and contrasting geographic regions of Alaska.

PPE 2 using texts/sources to analyze the similarities and differences in the cultural attributes (e.g., language, hunting and gathering practices, art, music/dance, beliefs, worldview), movement, interactions, and settlement of Alaska Native peoples.

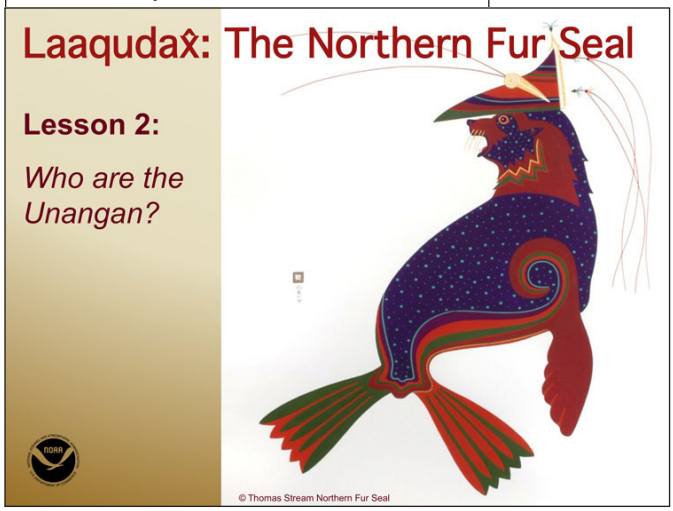
PPE 3 using texts/sources to analyze the effect of the historical contributions and/or influences of significant individuals, groups and local, regional, statewide, and/or international organizations.

PPE 7 using texts/sources to explain the political, social, cultural, economic, geographic, and historic characteristics of the student's community or region.

Individual, Citizenship, Governance, Power (ICGP)

The student demonstrates an understanding of the historical rights and responsibilities of Alaskans by:

ICGP 2 using texts/sources to analyze the impacts of the relationships between Alaska Natives and Russians (i.e., Russian Orthodox Church, early fur traders, Russian American Companies, enslavement, and Creoles).



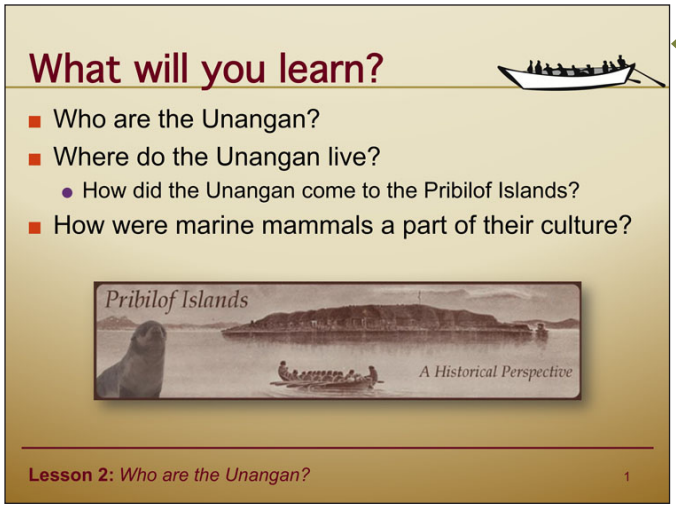
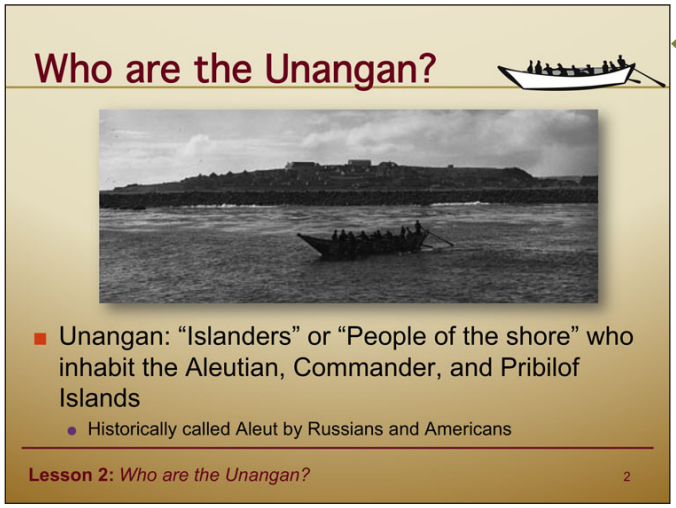


Image: Pribilof Islands Preserving the Legacy; NMML collection/AFSC/ NMFS/NOAA



The Unangan traveled to the Aleutian Islands from Asia, across the Bering Land Bridge. The term “Aleut” was first used by the Russians, but they also used the term “Aleut” to refer to other, non-Unangan people (Koniag Eskimos from Kodiak Island and other southern Eskimos, who had a different culture and language).

The Unangan lived in the Aleutian Islands for thousands of years, had a rich material culture in which each Unangan owned many possessions, and a complex intellectual culture that included their own written language and a detailed knowledge of human anatomy. Unangan were skilled sailors and navigators, and traveled among the Aleutian Islands for hundreds of miles in their kayaks (ulluxtaq).

Source: Laughlin, W. 1980. Aleuts: Survivors of the Bering Land Bridge; Torrey, B. 1978. Slaves of the Harvest.

Photo: Baidar near East Landing, St. Paul Island, Alaska – Pribilof Islands Preserving the Legacy; NMML collection/AFSC/NMFS/NOAA

Where did Unangan traditionally live?

- Aleutian and Commander Islands
- Beginning in the 1780s, Unangan lived on the Pribilof Islands
- Unangan called the Pribilof Islands **Tanax̂-Amix̂**



Lesson 2: *Who are the Unangan?* 3

The Unangan originally arrived in the Aleutian Islands on Umnak Island, then migrated in two groups: west towards Attu Island and east towards the Alaska Peninsula.

Today Unangan live all over Alaska and the lower 48 states.

Source: Laughlin, W. 1980. Aleuts: Survivors of the Bering Land Bridge.

Unangan and the Pribilof Islands

- Brought to the Pribilof Islands by Russian fur traders in 1788
- Forced to harvest fur seals for Russians and Americans



Lesson 2: *Who are the Unangan?* 4

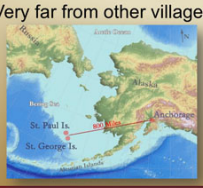
Russians arrived in the Aleutian Islands in 1741, and fought with the Unangan. Russian fur hunters forced the Unangan to hunt sea otter for Russian markets after they captured Unangam villages. 3,000-5,000 Unangan were killed in the Umnak-Unalaska area, and overall almost half of the original population of 16,000 Unangan had died by 1778. Source: Laughlin, W. 1980. Aleuts: Survivors of the Bering Land Bridge.

Gerasim (Gavriil) Pribylov discovered St. George Island (1786) and its fur seal rookeries, and his men discovered St. Paul Island in 1787. Unangan were taken to the Pribilof Islands from Atka and Unalaska in 1788 and forced to harvest fur seals. Source: Hanna, G.D (2008) The Alaska Fur Seal Islands. Torrey, B. 1978. Slaves of the Harvest

Image: Henry Wood Elliott illustration, Pribilof Islands Preserving the Legacy; NMML collection/AFSC/NMFS/NOAA

Life on The Pribilof Islands Before the Fur Trade

- Pribilofs were uninhabited by people until 1788
- Challenges for People
  - No fresh water streams
  - No protected bays for boat landings
  - Harsh weather conditions
  - Very far from other villages
- Benefits
  - Abundant wildlife: fur seals, harbor seals, sea lions, walrus, birds, halibut, crab







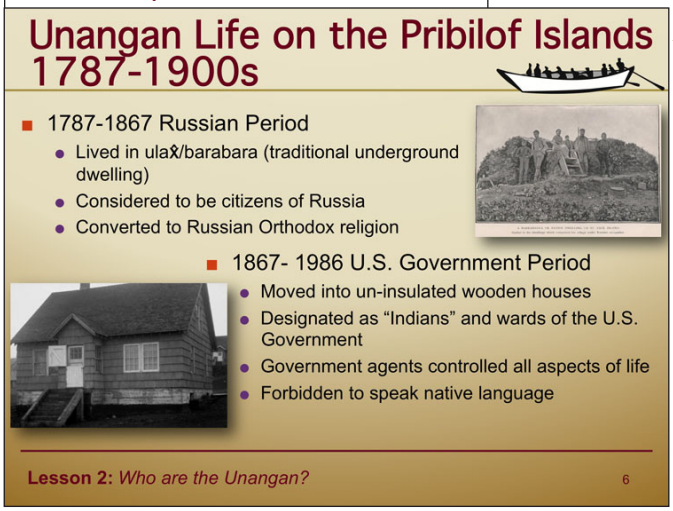
Lesson 2: *Who are the Unangan?* 5

The Pribilof Islands are flat, treeless, volcanic islands covered in grass and sedge. Wind, rain, and fog are common throughout the year. The Pribilof Islands sit in the middle of the Bering Sea at the edge of the continental shelf. In the 1700s neither island provided a good harbor or protected bay for anchoring or landing a vessel. The islands are roughly 800 miles from Anchorage and 250 miles from Unalaska Island in the Aleutian chain.

Source: Laughlin, W. 1980. Aleuts: Survivors of the Bering Land Bridge, Marine Exchange of Alaska: http://www.mxak.org/ports/northern_west/st_paul/st_paul.html

Map: NOAA Office of Response and Restoration: Pribilof Island Restoration Project http://archive.orr.noaa.gov/pribilofs

Photos: Pribilof Islands Preserving the Legacy; NMML collection/AFSC/NMFS/NOAA



1787-Russian fur traders first brought Unangan to the Pribilof Islands to harvest seals for the fur trade. Hunters were brought to the islands on a seasonal basis until 1820 when permanent encampments were established.

Unangan lived during the winter in subterranean houses called ulax or barabara. The houses had a framework of driftwood or whale bone. Family members entered through a portal in the roof. These dwellings were large, warm, and safe during the long Aleutian winters. It was not uncommon for several related families to live in one ulax.

Under Russian rule the Unangan were considered Russian citizens. They were allowed to keep their community based governing and to speak Unangan. Russian orthodox religion was introduced. Most Unangan were bilingual.

1867-US purchases Alaska from Russian. Private companies manage the fur seal harvest.

1911 –US government takes over managing the harvest and life on the Pribilofs. All aspects of the lives of the people on the islands are controlled by the government including marriage, housing, food, laws, travel, work, and socializing.

1960 US govt begins to phase out its administrative duties.

1983 Pribilofs become independent from US govt.

For more information see the Aleutian Pribilof Island Association (APIA) website: http://www.apiai.com/culture.asp?page=culture

Photos: house — Pribilof Islands Preserving the Legacy; NMML collection/ AFSC/NMFS/NOAA
ulax̂ — http://docs.lib.noaa.gov/noaa_documents/NOS/ORR/TM_NOS_ORR/TM_NOS-ORR_17/HTML/Seal_Islands.htm



Challenges – Everything must be shipped to the Islands by plane or boat. The only food available on the Islands is seal, birds, fish, crab, berries, shellfish, and native plants.

Weather can also be a challenge – fog, wind, snow, and ice can affect air travel, and the islands can go for a week or longer without planes being able to land (affects food availability as well as travel to and from the islands).

Only basic medical care is provided on the islands.

Advantages – Two types of fishing quotas

1. CDQ- The Western Alaska Community Development Quota (CDQ) Program allocates a percentage of all Bering Sea and Aleutian Islands quotas for groundfish, prohibited species, halibut, and crab to eligible communities. The purpose of the CDQ Program is to (i) to provide eligible western Alaska villages with the opportunity to participate and invest in fisheries in the Bering Sea and Aleutian Islands Management Area; (ii) to support economic development in western Alaska; (iii) to alleviate poverty and provide economic and social benefits for residents of western Alaska; and (iv) to achieve sustainable and diversified local economies in western Alaska. https://alaskafisheries.noaa.gov/cdq/
2. IFQ- individual fishing quotas go to individual fisherman who are involved in the fixed gear (ie: longline or pots) for halibut or sablefish in Alaska.

Photos: Pribilof Islands Preserving the Legacy; NMML collection/AFSC/ NMFS/NOAA. Pribilof Islands Environmental Restoration Project Photographs

How are marine mammals part of the culture?



- Hunted marine mammals for thousands of years for food and clothing
- Resources from marine mammals were shared in the community
- Stories and songs told about the fur seal islands (Tanax̂-Amix̂, the Pribilof Islands)

Lesson 2: *Who are the Unangan?* 8

Emphasize the concepts of **subsistence hunting** vs. **commercial harvesting**, which are two very different activities:

Subsistence hunting: hunting for the sake of survival and community sharing rather than for entertainment or monetary gain.

Commercial harvest: to catch, shoot, trap, etc. (fish or wild animals) usually in an intensive, systematic way as for commercial purposes. Benefits go to individuals or companies, not to the community.

Unangan hunted marine mammals for subsistence for thousands of years but were forced to harvest sea otters and fur seals for the Russians starting in the 1740s, and fur seals for the Americans after 1867, for monetary gain. The number of animals harvested was determined by Russians and Americans.

Based on the stories and songs, the Unangan knew about the Pribilof Islands from long ago.

Source: Torrey, B. 1978. Slaves of the Harvest

Image: Henry Wood Elliot Illustration — 1884, Repository, University of Washington, University of Washington Libraries, Freshwater and Marine Image Bank.

How are seals and sea lions part of everyday life?

- Animal parts used in clothing, hunting, and ceremonies
  - Flippers - soles of boots
  - Fur – trim on clothing, not used for coats
  - Stomach, intestines – waterproof clothing and floats
  - Teeth - fish hooks and decorations
  - Shoulder blades (scapulas) – musical instruments
  - Bones – toys


scapula instruments


gut parkas

Lesson 2: *Who are the Unangan?* 9

The Unangan never used marine mammal fur for coats. Marine mammal fur was used for trim and decoration. Due to the very wet environment in the Aleutians, fur was not a practical choice for a coat. Waterproof coats were made from marine mammal gut or intestine.

See Aleut Corporation for good definition of clothing (http://www.aleutcorp.com/index.php?option=com_content&view=section&layout=blog&id=6&Itemid=24)

Photos: gut parkas — Waldemar Jochelson, "History, Ethnology, and Anthropology of the Aleut." Smithsonian Institution, Alaska Native Collections
scapulas — Pam Goddard, www.thalassa-education.com

How are seals and sea lions part of everyday life?

- Food
  - Lusta – salted fur seal flipper
  - Braided seal meat – seal meat braided with intestines
  - Salted seal meat stew
  - Seal tongue soup
  - Seal pie
  - Alagnosa – salted seal
  - Stuffed seal stomachs
  - Kukleetka – sea lion meatballs
  - Piroshki – meat filled pastry
  - Hearts and livers
  - Stinky oil
  - Sea lion soup
  - Studen – sea lion flipper in a jellied salad



Lesson 2: *Who are the Unangan?* 10

All parts of the fur seal were used including the internal organs and flippers.

Source: Alaska's Child 1985. Fur Seal Flippers and other Delicacies – The Aleut People of Saint Paul Island Cookbook

Photos: Millie McKeown, Aleutian Pribilof Islands Association (APIA), used with permission .

Fur Seals in Stories and Songs

- Stories and Songs
  - Harvest dance
  - Aleut Tales and Narratives
  - Tanax̂-Amix̂ – Legend of the Fur Seal Islands



See video of Ms. Edna, Aleut culture and dance teacher: http://www.youtube.com/watch?v=ZWGpO5eChGk&feature=related.

Aleut Tales & Narratives by Waldemar Jochelson; edited by Knut Bergsland and Moses L. Dirks, 1990.

Tanax Amix: Legend of the Fur Seal Islands, Reprinted from Slaves of the Harvest by Barbara Boyle Torrey, Tanadgusix Corporation, St. Paul Island, 1978.

http://www.ankn.uaf.edu/ancr/aleut/culturalchange/chap.1-5.html

Photo: Lisa Hiruki-Raring, NOAA/AFSC

Summary

- Unangan traditionally lived on the Aleutian and Commander Islands
- Russians forced the Unangan to live on the Pribilof Islands and harvest fur seals in the 1780s
- Unangan used marine mammals for food, clothing, tools, and boats
- Today, the Unangan live all over the world



Photo: Pam Goddard, www.thalassa-education.com

LESSON TWO | WRITING ACTIVITY 2.1 | Grade Level K-6

I Am Who I Am

OBJECTIVE

To help students explore their personal and ethnic identities and what these identities mean to them.

TIME REQUIRED

40 minutes

BACKGROUND

These activities allow for exploration of self in various contexts from families to communities to being a U.S. citizen. They are purposely chosen to make students aware that part of being a responsible productive community member, is to possess and practice an appreciation for self in relation to their people and their culture. Furthermore, the activities proceed in an effort to teach that one must understand and, better yet, utilize the cultural knowledge and wisdom and its relationship to the physical environment, as cultural interactions are an integral part of the environment and vice versa. Creating and implementing culturally responsive and/or place-based curricula must be an ongoing collaborative and coordinated process involving cultural specialists, community members, teachers and students.
In Unangam culture, history was passed from generation to generation through stories and songs. Lessons were learned or taught using stories.

MATERIALS

- *There is no such thing as an Aleut*
- "I am who I am" worksheet
- Cultural Venn Diagram

PROCEDURES

- Read *There is no such thing as an Aleut*.
  - Find out more about the name "Unangan" and what it means. Why is it the name of the people?
  - Discuss cultural identity.
  - How many different cultures are represented in the classroom?
  - How do the students celebrate their culture? Have each student go home and discuss with their family how they celebrate their culture and report back to the class.
- " I am who I am" worksheet.
  - Ask each student to write down words that describe his/her self.
  - Share the descriptions. Put descriptions in a chart/columns: Physical, Personality, Ethnic/cultural, Family/social, and Citizen-self/community, state/country, worldly
  - Discuss the categories and how they played out in the chart, such as which areas were widely used and which were not. Why were some used more than others?
  - If the descriptions were clumped into one or two categories, encourage the students to expand their descriptions into other areas.
- Cultural Venn Diagram
  - Use as a tool to visually compare the student's culture to the Unangan.
  - Do some cultures have more in common with the Unangan?
  - Why is that?
- Sharing Knowledge: Create a song, dance, story, poem or picture that relates to the student's cultural identity.

DISCUSSION

How is the Unangam culture similar or different from other cultures?

After completing the Sharing Knowledge activity discuss how communicating without written words is different from communicating with written words.

This lesson was adapted from: Unangam-Based Environmental Education Primer for St. Paul Island, Alaska. Mierzejek, B., A.D. Lestenkof, and P.A. Zavadil. 2007, and used with permission.

There Is No Such Thing as an Aleut

By: Barbara Švarný Carlson
Qawalangix̂ originally from Iluulax̂, Unalaska

We call ourselves Unangan or Unangas (Atkan dialect). This is our autonym, our name for ourselves, the group identity for the indigenous peoples of the Aleutian Archipelago (including nine distinct subgroups) prior to contact with Europeans.

When Russian explorers came to our land, charting and mapping the area for their Czar, the first island group that they came upon were inhabited by the people who called themselves, Sasignan. For unclear reasons the Russians called them Aleut. They lived in what the Russians named the Near Islands, because of their proximity to Russia at the western end of the Aleutian Islands. As they moved eastward on their journeys, the Russians continued to call the people Aleut, even as they crossed a major dividing line of language and culture, encountering the Sugpiaq (many of whom now call themselves Alutiiq) Sugcestun-speaking people of the Alaska Peninsula.

The Russian language became the common acculturation denominator among these diverse groups. What is my point? We "Aleuts" are actually three different maritime peoples who had our own identities and subdivisions prior to our contact with the Russians: The Alutiiq speakers, the Central Yupik speakers of Bristol Bay, and the Unangam Tunuu (language of the Unangax̂) speakers. Why should we hang onto that foreign name, "Aleut?" To show the pride we have in our cultural heritage and reclaim and maintain our identities as a distinct people we should revive the original words we used to describe ourselves.

Our Unangam identities have become so tenuous that we, as a people, are excavating, sifting, and meticulously labeling the artifacts of various segments of our society with increasing fervor. If we do not, they may disappear forever, or be claimed by another group as their own, muddying our uniqueness and diffusing our very identity. So there is inherent in this work that element of reclamation that is necessarily a part of any revitalization of an indigenous culture.

It is not just material objects that make up our heritage. The endangered Unangam Tunnu, the Unangax̂ language, with its extant dialects is a virtually untapped resource concerning the clues it can provide to found objects, an understanding the profound relationship with land and sea, rules to live by, history, and perhaps most importantly, a unique view of the world to be shared and appreciated. Unangam folklore is a vital aspect of this contribution to the world bank of knowledge. It is like a gigantic puzzle in which museum artifacts fill another missing gap.

Common among Alaska Natives, people who were either raised away from our home villages, or who had to leave at some point during our lives, and had to remain away for some length of time, displaced Unangan/Unangas have a deepened sense of the sacred value of our origins. We feel a loss for what we have been missing, be it Native foods, songs, dance, stories, or seeing beauty reflected in artfully made objects. We miss seeing people who physically resemble ourselves and physically feeling the common elements with which our own people relate - elements such as wind, fog, salty air, and horizontal rain. We need to know these things about our cultural heritage and be able to share that common knowledge with family and community. We need to delight in hearing someone shout,

"Aang, Unangax̂! " (Hello, 'Aleut'). These are what many of those people returning from other places are searching for when they return to the village, or to Alaska. Many of us reside in the densely populated areas such as Anchorage and Fairbanks. Large numbers of Unangan/Unangas with close ties similarly reside on the west coast, particularly in Washington and Oregon. We consider our original villages home even if we have not been able to return there for many years. We share a need to assert, "Where we are from is important to us. What we like to eat is important. Our art is important. Our dance and music are important."

The Unangam foods are elemental to our culture. To have our Native foods sent to us when we are away is one of the most vitalizing, identity-rich gifts one's friends or family can bestow. Some of our traditional subsistence foods include aalax̂ (whale), isux̂ (hair seal), aanux̂ (red salmon), and qax̂ (any kind of fish). From the beaches some favorites are chiknan (limpets), wayĝin (blue mussels), aguĝaadan (sea urchins), qasiikun (chitons or gumboots), chuxlan (clams), and kahngadgin (seaweed). Saaqudan (aka Puuchkiis (R)), qaniisan (aka petrushkies (R)), fiddlehead ferns, and other native vegetables seem to make one feel healthier. My favorite is udax̂, dried fish with chadux̂, seal oil. When we eat these foods we know more strongly who we are.

These valuable links to the Unangam culture are validation of our origins, touchstones to our self- and group-identities. It is an awesome responsibility that pairs us with various types of scholars and researchers as partners as we search for culturally appropriate ways to document traditional knowledge and skills. We are not just an exploitable resource, but an equal partner in this compilation of our world knowledge bank. The more any of us can know about who we are and where we come from, the more sensitive and confident we can be in our interactions among culturally diverse societies. Qax̂ aasakung.

Thank you, for listening.

A version of this essay was printed in the Arctic Studies Center's publication of *Crossroads Alaska: Native Cultures of Alaska and Siberia* (1995) and *Alaska Native Writers, Storytellers and Orators: The Expanded Edition*, Alaska Quarterly Review (1999) Ronald Spatz, Executive Editor.

ACTIVITY 2.1 WORKSHEET 2.1.2 I am Who I am

Directions: *Fill in the blanks with your unique answer.*

1. My name is_____.

2. My street address is_____.

3. My town/village name is _____.

4. My birthday is_____. (day/month/year)

5. I am _____years old.

6. The color of my eyes are:_____.

7. The color of my hair is _____.

8. I am_____ inches tall.

9. My father's name is_____.

10. My mother's name is _____.

11. I am the _____ (first, middle, last, only) child in my family.

12. I have _____brothers and _____sisters.

13. My paternal grandfather's name is _____.

14. My paternal grandmother's name is _____.

15. My maternal grandfather's name is_____.

16. My maternal grandmother's name is _____.

17. My paternal great grandfather's name is_____.

18. My paternal great grandmother's name is_____.

19. My maternal great grandfather's name is _____.

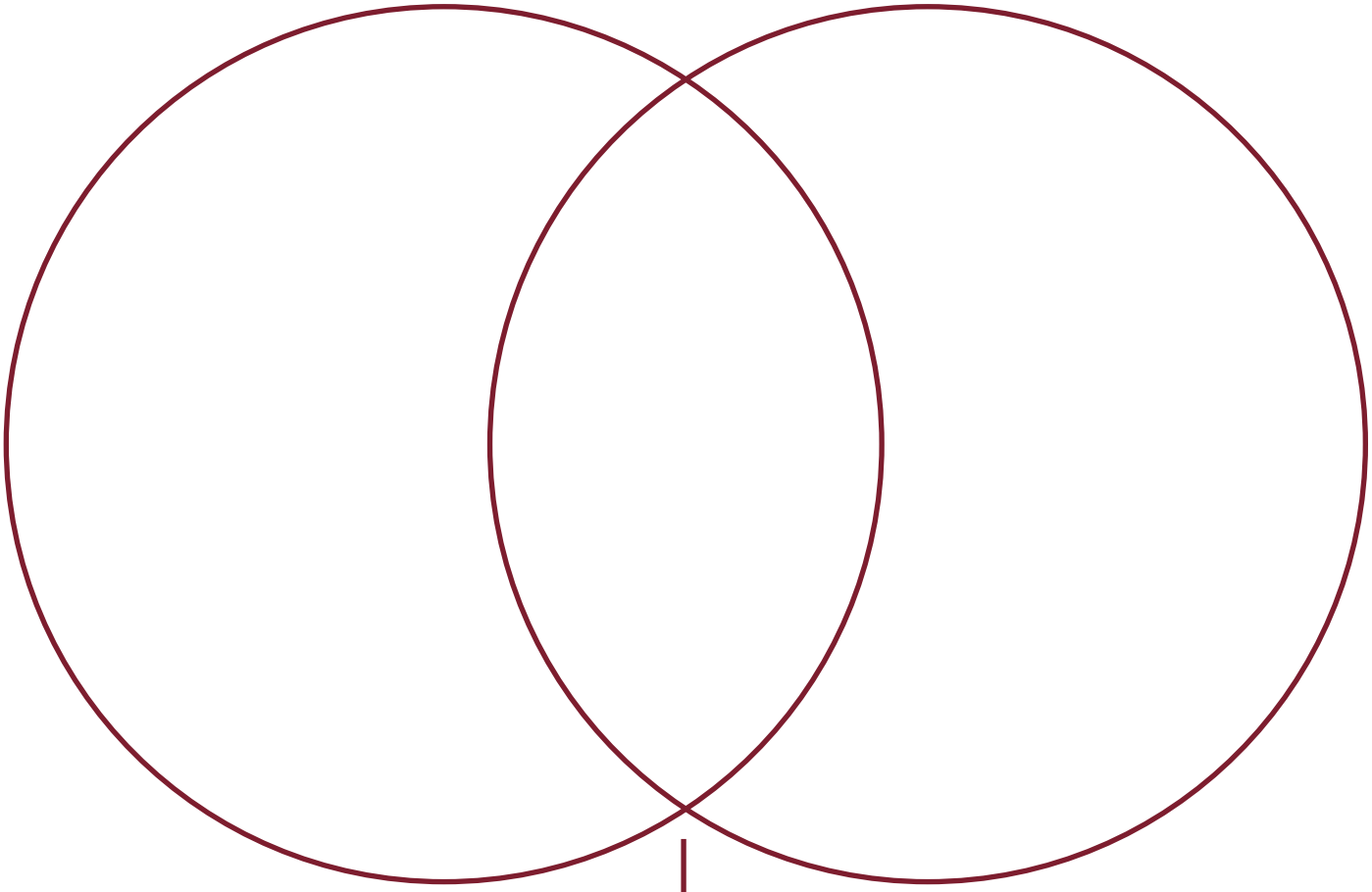
20. My maternal great grandmother's name is _____.

21. I was named after _____.

ACTIVITY 2.1 **WORKSHEET 2.1.3** What we have in common

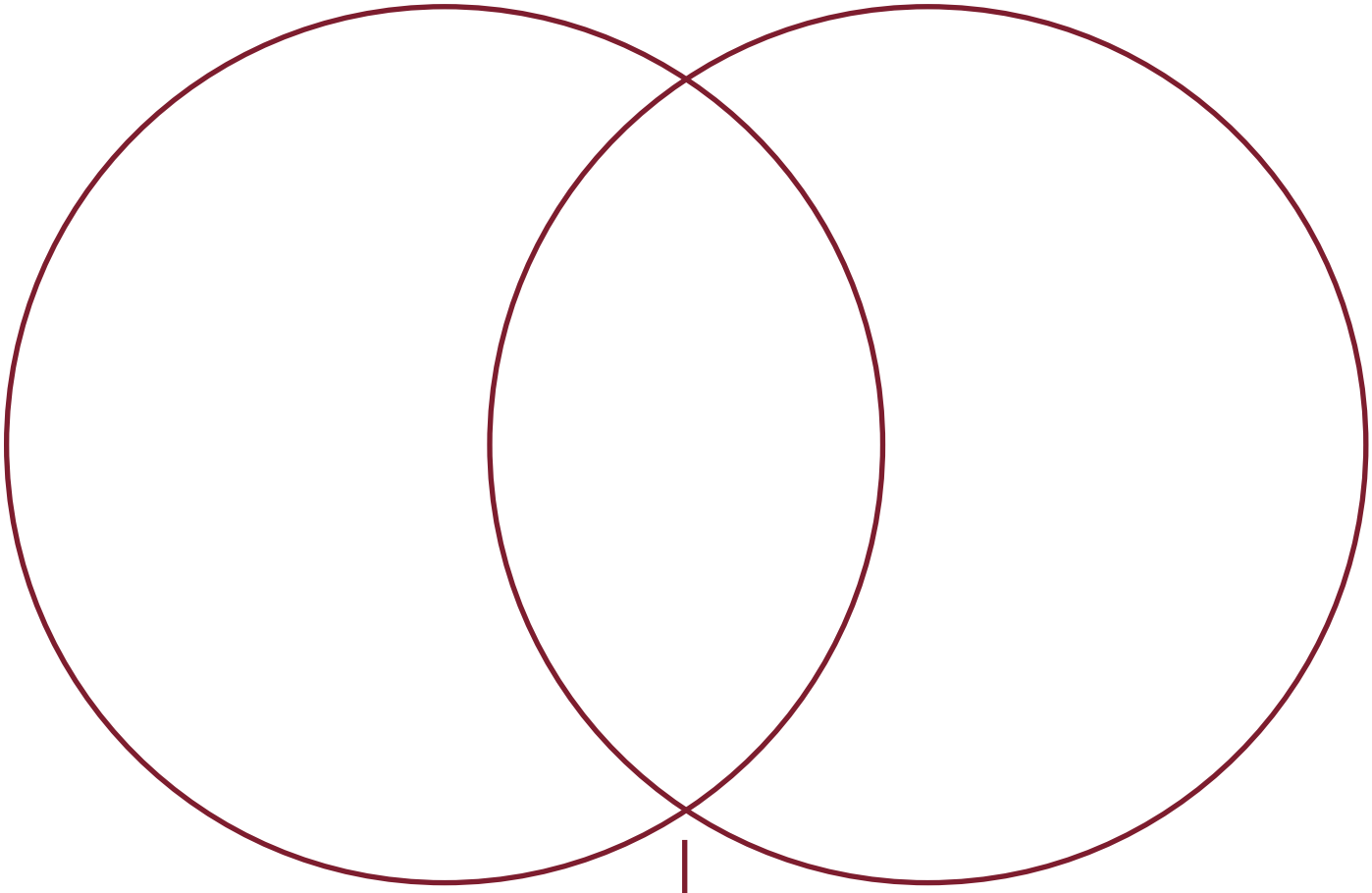
Cultural Comparisons (Venn Diagram)

Compare Unangam values or ceremonial traditions with the values and ceremonial traditions of others.



Unangan

ACTIVITY 2.1 TEACHER KEY 2.1.3 What we have in common



Unangan	Other Culture
• strong sense of community • elaborate hunting ceremonies • food is a part of the culture • oral history • subsistence hunters • respect for all creatures • only take what is needed • share take with elders • very spiritual	*Students can compare to urban cultures, other countries, or other indigenous cultures.*

ACTIVITY 2.1 WORKSHEET 2.1.4 Sharing Knowledge

By Aquilina D. Lestenkof, St. Paul Island, Alaska

This activity provides the opportunity for students to hone their communication skills. Tell the students to pretend they don't know how to write words. Then ask them to come up with other ways to communicate, share what they know, or what they have learned without writing words – song, dance, story, poem, picture writing, dramatization.

Divide students into groups. Have them pick one communication method to express what they have learned in this lesson. It's up to you to decide how much writing of words they can use as they develop a chosen reporting method. They may be uncomfortable and therefore "funny". Try not to dissuade "funny" but tell them that it should not distract from the information they are imparting and ask them to try to employ humor purposefully, in such a way that their audience remembers the information they share. Try different approaches.

One approach you can try is improvisation. For example, one group may have their report in story form with a lot of action words and may be allowed to select another group to act it out as it is being read. You can demonstrate this method with the whole group to loosen them up using one of the Aleut stories in Activity 2.4 or another traditional story from your culture.

Following are some ways to use the various mediums:

Song: A group may compose only the chorus (for example, the core of the information they are trying to impart), a whole song, or music without words. Encourage students to create both words and music, but just one or the other will do.
Bonus: do a song and dance together.

Dance: A group may come up with motions that impart the information they wish to share. Students can decide if the group dances the story or just one person. They may feel the need to have music to go with the dance but should not be too dependent on words. Encourage actions to speak louder than words. This is a good time to encourage the use of humming or a simple chant such as "*la la la la*" or "*ay-ya ay-ya.*"
Bonus: do a song and dance together.

Story or Poem: A group may choose to tell a story because it's more comfortable. Fine, but expand on this by applying more structure. Such as, "Make the story or poem so as 3 and 4 year olds will understand it." Or "Make the story or poem into a wise tale."

Picture Writing: Picture writing is someone telling and drawing [no words] a story and the listeners draw what the storyteller is saying, too. The storyteller may even tell the others exactly what to draw. For example, the storyteller may say, *"One day, grandfather was walking by a lake. Okay, you all draw a lake at the bottom of your paper and draw grandfather on the right side of the lake. There were six ducks at the east end of the lake. Draw six ducks, and make one bigger than the others..."* All members of the group may have a chance to be the storyteller. Picture writing can be two-tiered. The group can do this among themselves and then display all their picture writings; or use them to tell "the story" to another audience or the whole class.

Dramatization: All forms of theatrical activity can be used. Employing song, dance, stories, poems, or picture writing in dramatization can be encouraged by providing additional incentives such as extra credit for using multiple techniques to tell a story.

LESSON TWO | GEOGRAPHY ACTIVITY 2.2 | Grade Level K-6

Where Are the Aleutian Islands and the Pribilof Islands?

OBJECTIVE

Students will explore the geography and environment of the Aleutian Islands and Pribilof Islands.

TIME REQUIRED

20 minutes

BACKGROUND

The Aleutian Islands are a chain of 14 large volcanic islands and 55 smaller ones extending about 1,200 miles (1900 km) westward from the Alaskan Peninsula. The Pribilof Islands are a group of volcanic islands: two larger islands (St. Paul and St. George) and three smaller islets (Otter Island, Walrus Island, and Sea Lion Rock). The Pribilof Islands are in the Bering Sea, about 200 miles (320 km) north of Unalaska Island in the Aleutian Islands.

MATERIALS

- Maps of Alaska, North America, world, or globe
- "The Bering Sea and Aleutian Islands, Regions of Wonder"
- Information on physical environment on Pribilofs and town/city of residence
- Climate & weather information
- Wildlife & natural resource information

PROCEDURES

Hand out Worksheet 2.2.1 : Where are the Aleutian Islands and the Pribilof Islands?.
Discuss the following natural elements regarding the Aleutian and Pribilof Islands and the roles they play in shaping the tools, language, beliefs, spirituality, education, economy, transportation, and other aspects or practices of the Unangan. Also allow for comparison to other peoples, their defining characteristics, and the natural elements in their locations on the Aleutian Islands or the Seward Peninsula, Alaska Peninsula, the Russian Far East, or other locations. Using the resources listed below, have students fill out Worksheet 2.2.1.

- Physical Environment
  - Location: Distance from mainland? Nearest town or city?
  - Geology: How were the Pribilof Islands formed? How were the Aleutian Islands formed?
  - What is topography? Are there hills, lakes, rivers?
- Climate and Weather
  - Describe the weather during the seasons: summer, fall, winter, spring.
  - What is sea ice? When does it form during the year? When does it break up?
- Wildlife and Natural Resources
  - Describe the wildlife: marine animals, birds, mammals
  - Describe the plants

Hand out Worksheet 2.2.2 Map of Traditional territories of Alaska Native cultures.
This outline map shows traditional territories of Alaska Native cultures. Using the list of Alaska Native cultures label and shade in the respective regions.

Extra Credit
Shade in the "Unangan" regions of the maps. Compare and contrast to the other regions. The Unangan region starts at Unimak pass and goes west to the end of the Aleutians.

DISCUSSION

If you live on the Pribilof Islands describe how your environment is different from the rest of Alaska. Discuss weather, climate, geography, and wildlife.

If you don't live on the Pribilof Islands, how are the Pribilof Islands different from where you live? Discuss weather, climate, geography, and wildlife.

RESOURCES

Maps of Alaska, North America, world

- maps.google.com
- earth.google.com
- http://dsc.discovery.com/discovery-earth-live/#
- www.mapquest.com/
- "The Bering Sea and Aleutian Islands, Regions of Wonder" by Terry Johnson, 2003. Alaska Sea Grant College Program, Fairbank, Ak.

Information on physical environment on Pribilofs and town/city of residence

- http://www.amiq.org/pribilof.html

- http://www.encyclopedia.com/topic/Pribilof_Islands.aspx

Climate & weather information

- http://docs.lib.noaa.gov/noaa_documents/NOS/ORR/TM_NOS_ORR/TM_NOS-ORR_17/HTML/Pribilof_html/Pages/pribilof_island_climate.htm
- http://www.nws.noaa.gov/
- http://www.weather.gov/climate/
- http://worldweather.wmo.int/

Wildlife & natural resource information

- http://www.stgeorgetanaq.com/tourism.html
- http://serc.carleton.edu/research_education/nativelands/pribilofs/floraandfauna.html
- http://alaskamaritime.fws.gov/visitors-educators/wildlifeviewing/pribilofs.htm
- http://www.adfg.alaska.gov/index.cfm?adfg=viewinglocations.pribilofislands

Adapted from "I Am Where I Am": Mierzejek, B., A.D. Lestenkof, and P.A. Zavadil. 2007. Unangam-Based Environmental Education Primer for St. Paul Island, Alaska.

ACTIVITY 2.2 **WORKSHEET 2.2.1**

Where are the Aleutian Islands and the Pribilof Islands?

Fill in the location you are comparing with the Pribilof Islands.

Environment on Pribilof Islands	Characteristic	Environment on
	Physical Environment	
	Climate and Weather	
	Wildlife and Natural Resources	

ACTIVITY 2.2 **TEACHER KEY 2.2.1**

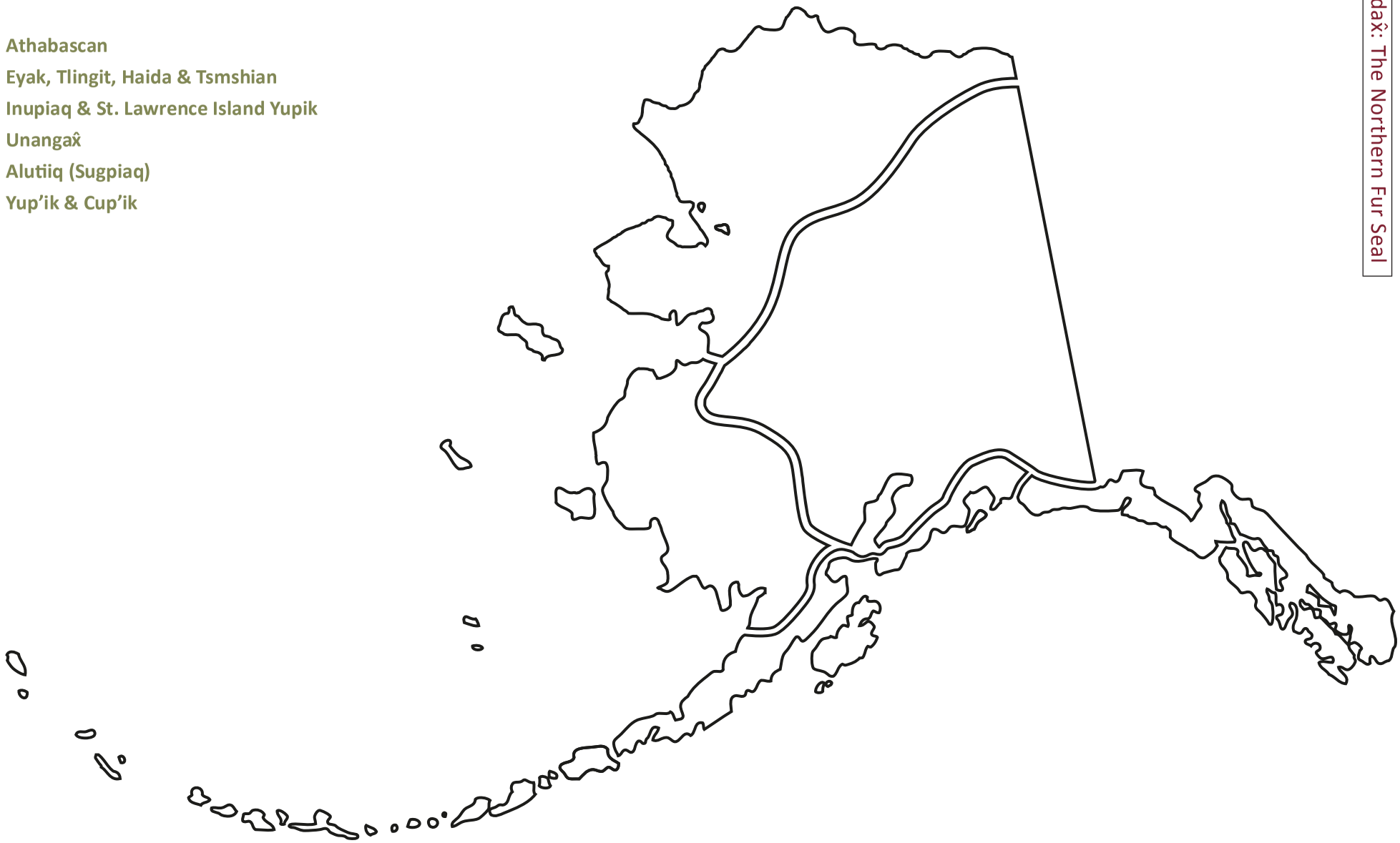
Where are the Aleutian Islands and the Pribilof Islands?

(Example: answers may vary)
Fill in the location you are comparing with the Pribilof Islands.

Environment on Pribilof Islands	Characteristic	Environment on HAWAIIAN ISLANDS
Distance from Aleutians = 250 miles Nearest mainland town or city = Anchorage, approximately 750 miles away. In Bering Sea Geology – volcanic origin	Physical Environment	Distance from mainland = 2,045 nautical miles Nearest mainland town or city = Point Arena, California Lighthouse, although locations on the Aleutian Islands are closer In North Pacific Ocean Geology – volcanic origin
Summer weather, avg. temp: 46.1˚ Winter weather, avg. temp: 29˚ Typical weather, foggy in summer… etc.	Climate and Weather	Summer weather, avg. temp: 94˚ Winter weather, avg. temp: 87˚ Typical weather, sunny with frequent rain on windward side of island
Native mammals – northern fur seal, fox, killer whales, other whales (gray whales, humpbacks) Steller sea lions, harbor seals, sea otter, walrus Introduced mammals – reindeer Birds – over 200 species have been identified including: tufted puffin, black leg kittiwake, common murre, Fish – halibut, pollock, cod Plants – native grass, wild celery - putschki, chocolate lily, willow, mossberries Trees – none	Wildlife and Natural Resources **NOTE: Other categories can be added**	Two native mammals, bat and Hawaiian monk seal Native birds – examples ‘iiwi, Hawaiian goose (nene), tropicbirds, albatross Introduced birds – Mallard (*Anas platyrhynchos*), Japanese Quail (*Coturnix japonica*), Zebra Dove (*Geopelia striata*) Fish – blackfin barracuda, angelfish, Hawaiian zebra blenny Plants…

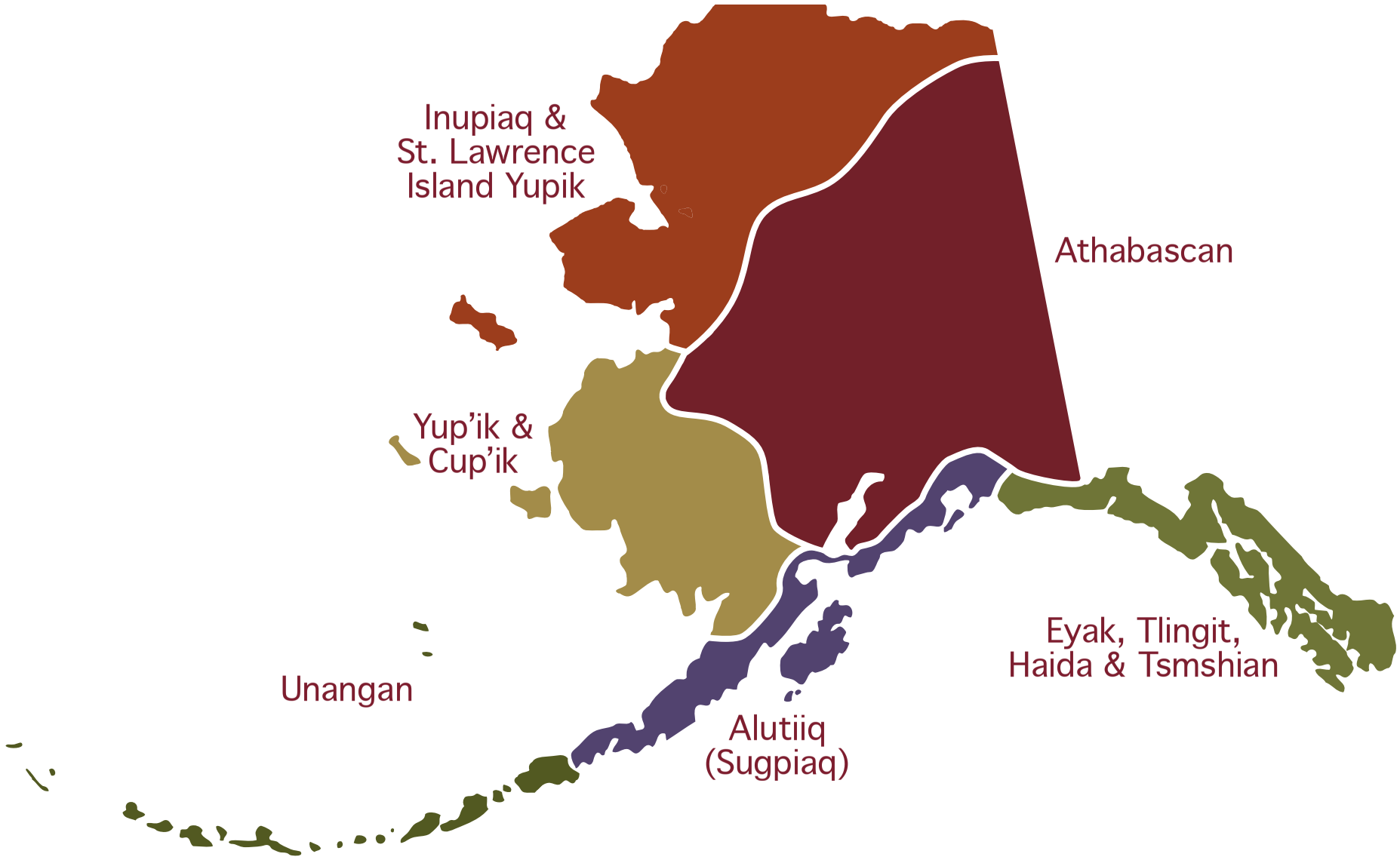
Map of Traditional territories of Alaska Native cultures

Athabascan
Eyak, Tlingit, Haida & Tsmshian
Inupiaq & St. Lawrence Island Yupik
Unangax̂
Alutiiq (Sugpiaq)
Yup'ik & Cup'ik



*Adapted from source map by: Alaska Native Heritage Center, Ancorage Alaska http://www.alaskanative.net/. Used with permission.

Map of Traditional territories of Alaska Native cultures*



*Adapted from source map by: Alaska Native Heritage Center, Ancorage Alaska http://www.alaskanative.net/. Used with permission.

LESSON TWO | READING/WRITING ACTIVITY 2.3 | Grade Level K-6

Unangam Clothing and Environment

OBJECTIVE

Students will create or present a traditional clothing item to learn how environmental elements and processes influence types of clothing.

TIME REQUIRED

20 minutes

BACKGROUND

Traditional Unangam clothing was very different from the clothing worn today. All garments came from materials gathered from the surrounding environment.

MATERIALS

- Information on traditional clothing of the Unangan, gathered from the Internet or books.

PROCEDURES

- Have groups of students research the traditional dress of the Unangan and create a costume, poster, or presentation of examples of the clothing.
  - Relate how the clothing was influenced by the environment
  - Provide an explanation of materials used for the clothing
  - Explain the materials used for different garments

DISCUSSION

How is the Unangan clothing different from the clothing you wear today?
What clothing today is made from the same or similar material?

RESOURCES

- http://www.anchoragemuseum.org/galleries/alaska_gallery/aleut.aspx
- http://www.mnh.si.edu/arctic/features/croads/aleut.html
- http://alaska.si.edu/culture_unangan.asp

ACTIVITY 2.3 WORKSHEET 2.3.1 Traditional Unangam clothing

Traditional Unangam Clothing	Characteristic	Clothing from
	Clothing Item	
	Purpose	
	Material	

ACTIVITY 2.3 TEACHER KEY 2.3.1 Traditional Unangam clothing

(Example: answers may vary)

Traditional Unangam Clothing	Characteristic	Clothing from Today
chaĝtalisax̂ or kamleika gut parka with hood and draw string	Clothing Item	Rain coat/parka
Waterproof kayaking and hunting parka Drawstring at the bottom of the parka can be tied around the opening of the kayak to prevent water from entering, similar to kayak skirts worn today.	Purpose	Waterproof jacket. Drawstring hood and elastic wrists. Used to stay dry when outside during rainstorms. Some coats have a kayak skirt attached.
• Fur seal or sea lion gut (intestine) • Sinew from fur seal or sea lion used as thread. • Bird or fish bone needles were used to sew.	Materials	• Nylon, Gortex, rubber, or vinyl • Cotton or nylon thread
women	Made by	Mostly made by factory workers in China, Indonesia, and India. A few companies sell parkas made in the United States.
Source: Alaska Native Collections Smithsonian Institution http://alaska.si.edu/record.asp?id=265	**NOTE: Other categories can be added**	

LESSON TWO | READING ACTIVITY 2.4 | Grade Level K-3

Essays from "Aleut Images"

OBJECTIVE

Students will learn about Aleut life through short essays written by students in Alaska.

TIME REQUIRED

20 minutes

BACKGROUND

“Aleut Images” is a collection of Aleut culture stories from class projects at Alaska Pacific University.

MATERIALS

- “Aleut Images”
  - Short essays with comprehension questions
  - Additional stories can be found at Alaskool.org
- Text for the following readings is reproduced here, but there are many other paragraphs
  - Aleut Women
  - Tools from Animals
  - Aleut History
  - Food for the Aleuts
  - or other stories

PROCEDURES

K-1

- Read the stories aloud to the students; discuss the main idea of the story

2-3

- Individually or in small groups, have students read one of the suggested paragraphs (included in this lesson) or choose their own from the list of readings on the website.

DISCUSSION

How are the topics described in the story different from your life today?

“Aleut Images” is used with permission from the State of Alaska, Alaska Pacific University, Alaskool and Dana G. Anderson. Copyright 1980. http://www.alaskool.org/projects/traditionalife/Aleutian_Chain/Text.html

Aleut Women

Aleut women have important places in their society. Famous as weavers, they were equally skilled in other ways.

The women excelled as doctors and nurses. They knew which wild plant controlled bleeding and which healed open cuts. They knew which plant cured fish poisoning. They mixed certain herbs with goose fat for coughs and fevers. They applied a different mixture of herbs to swollen joints and muscles.

Aleut women were expert at food preparation. They preserved the meat and fish by drying it in the open air on poles or they smoked it over an open fire. They gathered berries in the fall. Blueberries and cranberries were kept a long time in finely woven baskets filled with fresh water.

The women were skilled seamstresses. They made parkas that were both warm and dry. The seams were sewn with a bone needle threaded with fine sinew. Along each seam they stitched in twisted and braided animal hairs. These decorations formed hooks and tassels.

Aleut women were very skillful people. Important roles were delegated to them.

TEST YOUR READING SKILLS

The main topic of this article is

(1) sewing

(2) Aleut women

(3) smoked fish

Teacher Key

(1) sewing

(2) Aleut women

(3) smoked fish

Tools from Animals

The tools the Aleuts used were made from whales, birds, seals, sea lions and drift wood. Spoons were made from breastbones of ducks. Bone wedges were used for splitting firewood. Fishhooks were made by lashing two small bones together. Bird skins and whale intestines were made into rain gear. The gut or intestines were also made into translucent windows for their homes.

Seal and sea lion bladders or stomachs were used for storing fat and as floats. The floats prevented wounded sea mammals from sinking. They also served as markers or buoys. The markers were whitened and used to guide the hunters when they were out of sight of land. They were dropped over the side of the boat at intervals so the hunters could see one marker from the other. To make sure the hunters could get them back, they were tied to each other by cord made from sinew.

What we can learn from the tools Aleuts left behind is that they made clever use of the resources available to them.

TEST YOUR READING SKILLS

This article is about

(1) types of tools

(2) boat equipment

(3) animal habits

Teacher Key

(1) types of tools

(2) boat equipment

(3) animal habits

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http://www.alaskool.org/projects/traditionalife/Aleutian_Chain/Text.html
http://www.alaskool.org/projects/traditionalife/Aleutian_Chain/Text.html#aleut
http://www.alaskool.org/projects/traditionalife/Aleutian_Chain/Text.html#tools

Aleut History

Aleuts have an oral history. Storytellers tell the things of the past to the children and to each other. Aleuts call this REMEMBERING. They tell again legends that they heard in childhood. They recall the clothing, toys, tools and boats seen or used while growing up. They remember the old ways on special days. The REMEMBERING by each person is important. It is key to the whole picture—the Aleut history.

A storyteller named Will Durant put it this way:

Grow strong, my comrade . . .
That you may stand
Unshaken when I fall;
That I may know
The shattered fragments
Of my song will come
At last to finer melody in you;
That I may tell my heart
That you begin
Where passing I leave off,
And. . . you know more.

TEST YOUR READING SKILLS

This passage suggests that history is

(1) not always written

(2) dull and dry

(3) a story

Food for the Aleuts

Food was easy to get on the Aleutian Islands. Even today, the Aleuts can live off the land and the sea.

People who live near ocean reefs can get food easily. Both the young and old people can gather sea urchins, mussels and little snails from the reefs. Many species of birds and ducks live on the "Aleutian Chain." Their eggs are good food as is their flesh.

Fish is an important food for the Aleuts. Cod and halibut can be caught all year. There are salmon runs in the fall, and Dolly Varden is caught for variety.

Sea otters and seals are hunted for their meat, as well as their skins. Some islands near the peninsula have caribou, moose and bear which may be hunted.

In the summer, berries can be gathered in the hills and swamps. Aleuts have developed ways of keeping berries for a long time. At one time, there were more Aleuts than any other Native Alaskan group. The abundant food supply on the Aleutian Islands is one reason for this.

TEST YOUR READING SKILLS

The main idea of this passage is that early Aleuts ate

(1) many kinds of food

(2) sea urchins

(3) bird and duck flesh

Teacher Key

(1) not always written

(2) dull and dry

(3) a story

Teacher Key

(1) many kinds of food

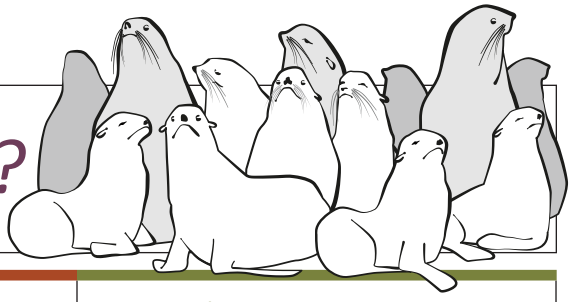
(2) sea urchins

(3) bird and duck flesh

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http://www.alaskool.org/projects/traditionalife/Aleutian_Chain/Text.html
http://www.alaskool.org/projects/traditionalife/Aleutian_Chain/Text.html#history
http://www.alaskool.org/projects/traditionalife/Aleutian_Chain/Text.html#food

LESSON THREE

What is a fur seal rookery?



Subject Area(s): Life science, genetics, reading	Grade Levels: K-6	Presentation – 10–15 minutes Activities – variable

Lesson Topics:	Fur seal rookery structure, location, and seasonal changes.	**Focus Questions**	• What is a fur seal rookery? • What do seals do at the rookery? • How does the rookery change over the season? • Why do we want to know?
Learning Objectives:	Students will: • describe the seasonal timeline of a northern fur seal rookery • describe what fur seals in different age groups do at the rookery	**Key words:**	rookery, haulout, vocalization

ACTIVITIES		ALASKA STANDARDS			
		Math	Science	Minutes	Grades
Activity 3.1	How Many Babies?	K.CC.4–6 K.MD.3 1.MD.7 2.MD.9–10 3.MD.6 4.MD.6 5.MD.6	SC 2	2x15	K–6
Activity 3.2	Rookery Timeline	4.MD.1 5.MD.1	SC2	25	3–6
Activity 3.3	Create a Rookery – Rubber Stamp Making		SC2	50	K–6
Activity 3.4	Find Your Fur Seal Family		SC2	10	K–6
Activity 3.5	Vocalizations in Northern Fur Seals		SC2	10	3–6

Targeted Alaska Grade Level Expectations (GLEs) — SCIENCE

Math

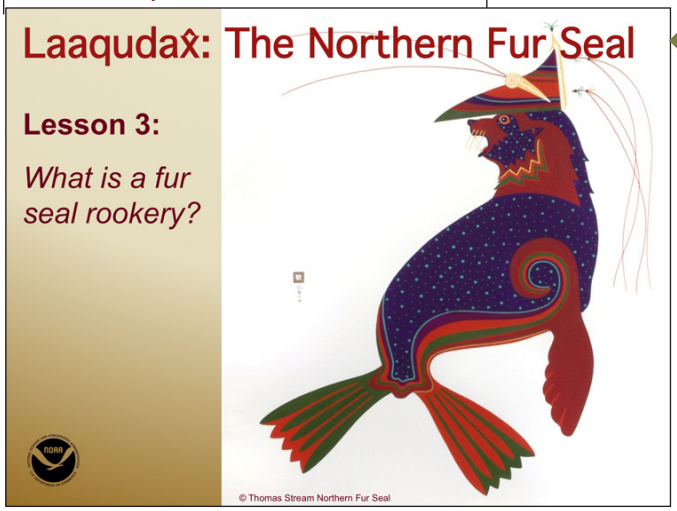
CC Counting and Cardinality

MD Measurement and Data

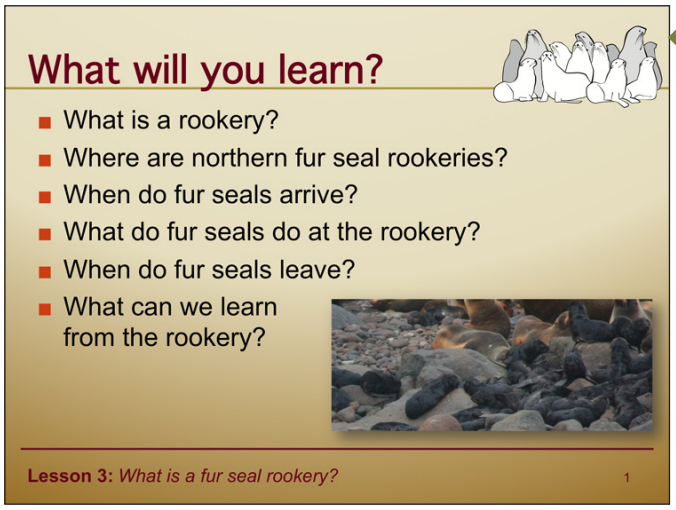
Science

Concepts of Life Science

SC2 Students develop an understanding of the structure, function, behavior, development, life cycles, and diversity of living organisms.



Lesson 3 gives an overview of what a rookery is, the timing of fur seals' arrival at and departure from the rookery during the breeding season, and what we can learn from the rookery.



Background on fur seal life history

Northern fur seals spend much of the year at sea, but return to land to breed (mate and have pups) during the summer. They gather in large groups at specific areas, called rookeries, on islands in Alaska, California, and Russia.

Most female fur seals return to the same spot year after year to give birth (a behavior called philopatry).

Philopatry – returning to the location where an individual was born

Some females return to tthe same island and rookery but not the site where they were born (a behavior called site fidelity).

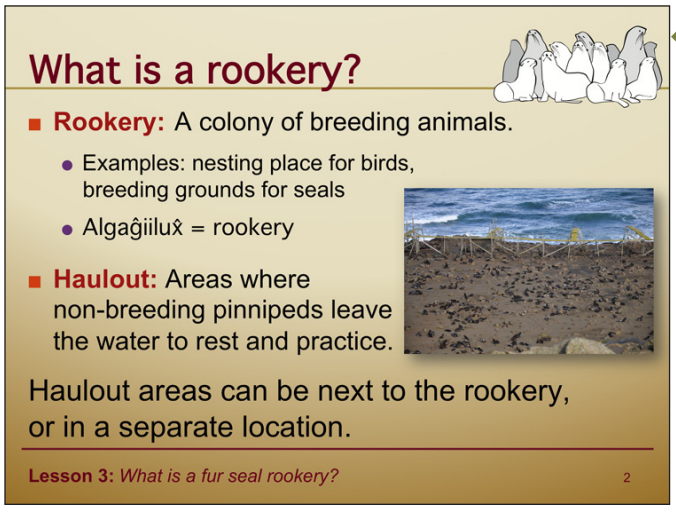
Site fidelity – returning to the same place (can be in relation to the destination of a feeding place, a migration, or a breeding area, among other things)

Because of this, males gather in areas where female fur seals will arrive each year to breed, and set up territories that they defend against other males.

The biggest, strongest, most dominant males have the most females in their territories.

Sources: Riedman, M. 1990. The Pinnipeds. Gentry, R. 1998. Behavior and ecology of the northern fur seal.

Photo: NOAA/NMFS/AFSC/NMML



Rookeries are specific areas where animals gather each year to mate and raise young. Many different kinds of animals gather in rookeries; examples are elephant seals, fur seals, seabirds (including penguins).

There are several Unangam words for "rookery" – algaĝiiluxˆ, angaxˆtaaluĝin, isxaxˆ, tanaxˆ

Haulout sites are specific areas where pinnipeds who are not breeding gather to rest. Haulout sites may be at the edges of rookeries, or they may be totally separate from rookeries.

Juvenile males sit off to the side at haulout sites and practice territorial behavior.

Photo: Lisa Hiruki-Raring, NMML/AFSC/NMFS/NOAA

Who is at the rookery?

- **Adult male (aataax):** a male seal that is old enough to mate (usually 7 years or older)
  - Breeding male – defends a territory containing females, usually 9 years or older
  - Idle male – may hold a territory but does not hold females on the territory
- **Adult female (maatkax̂):** a female seal that is old enough to have pups (usually 3 years or older)
- **Pup (laaqudaax̂):** A fur seal in the first year of its life



Lesson 3: *What is a fur seal rookery?* 3

Source: Antonelis G. (1992) Northern fur seal techniques manual. U.S. Dep. Commer, Seattle. NOAA Tech Memo NMFS F/NWC-214, 47 p. (adult males); York (1987) – female reproduction

Photo: NOAA/NMFS/AFSC/NMML

The next two slides briefly describe the different age groups of fur seals that are found at the rookery and on haulouts.

- Male fur seals may take up to 7-10 years to become breeding males and may only keep a territory on the rookery for a few years.
- If they become territorial males (adult males who hold a territory on the rookery) they may father many pups per year during the time that they have a territory. Not all males become breeding males; some are idle males (defend a territory but don't have females) and some remain on the haulout areas.
- Female fur seals begin to breed at 3-5 years of age and then have one pup per year until they are 18-20 years old. Females choose a location on the rookery that increases their chances of weaning a pup.
- Pups are born in July and remain on the rookery until they are weaned, four months later.

Adult males who hold a territory exclude all non-adult males from the rookery. Adult males defend territories from May to August. After territorial males leave the rookery in August, they are replaced on the rookery by non-territorial males (usually older subadult males or adult males who have not been able to hold territories). During this time, adult females with pups continue to use the rookery as a nursery area.

The pregnancy rate for females is approximately 60% for females age 3 and greater, and 68% for females age 4 and greater (York 1987). Nearly 90% of females in their reproductive prime, 8-13 years old, are pregnant every year with the pregnancy rate gradually decreasing after 13 years of age.

Who is NOT at the rookery?

- **Juvenile:** A fur seal that is too young to mate or have pups
  - Juvenile males (x̂ulustaakax̂) are up to 7 years old and stay on haulout sites
  - Juvenile females return to the rookery when they are ready to mate for the first time.

As males get older (7-8 years old), they move from the haulouts to the edge of the rookery.



Lesson 3: *What is a fur seal rookery?* 4

Most yearlings and 2-year-olds are not at the rookery, they spend the their first two years at sea. Each summer, juveniles 3 years and older return to the Pribilof Islands. Females return to mate while males return to practice mating behavior. Juvenile males gather on haulout sites, which can be on the edge of the rookery or inland of the rookery, or in a separate area of the island.

Because it takes males longer to reach breeding age (they do not reach breeding age until 7-9 years old, while females can start breeding between 3-5 years old), there are many more juvenile males than females. Juvenile males spend their time on the haulout practicing herding behavior.

Males can physically mate at 7 years, but most are not socially able to mate (i.e., they are not able to hold and defend territories on the rookery) until they are a few years older. Males who are closer to breeding age start to defend areas at the edge of rookeries. As they gain more experience, they can begin to hold territories and breed.

Xulustaakax – male fur seal too young to have a territory with females

Source: Gentry R. 1990. Behavior and ecology of the northern fur seal, Antonelis

Photo: Rolf Ream, NOAA/NMFS/AFSC/NMML: http://www.afsc.noaa.gov/nmml/gallery_admin/albums/nfs/SNP92juvs.jpg

Fur seal life history





- Breed on rookeries
  - Territories - areas on the rookery defended by a male; can contain one or more females
- Each female has one pup
  - Female nurses the pup for about 4 months, then pup is on its own

Lesson 3: *What is a fur seal rookery?* 5

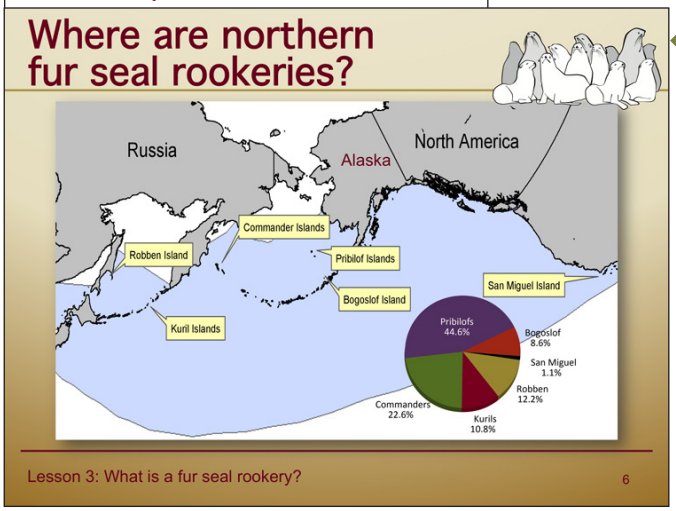
During a given year, a female has one pup.

Males can mate with many females.

Only about 10% of male pups become breeding males, whereas most females become breeding females.

Source: Gentry, R. 1990. Behavior and ecology of the northern fur seal.

Photos: Pam Goddard, www.thalassa-education.com



Unangam names:

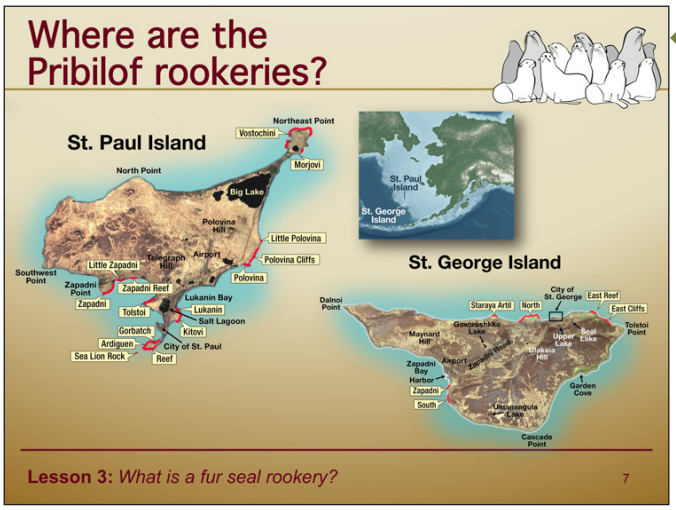
Tanax̂-Amix̂ - Pribilof Islands

Aĝasaaĝux̂ - Bogoslof Island

There are five northern fur seal breeding rookery locations: three in Russia (Commander Islands, Robben Island, Kuril Islands), two in the Bering Sea (Pribilof Islands, Bogoslof Island) and one in California (San Miguel Island). The largest proportion of the northern fur seal population is on the Pribilof Islands. At each location, fur seals breed at specific rookeries (e.g., in the Pribilof Islands, there are 15 rookeries on St. Paul Island and 6 on St. George Island.

Percentage of the worldwide northern fur seal population in different rookery locations (2012):

44.6% Pribilof Islands
22.6% Commander Islands
12.2% Robben Island
10.8% Kuril Islands
8.6% Bogoslof Island
1.1% San Miguel Island
Map: NOAA/NMFS/AFSC/NMML observer PowerPoint



Unangam names:

Amix̂ - St. Paul Island

Aŋĝaaxchalux̂ - St. George Island

There are 15 rookeries on St. Paul Island and 6 on St. George Island.

Maps adapted from NOAA/NMFS/AFSC/NMML website and NOAA Office of Response & Restoration



Northern fur seals arrive at different times on the rookery and haulout.

Adult males arrive first to set up their territories. Adult males start arriving in the water around the islands in March and are seen on land in late April to June. They get situated on the rookery in May.

Adult females arrive during late June-August, with the peak in July; oldest females arrive first, younger ones arrive later. The pup is born a few days after the female arrives at the rookery.

Juvenile males arrive by age with oldest males first, and progressively younger fur seals arriving later. Juvenile males are kept out of the rookery by breeding males until late August-early Sept.

Source: Gentry, R. 1998. Behavior and ecology of the northern fur seal; also, NOAA/NMFS/AFSC/NMML Alaska Ecosystem Program staff

Photo: Mikhail Shlemov (Russian photographer) via Vladimir Burkanov, NOAA, NMML (0K9O2848-Shlemov.jpg)

What do seals do at the rookery?



- Adult males
  - Defend territories, herd females within territories, mate with females
  - Do not eat while on rookery
- Adult females
  - Return to the same area each year to give birth to one pup (site fidelity)
  - Mate with an adult male
  - Alternate feeding trips at sea with visits ashore to nurse pup
- Pups
  - Nurse, grow, play



Lesson 3: *What is a fur seal rookery?* 9

The main purpose of fur seals on the rookery is for breeding fur seals to mate and for the females to raise their pups. Therefore, the adult males guard their territories and keep their females in the territory, while the females alternate feeding at sea and coming back to nurse their pups.

Some females return to the rookery where they were born (philopatry). Scientists have seen tagged females who will even come back to a specific rock each year. Other females return to the general area where they were born (site fidelity).

Pups stay on the rookery while their mothers are away feeding, so they play with other pups and learn to swim in the water close to shore. When the mother comes back to the rookery after a feeding trip, she will call and listen for her pup to respond. Mothers recognize their pup's call and then verify the identity of their pup by smelling it when the pup is close enough to touch.

Photo: Mikhail Shlemov (Russian photographer) via Vladimir Burkanov, NOAA, NMML

What do seals do at the haulout?



- Juvenile males
  - Alternate feeding trips at sea with time ashore to rest and practice breeding behavior
  - Practice holding territories and mating behaviors
  - Molt (shedding old fur and growing new fur)



Lesson 3: *What is a fur seal rookery?* 10

Juvenile males are the only seals on the haulouts. They use time at the haulouts to practice breeding behavior and to molt (shedding old fur and growing new fur). Males will practice herding females and mock fighting with other males.

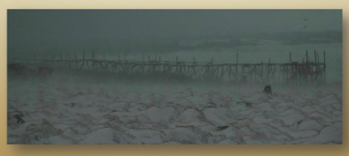
Source: Riedman, M. 1990. The Pinnipeds. Gentry, R. 1998. Behavior and ecology of the northern fur seal.

Photo: Vladimir Burkanov, NOAA, NMML visiting scientist

When do seals leave the rookery and haulout?



- Adult males – mid to late August
- Adult females – late Oct. to early Dec.
- Juveniles – late Oct. to early Dec.; older first, younger ones later
- Pups – mid-Nov. to early Dec, after first big storms of the fall



Lesson 3: *What is a fur seal rookery?* 11

Fur seals of all ages molt on land. Male and female fur seals of different ages leave the rookery at different times.

- Because adult males arrive first (in May), and they don't eat while they are on the rookery, they are the first to leave (late July)
- Adult females leave between late Oct and early Dec. Females who didn't have pups, or whose pups died leave as early as October. All other females leave once their pup has weaned itself, usually in November.
- Juvenile male fur seals leave once molting is complete, up to early Dec.
- Juvenile males leave the rookery in the same order they arrived – older juveniles first, younger ones last.
- Pups leave the rookery in Nov. after the first big storms; tagging data suggests pups leave when the mother is away on a feeding trip.
- Females whose pups have left the island return to the rookery one last time, spend a few days, and then depart for the year.

Source: Lea, M.; Goebel PhD thesis; Ragen 1995; Ream 2005.

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

What can we learn at the rookery?



- Size of population
- Behavior of fur seals
- Diet and feeding behavior
- Health and diseases
- Which seals are related
- Births and deaths

Lesson 3: *What is a fur seal rookery?* 12

Scientists from around the world come to the Pribilof Islands to study northern fur seals.

Photo: Rolf Ream, NMML/AFSC/NMFS/NOAA

How do we know?

- Observation
- Counts
- Capture live seals
  - Collect tissues (blood, skin, nasal swab, fat)
  - Mark with tags
  - Attach tracking instruments (radio tags, satellite tags, time-depth recorders)
- Collect scats



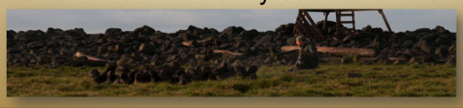
Lesson 3: *What is a fur seal rookery?* 13

- Size of population and behavior of fur seals is studied by observing the fur seals, conducting counts, putting instruments on seals, and analyzing genetic samples.
- Feeding, diving and migrating behavior can be studied by instrumenting animals.
- Health and diseases can be studied by scat, blood, and genetic analyses of tissues.
- Diet can be studied by examining scat, spews (thrown up bones) and analyzing fat samples.
- Relatedness of seals is studied using genetic samples.

Photo: Rolf Ream, NMML/AFSC/NMFS/NOAA

Summary

- Northern fur seals return to rookeries once a year to have pups and mate
- Adult males arrive first in May, followed by adult females in late June-Aug.
- Pups are born a few days after females arrive
- By studying the seals on the rookery, scientists learn about their life history both on land and at sea



Lesson 3: *What is a fur seal rookery?* 14

- Seals arrive in reverse order of age, oldest first, youngest last
- Pups wean themselves and most leave by early December (average date of leaving for pups is mid-November); by late December all seals have left the rookery.

Photo: Pam Goddard, www.thalassa-education.com

LESSON THREE | SCIENCE ACTIVITY 3.1 | Grade Level K-6

How Many Babies?

OBJECTIVE

Students learn that some mammals have one baby at a time and some mammals have many babies. Marine mammals only have one baby at a time

TIME REQUIRED

2 x 15 minutes

BACKGROUND

Animals have different numbers of babies at one time. Some animals have many thousands of babies (fish), and some have only a few (cats, dogs) and some have only one at a time (fur seals). In general, mammals have fewer babies than non-mammals. We will go through different types of animals, review the characteristics of mammals and marine mammals, and learn how many babies they have. This activity provides background information for the upcoming rookery activities, to emphasize that northern fur seals have only one pup per year. If that pup dies the female does not have another pup until the following year.

MATERIALS

- Worksheets
- Internet
- Encyclopedias

PROCEDURE

- Have the students work independently or in pairs to complete the following worksheets.
- Tell students that they will be learning about how many babies different kinds of animals have.
- For younger grades, complete the worksheets as a class. Use words like "one, a few, several, lots" rather than specific numbers, if necessary.
- Older students should work independently or in pairs to research exact numbers of offspring produced by each animal.

DISCUSSION

- Students should learn that all marine mammals (except polar bears) have only one baby at a time. Some marine mammals, like seals, have one each year; others, like walrus or large whales, have one baby every two to three years.
- Ask if all animals have the same number of babies

  Some have many babies, some only have one at a time.

  Students may also notice that some egg-laying animals have many babies at a time.
- Discuss examples of animals that have a lot of babies and animals that only have one baby at a time.

  Use different categories of animals (e.g., non-mammals, mammals, land animals, sea animals)
- How many babies does a female fur seal have each summer?

  One
- Why is it important to know how many babies an animal has?

  If a fish lays thousands of eggs but only 100 of the eggs hatch and the rest die or are eaten, the fish will still have some babies that survive. If a fur seal has only one pup and that pup dies, the fur seal cannot have another pup until the next year.

  The death of a seal's pup has a much bigger effect on the population than the loss of thousands of fish eggs.

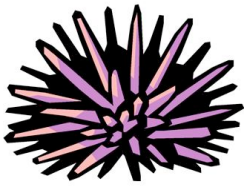
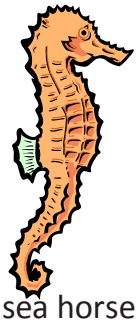
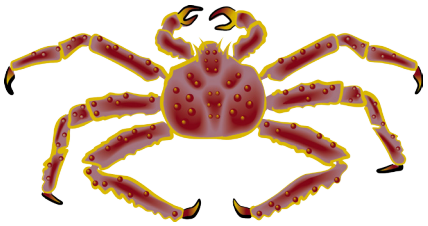
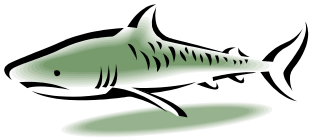
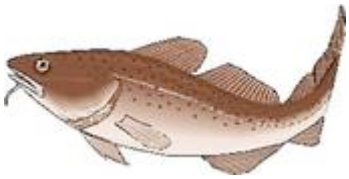
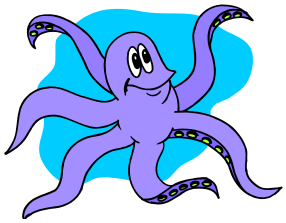
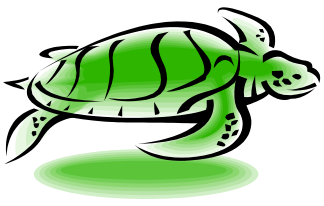
EXTEND AND EXPLORE

Define the word fecundity. Research one of the animals on the worksheets and answer the following questions.

- At what age does it begin to reproduce?
- How long does it live?
- How often does it reproduce?
- How many offspring does it have?
- An animal's reproductive strategy is the way it allocates energy to producing babies that survive. For example, some animals put their energy into making lots of eggs so that a few will survive, while other animals spend a lot of energy having a few large babies that will have a good chance of surviving. Explain your animal's reproductive strategy and tell why you think it is successful.

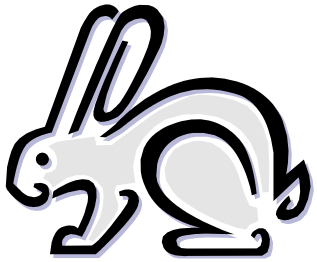
ACTIVITY 3.1 **WORKSHEET 3.1.1**

How Many Babies?
SEA CREATURES

 sea urchin — eggs	 sea horse — eggs
 lobster — eggs	 red king crab — eggs
 starfish — eggs	 Salmon shark — pups
 Pacific cod — eggs	 giant Pacific octopus — eggs
 clown fish — eggs	 sea turtle — eggs

ACTIVITY 3.1 **WORKSHEET 3.1.2**

How Many Babies?
MAMMALS



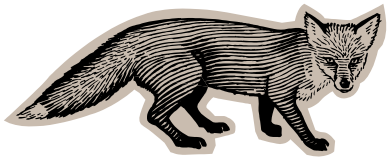
rabbit



mouse



wolf



fox



bear



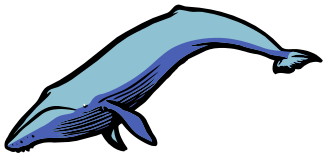
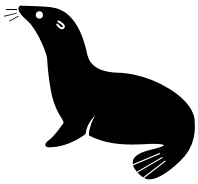
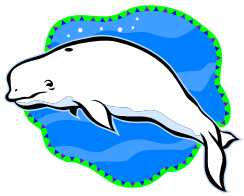
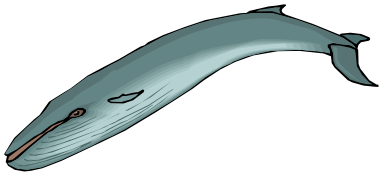
moose

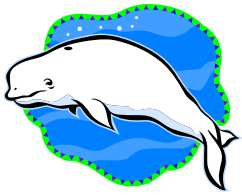
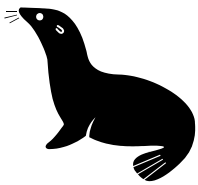


musk ox



bison

 walrus (pinniped)	 orca (cetacean)
 sea lion (eared seal, pinniped)	 dolphin (cetacean)
 harbor seal (true seal, pinniped)	 humpback whale (cetacean)
 fur seal (eared seal, pinniped)	 beluga whale (cetacean)
 sea otter (fissiped)	 blue whale (cetacean)

	fox	
	wolf	
	bison	
	beluga whale	
	fur seal	

ACTIVITY 3.1 TEACHER KEYS

Elementary Curriculum: Grades K–6

ACTIVITY 3.1 WORKSHEET 3.1.1 How Many Babies? SEA CREATURES

 sea urchin	1,000,000 eggs	 sea horse	25–1,000 eggs
 lobster	3,000-75,000 eggs	 red king crab	25,000–75,000 eggs
 starfish	1,000,000s eggs	 Salmon shark	2–5 pups
 Pacific cod	>1,000,000 eggs	 giant Pacific octopus	20,000–100,000 eggs
 clown fish	100–1,000 eggs	 sea turtle	50–200 eggs

Laaqudax̂: The Northern Fur Seal

ACTIVITY 3.1 WORKSHEET 3.1.2 How Many Babies? MAMMALS

 rabbit	5-7	 mouse	7–12
 wolf	4-7	 fox	5–8
 bear	1–2	 moose	1–2
 musk ox	1	 bison	1

Elementary Curriculum: Grades K–6

ACTIVITY 3.1 WORKSHEET 3.1.3 How Many Babies? MARINE MAMMALS

 walrus (pinniped)	1 every 2 years	 orca (cetacean)	1 every 5 years (average)
 sea lion (eared seal, pinniped)	1 every year	 dolphin (cetacean)	1 every 2–3 years
 harbor seal (true seal, pinniped)	1 every year	 humpback whale (cetacean)	1 every 2 years
 fur seal (eared seal, pinniped)	1 every year	 beluga whale (cetacean)	1 every 2–3 years
 sea otter (fissiped)	1 every year	 blue whale (cetacean)	1 every 2–3 years

Laaqudax̂: The Northern Fur Seal

ACTIVITY 3.1 WORKSHEET 3.1.4 REVIEW How Many Babies?

	fox	5–8
	wolf	4-7
	bison	1
	beluga whale	1
	fur seal	1

Source: NOAA Office of Protected Resources

LESSON THREE | ACTIVITY 3.2 | Grade Level 3–6

Rookery Timeline

OBJECTIVE

Students will learn about the sequence of events at a fur seal rookery through creation of a timeline.

TIME REQUIRED

25 minutes

BACKGROUND

The Create a Rookery Timeline Activity demonstrates the sequence of events over a one-year period at a fur seal rookery. As fur seals of different ages arrive on the rookery, the structure of the rookery changes.
The activity can be used to introduce concepts of northern fur seal seasonality and rookery structure:

- males establish territories, which they defend from other males
- females gather in the same areas each year to have their pups (site fidelity)
- non-breeding seals gather in haulouts
- pups gather into groups called “pup wads” when their mothers are not on the rookery

The activity can also introduce life history:

- adult males stay on the rookery to defend their territory and to mate with females
- adult males fast during the breeding season
- females alternate periods of time at the rookery to nurse their pups with trips out to sea to feed
- females only have one pup per year.

MATERIALS

Large sheet of butcher paper (five to six feet long) or smaller pieces taped together to form a long line.

- (optional) pictures or drawings of northern fur seal male, female, juvenile and pups - can be taped or glued to the timeline at the appropriate locations.
- Markers

PROCEDURES

For younger grades, the timeline can be a class project, with images pasted onto a large timeline at the front of the class. For older students, each student can create his or her own timeline, or they can work in groups of two to four students.

- Introduce the concept of a timeline by using the school year as an example. Add holidays and any other significant events.
- Have students draw a timeline on their paper and divide it into 12 months: January to December (or May to December, if space is an issue)
  - Ask the students to add the following events to the rookery timeline:
    i. adult males arrive
    ii. adult females arrive
    iii. pups are born
    iv. adult males leave
    v. pups leave
    vi. adult females leave

DISCUSSION

Discuss why the rookery changes over the season. Lesson 3 PowerPoint or Activity 3.3 Create a Rookery Teacher Key can be used as a reference.

- Why do all the seals come to the rookery at the same time of year?

  To mate and raise pups.

- Why do the fur seals leave the rookery before the winter?

  Cold weather/storms; can feed farther away where waters are more productive in winter; pups are weaned, so females don’t have to stay around the rookery.

- What is a simlar timeline in your life?

  Compare the rookery cycle to the school year – teachers come back to school first, then students; limited amount of time (August to May); at the end of the school year, students leave school and when they come back in the fall, they are in the next grade.

- Can you think of other examples of seasonal cycles in the year?

EXTEND AND EXPLORE

Add the juvenile males to the timeline. Males reach breeding age between seven and nine years of age (females reach breeding age earlier, at age three to five years). Juvenile males gather on haulouts until they are able to breed, then they move closer to the rookery and challenge territorial males.

Technology – older students can learn Excel to recreate the timeline on the next page.

ACTIVITY 3.2 TEACHER KEY Create a Rookery Timeline

The following events should be on the rookery timeline:

i. **May:** Adult males arrive at the rookery.
ii. **Late June–August:** Adult females begin to arrive at the rookery. Oldest arrive first, youngest arrive last, with most females arriving in July.
iii. **June–July:** The pup of each female is born a few days after she arrives at the rookery.
iv. **July:** Adult females stay at the rookery for one week after the pup is born, to nurse the pup; after a week, the female starts alternating feeding trips at sea with visits ashore to feed the pup.
v. **May:** Juvenile males start arriving at the haulouts in May, with older juveniles returning first and progressively younger males arriving later.
vi. **Late July:** Pup wads (big groups of pups of all ages that play and hang out together) form at the rookery since their mothers are out at sea feeding.
vii. **Mid to Late August:** Adult males begin to leave the rookery; older juvenile males start to move to the edges of the rookery.
viii. **Mid-November:** Pups wean from their mothers (they stop nursing) and leave the rookery after the first winter storms.
ix. **Late-October–early December:** Adult females and juveniles leave the rookery. Adult females without pups, or whose pups have died, leave in late October/early November; adult females with pups leave after their pups have weaned and left the rookery.

Activity 3.1 Northern Fur Seal Rookery Timeline

	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Adult males			Adult males arrive on the rookery in May. Adult males leave the rookery in mid to late Aug.							
Adult females					Females arrive late June to August (older females first, younger ones later) with most arriving in July. Females have pups within a few days of their arrival on rookery, then alternate nursing pup on shore with feeding trips at sea. Females leave the rookery in mid-November after their pup leaves.					
Juvenile males			Juvenile males start to arrive at haulout sites in May, with older males arriving first, and progressively younger males arriving later. Juvenile males are excluded from the rookery by adult males. Older juveniles start to come into the rookery in late August-early Sept. after adult males leave.							
Pups					Pups are born a few days after a female arrives on rookery. As they grow, pups group together into “pup wads.” Pups leave the rookery in November after the first winter storms.					

Create a Rookery — Rubber Stamp Making

OBJECTIVE

Students will learn the structure of a rookery through art. Make rubber stamps of the components of a rookery. Create pictures of the rookeries at different times of the year using the stamps.

TIME REQUIRED

50 minutes

BACKGROUND

The rookery structure changes throughout the season. First males arrive, then females arrive , pups are born, males leave, pups leave, and finally the females leave. Through art, students can visualize the changes on the rookery between June and November. The different behavior of males and females is shown through their distribution on the rookery. See diagrams of rookery structure in the Teacher Key.

NOTE

This art project can be adapted for all age levels. Students as young as five are able to sketch basic images of seals, grass, rocks, clouds, and water, which can be cut out by older students or adults. The older the students, the more complex the final image can be.

MATERIALS

- #2 pencils
- 3-inch x 3-inch Post-its
- Soft-Kut rubber (size of a square post-it note) for each student; can be purchased in a 12 x 18-inch mat and cut to size
- paper plates – for paint
- sponges – 1-inch x 1-inch cubes for painting
- acrylic paint
- stamp pads (washable ink) – various colors
- linoleum cutters – various size blades, e.g. #1 liner, #2 V-gouge, #3 large line, #4 U-gouge
- paper to print on – good variety of colors and textures, but copy paper will work. Fabric can also be used instead of paper.
- wipes – for hands
- newspaper – to cover painting surfaces
- table covering paper
- 2-inch or 3-inch paint brayer (roller)

PROCEDURES (See illustrations below)

1. Sketch on post-it; have each student pick one component of the rookery for each Soft-Kut rubber block (make sure all components of the rookery are represented, males, females, pups, rocks, waves, grass, clouds...)
2. Put Post-it on soft cut rubber with the image touching the rubber. The student should be looking at the blank side of the Post-it.
3. Transfer image to Soft-Kut rubber by gently rubbing the blank side of the Post-it with your hand or by rolling a pencil over the Post-it.
4. Cut image into rubber using linoleum cutters.
    a. Don't cut too deep
    b. Cut what you don't want to show up.
    c. Trace around objects
5. Spread small amount of paint on paper plate.
6. Lightly roll paint onto brayer/roller.
7. Once roller is covered with light coating, gently roll paint onto the soft rubber.
8. Invert soft rubber cutout onto paper or fabric.
9. Gently rub back of cutout to transfer paint to paper or fabric.
10. Allow paint to dry.
11. Wash cutout and try with other colors.
12. Create four rookery scenes that represent the changes over one breeding season.

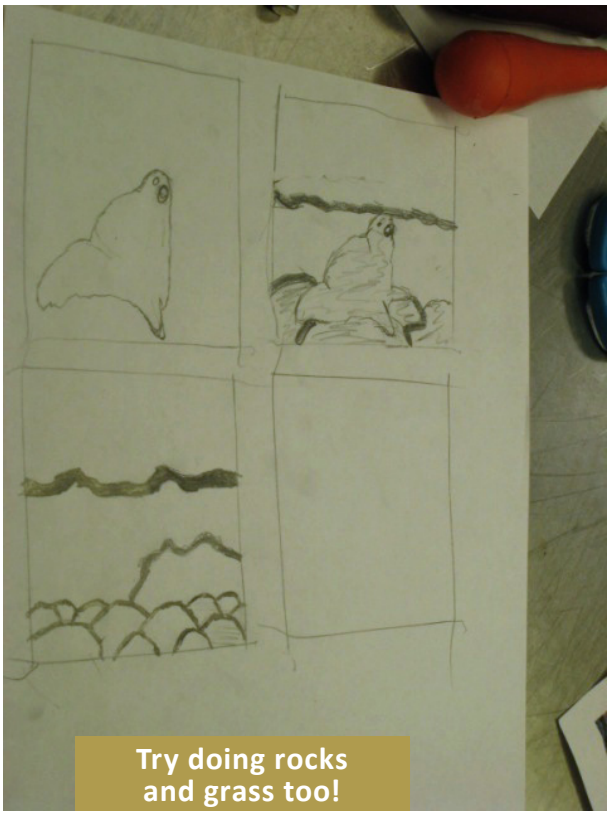
DISCUSSION

- How does the rookery change over the summer?
- Discuss other seasonal cycles (e.g. birds, deciduous trees, gray whales).
- Many other animals migrate to Alaska for the summer. Research some of the other animals.

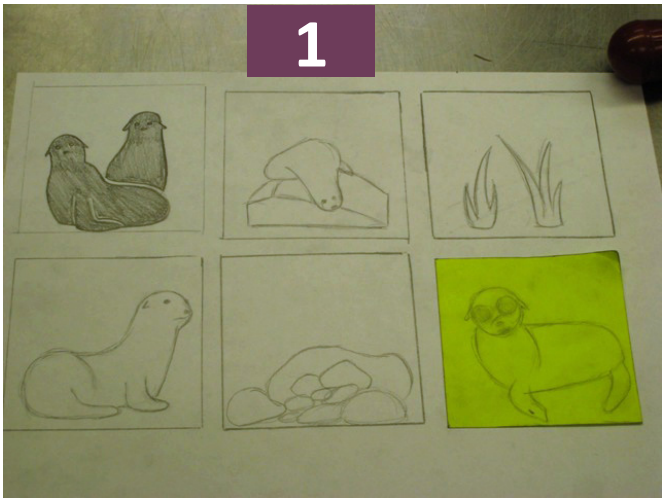
Creat a Rookery activity was developed with Seattle artist Liz Haven.

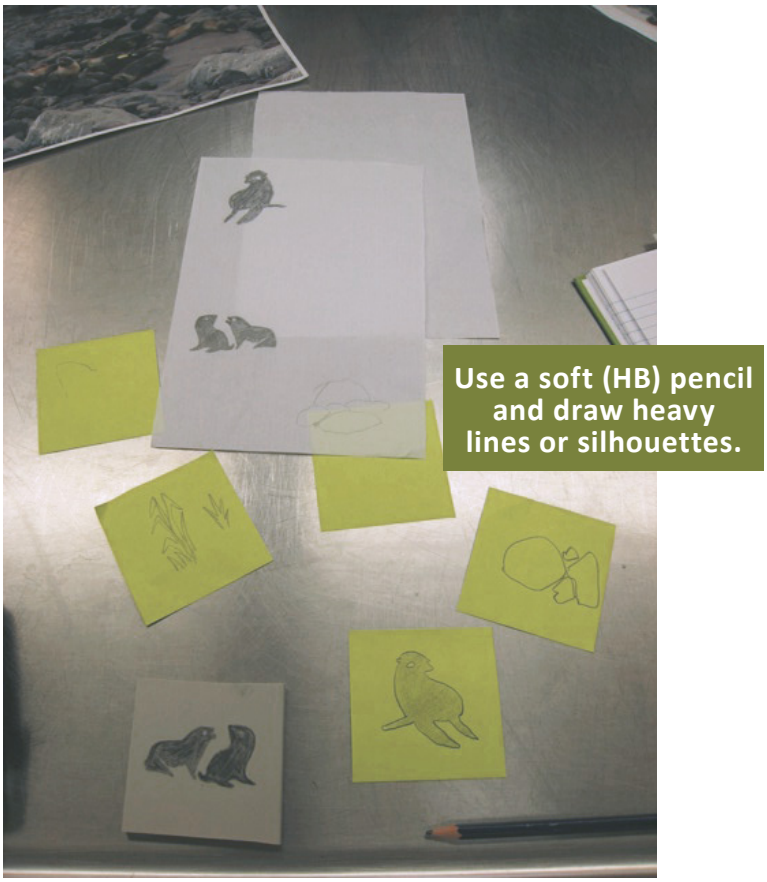
ACTIVITY 3.3

Create a Rookery with rubber stamps!

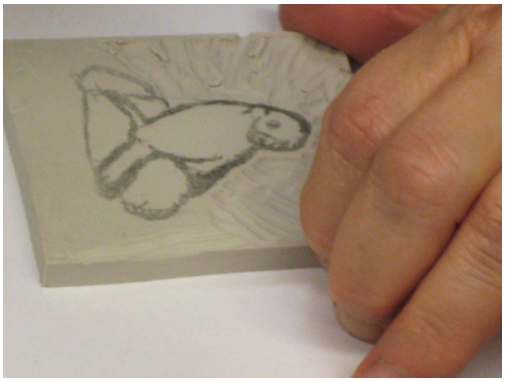


1. Sketch a picture on a post-it note
2. Put post-it face-down on rubber square.
3. Transfer image to rubber square by rubbing the the back of the post-it.





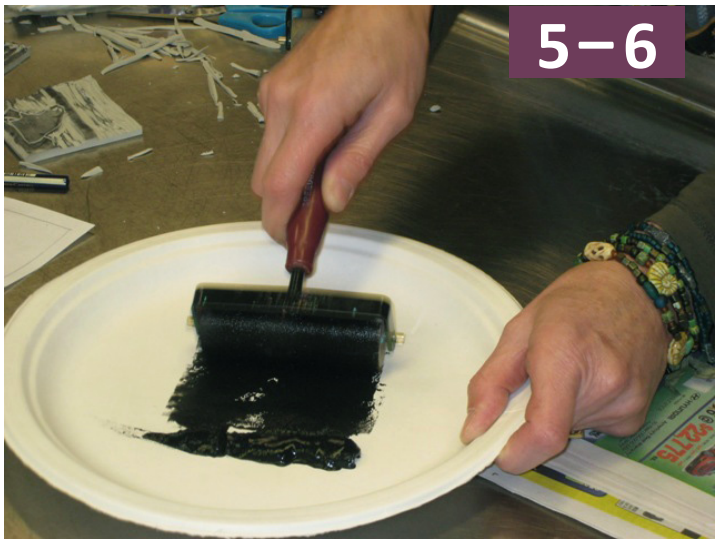
Outlines and simple shapes are easiest.





Cut the area around your design
(cut what you don't want to show).

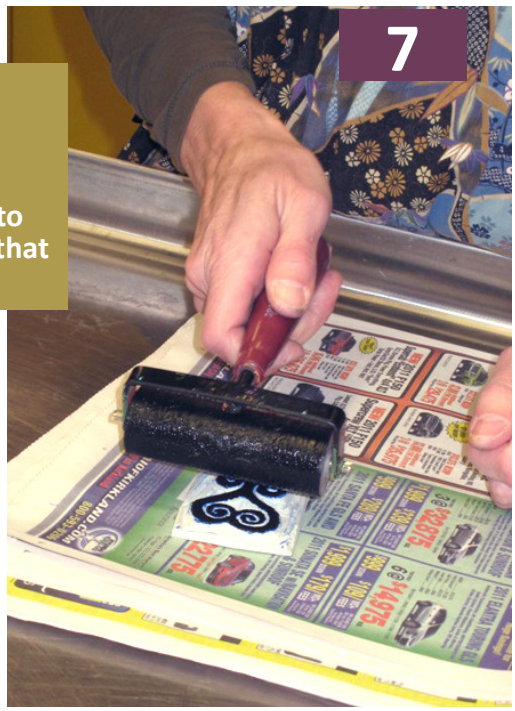
4. Cut image into rubber, using linoleum cutters.
5. Spread small amount of paint on paper plate.
6. Lightly coat roller with paint.
7. Gently roll paint onto rubber stamp.
8. Place rubber stamp onto paper face down.
9. Rub back of stamp to transfer paint.





Note: paint only on raised image.

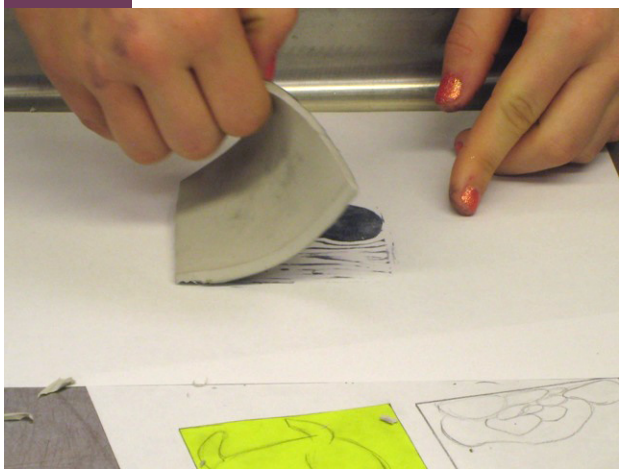
If you push too hard on the roller the paint will transfer to the areas around the image that you want to be paint free.

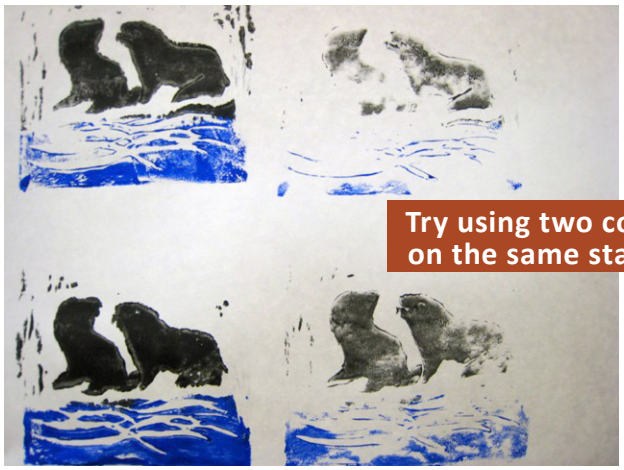




10. Look at your picture! Allow paint to dry.
11. Wash rubber stamp (with wipes or wet paper towel) and try other colors.
12. Combine stamps to make a picture.
13. Try different paper and ink colors!

10

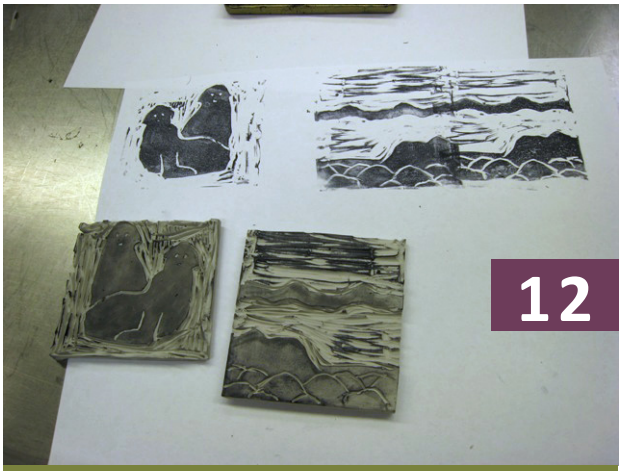




Try using two colors on the same stamp.



11



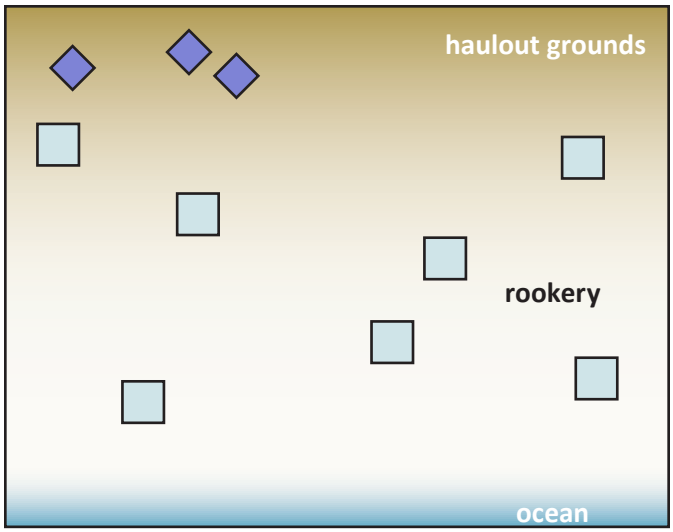
12

Make a landscape by repeating a scenery stamp.



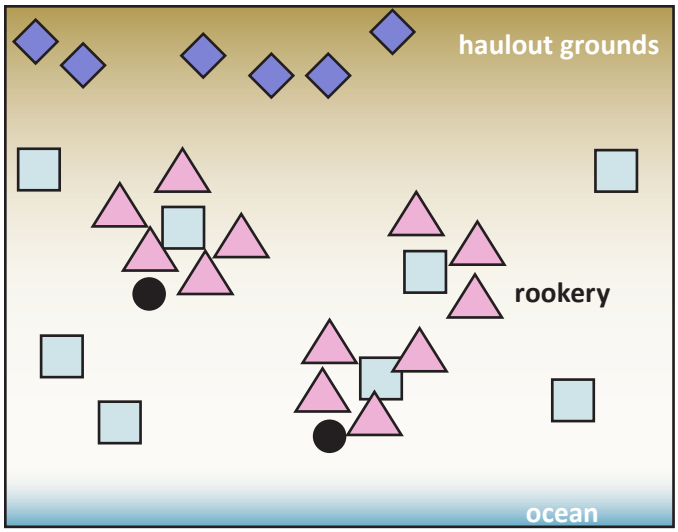
13

ACTIVITY 3.3 TEACHER KEY Create a Rookery



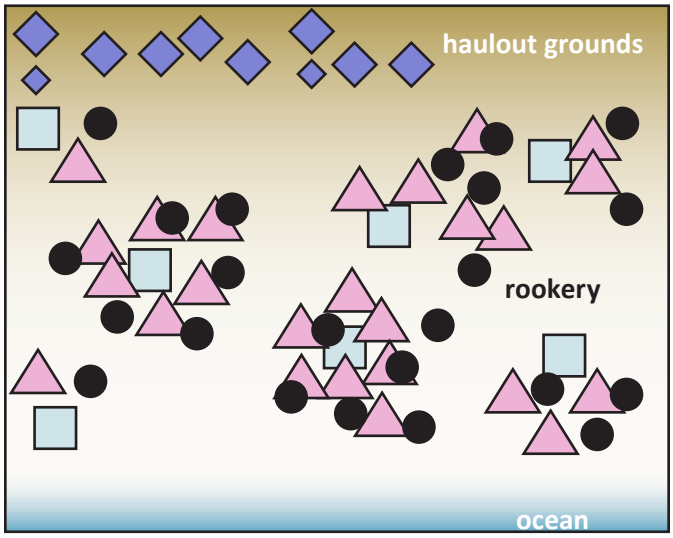
Early to mid-May

- adult males on territories
- males are spaced out (they defend area around them)
- no females at rookery yet
- older juvenile males arrive at haulout grounds



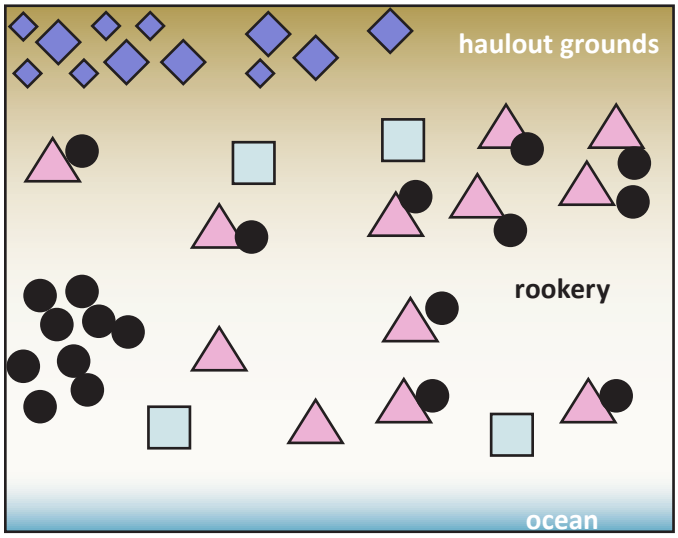
Late-June

- adult females begin to arrive at rookery and have pups within two to three days.
- females gather in territories
- a few males with central territories have most females
- some males only have a few females, over half have none



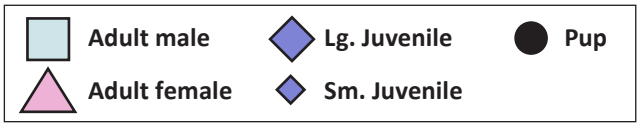
Mid-July

- more adult females arrive at rookery
- females have pups a few days after they arrive at rookery (one pup/female)
- females stay with pups for about a week, then begin to alternate feeding trips at sea with visits ashore to nurse pup
- Younger juvenile males arriving at the haulout grounds

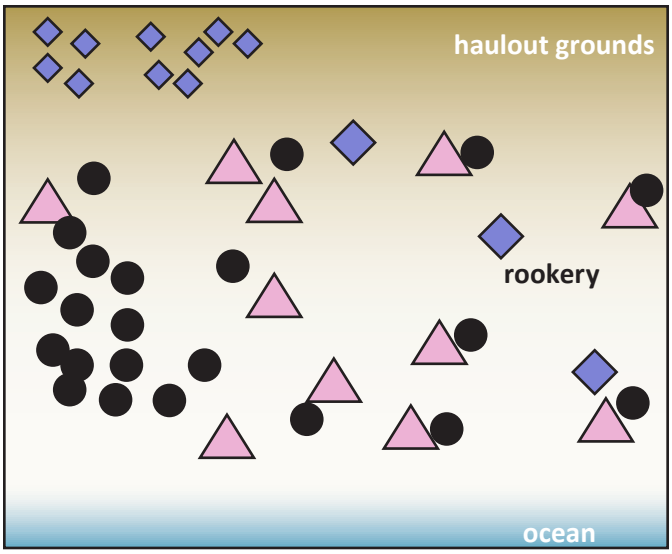


August

- all females are coming and going from rookery; some pups are nursing
- pups whose mothers are feeding at sea gather in "pup wads" (big groups of pups)
- adult males leave rookery in mid to late August
- juvenile males gather at haulout grounds at the edge of the rookery

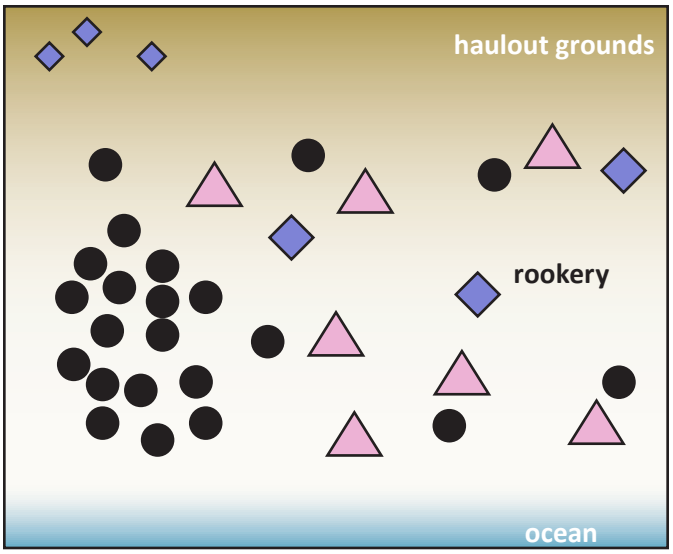


ACTIVITY 3.3 TEACHER KEY Create a Rookery



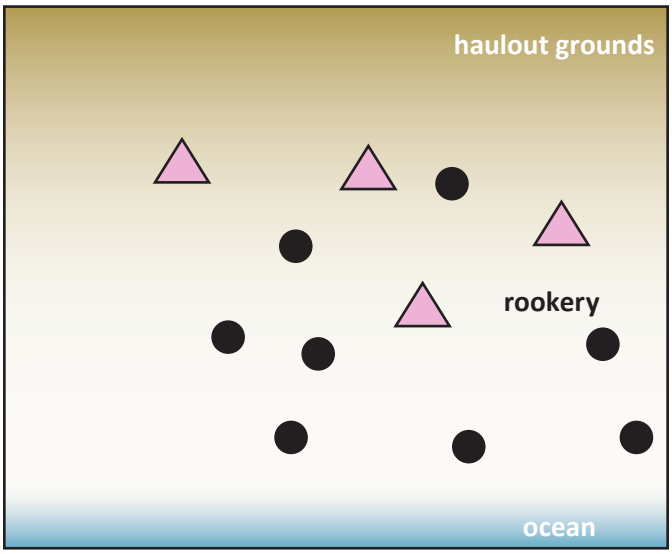
September

- females nursing pups, returning to and leaving the rookery
- pups are in "pup wads"
- younger juveniles are at haulout grounds
- older juvenile males are at the rookery practicing for the next breeding season



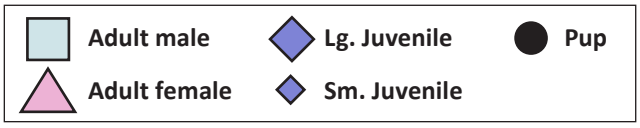
Late October

- females without pups begin to leave rookery
- pups are in "pup wads"
- older juvenile males begin to leave the rookery



November–December

- pups depart while their mothers are feeding at sea
- females leave rookery after their pup leaves
- juveniles leave rookery



LESSON THREE | ACTIVITY 3.4 | Grade Level K–6

Find Your Fur Seal Family

OBJECTIVE

Students will learn how a fur seal mother finds her pup in a crowded rookery.

TIME REQUIRED

10 minutes

BACKGROUND

Because female northern fur seals have to leave the rookery to feed at sea, they face the problem of finding their pup when they return. Females and pups reunite by calling to each other (the female recognizes the pup's call); when they get close enough, the female double-checks that the pup is hers by smelling it. Pups will answer several females' calls, but the female recognizes the pup's call and navigates across the rookery, calling to the pup all the way and listening for the pup's answering call.

MATERIALS

Slips of paper with pairs of capital and small letters.

PROCEDURE

Distribute the slips of paper to the students (make sure that you distribute pairs of letters, but only give one slip of paper to each student). Ask the students to keep their letters secret from one another.

First activity – early season

- When all students have received their slips of paper, tell them that if they have a CAPITAL letter, they are adult female seals. If they have a small letter, they are pups. They are to find the student with the letter that matches them, by calling out their letters.
- Pups may answer to several letters but females have to listen very carefully for their own letter and only respond to that one.
- When the pup and female get close enough that they can touch each other, they can show each other their letters.
- After all the students have matched up, collect the slips and discuss whether it was difficult for student pairs to find each other.

DISCUSSION

How do females find pups?

- Females and pups have unique vocalizations that they recognize. Once the female gets close enough to the pup, she uses smell to confirm its identity.

Second activity – late season

- The second round of this activity takes place after pup wads have formed (late July-early August). Distribute only the small letters for the pups, and have them gathered together in a small area.
- Choose two or three other students, give them a CAPITAL letter, and tell them to go to the pup wad and find their pup.
- All the pups are allowed to answer when a female calls, but the female has to listen very carefully for her own pup's call.
- This round can be repeated several times with different students playing the role of the females.

DISCUSSION

Discuss with the students whether it's easier or harder to find pups when they are in a pup wad. Why do pups respond to many females' calls but females only respond to one pup?

If a pup gets close enough to a female to fool her into thinking it is her pup, it can get more milk than if it only responds to its own mother.

EXTENSION

- Visit a rookery; look for mothers calling for their pups. Are the pups responding to the females?
- Watch a video of fur seals and pups.

ACTIVITY 3.4 Find Your Fur Seal Family

A	a	N	n
B	b	O	o
C	c	P	p
D	d	Q	q
E	e	R	r
F	f	S	s
G	g	T	t
H	h	U	u
I	i	V	v
J	j	W	w
K	k	X	x
L	l	Y	y
M	m	Z	z

LESSON THREE | ACTIVITY 3.5 | Grade Level K–6

Vocalizations in Northern Fur Seals

OBJECTIVE

Students will learn that males, females, and pups have different vocalizations.

TIME REQUIRED

10 minutes

BACKGROUND

Northern fur seals have a variety of calls. Female seals and pups use their calls to identify each other. Students will listen to fur seal vocalizations and describe them.

MATERIALS

Pribilof Islands, Preserving the Legacy DVD or website

PROCEDURES

Students will watch a short video segment on northern fur seal research (Video clip "Fur Seal Research" in the Video Gallery section) or listen to northern fur seal audio files from the resources listed below. Students will describe the vocalizations that they hear, and identify them as coming from a male, a female, or a pup.

DISCUSSION

- What do they sound like? Are the sounds what you think a seal sounds like, or are they different?
- Why do the animals have different vocalizations?

RESOURCES

Pribilof Islands: Preserving the Legacy DVD or website
http://docs.lib.noaa.gov/noaa_documents/NOS/ORR/TM_NOS_ORR/TM_NOS-ORR_17/HTML/Pribilof_html/Images/Movies/SealResearch.mpg

Northern Fur Seals
http://www.dosits.org/audio/interactive/#/70

Borror Laboratory of Bioacoustics
The Ohio State University (used with permission borrowerlab@osu.edu)
http://blb.biosci.ohio-state.edu/commonname.asp
Search on northern fur seal.

EXTENSION FOR PRIBILOF STUDENTS

On the field trip to the blind, listen for different vocalizations. Try to record the vocalizations with a video camera or tape recorder. Play back the vocalizations in the classroom. Can you distinguish between the males, females and pups?

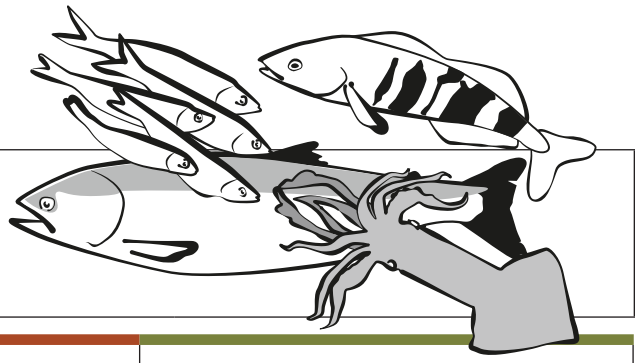
Post your video on YouTube for other students.

Listen to other pinniped vocalizations.
Scripps Institute of Oceanography: Voices of the Sea
http://cetus.ucsd.edu/voicesinthesea_org/species/pinnipeds/caSeaLion.html

Discovery of Sounds in the Sea
http://www.dosits.org/audio/interactive

LESSON FOUR

What do fur seals eat?



Subject Area(s): Life science	**Grade Levels:** K-6	Presentation – 10 minutes Activities – variable

Lesson Topics:	Marine mammal and northern fur seal diets, scat and stomach analysis.	**Focus Questions**	• How do scientists study what fur seals eat if they eat at sea? • Why do we want to know what fur seals eat?
Learning Objectives:	Students will: • learn what fur seals eat • identify fur seal scat contents • learn two ways scientists determine what fur seals eat • summarize lunch contents • explain why it is so hard to study what marine mammals eat	**Key words:**	diet, prey, ecosystem, scat, food habits

ACTIVITIES		ALASKA STANDARDS			
		Math	Science	Minutes	Grades
Activity 4.1	Make a Food Chain		SC3.2	15	K–2
Activity 4.2	Lunch Box Detective	K.CC.4–6; K.MD.3 1.MD.7 2.MD.9–10 5.MD.4	SA1.1–1.2 SA2.1	15	K–2
Activity 4.3	Scat Detective	K.CC.4–6; K.MD.3 1.MD.7 2.MD.9–10 3.MD.4 3.MD.6 4.MD.6 5.MD.4	(3–6) SA1.1–1.2 SC2.1 SG2.1	30	3–6
Activity 4.4	Microworlds: What do Marine Mammals Eat?			15	K–6

Targeted Alaska Grade Level Expectations (GLEs)

Science as Inquiry and Process

SA1 Students develop an understanding of the processes of science used to investigate problems, design and conduct repeatable scientific investigations, and defend scientific arguments.

SA2 Students develop an understanding that the processes of science require integrity, logical reasoning, skepticism, openness, communication, and peer review.

Concepts of Life Science

SC2 Students develop an understanding of the structure, function, behavior, development, life cycles, and diversity of living organisms.

SC3 Students develop an understanding that all organisms are linked to each other and their physical environments through the transfer and transformation of matter and energy.

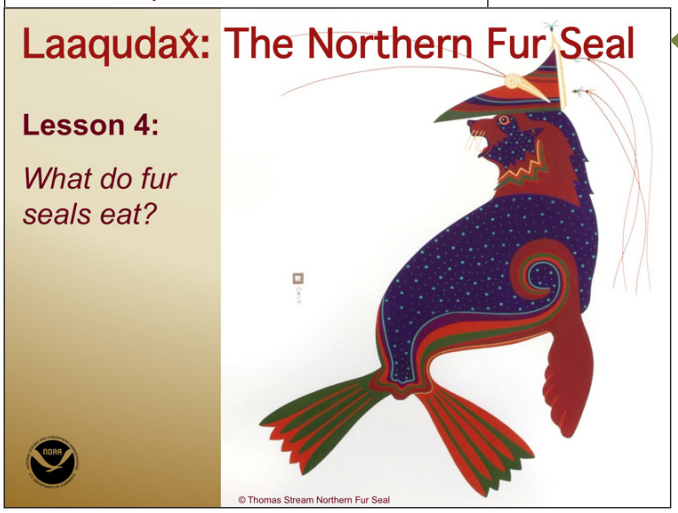
Science and Technology

SE1 Students develop an understanding of how scientific knowledge and technology are used in making decisions about issues, innovations, and responses to problems and everyday events.

SE2 Students develop an understanding that solving problems involves different ways of thinking, perspectives, and curiosity that lead to the exploration of multiple paths that are analyzed using scientific, technological, and social merits.

History and Nature of Science

SG2 Students develop an understanding that the advancement of scientific knowledge embraces innovation and requires empirical evidence, repeatable investigations, logical arguments, and critical review in striving for the best possible explanations of the natural world.



Lesson 4 gives an overview of what fur seals eat when they are at the rookery, traditional knowledge, and current scientific methods of studying fur seal food habits.

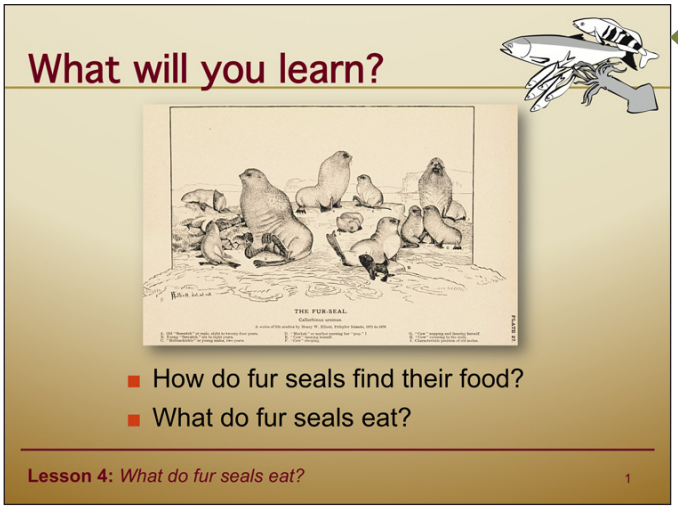
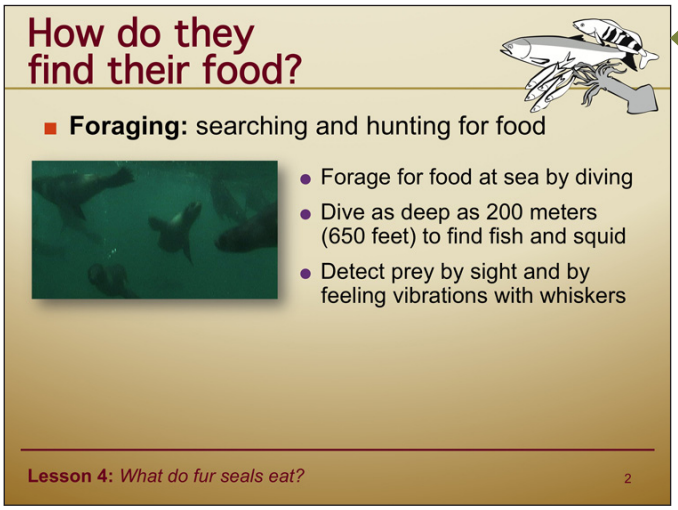


Image: Henry Wood Elliott illustration, The Fur Seal, University of Washington Library.



Fur seals find their food by foraging and diving while at sea. Most fur seals feed at night when fish and squid move closer to the surface. Fur seals large eyes are well suited for seeing underwater and in low light conditions. Their whiskers detect vibrations caused by prey moving in the water and they can hear very well.

Listen to sounds created by sea creatures at Discovery of Sound in the Sea. www.dosits.org/audio/interactive

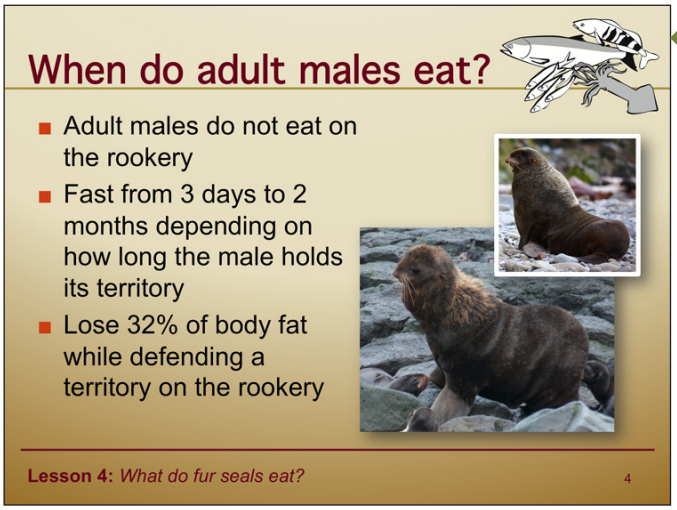
Photo: Paul Hillman, NOAA Ocean Media Center



Fur seals eat different fish in different places. The scat from St. Paul Island and St. George Island contain mostly pollock. Other prey species are squid, herring, salmon, and atka mackerel.

It is important to note that seals and humans are consuming the same species of fish and squid.

Photos: NOAA/AFSC website (http://www.afsc.noaa.gov/ABL/MSI/msi_sae_psf.htm)

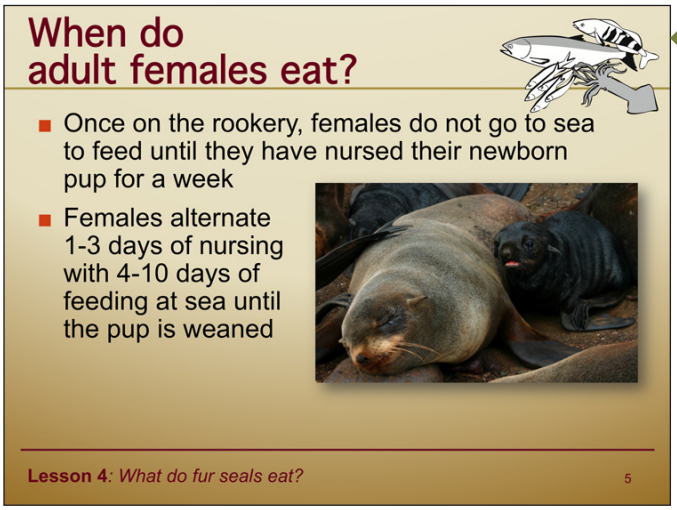


When do the different age groups eat?

Adult males on the rookery do not leave to eat; they fast for the whole time they are on the rookery. If a male left its territory to feed at sea, another male would move in and take over his territory. Males spend most of the winter feeding and gaining weight for the breeding season.

During the summer, non-territorial males and non-breeding males alternate between time on shore to rest and time at sea to feed.

Photos: thin male — Pam Goddard, www.thalassa-education.com
inset — Mikhail Shlemov (Russian photographer) via Vladimir Burkanov, NMML/AFSC/NMFS/NOAA



The pup is nursed for about 4 months before it weans and starts feeding itself.

As the nursing pup gets older and needs more milk, the female goes out for a longer time to feed.

Females from different rookeries eat different fish and feed in different areas.

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

What & when do pups eat?

- The pup drinks its mother's milk for the first 4 months
  - Milk is 49% fat, 37% water, 11% protein
  - Pups nurse for 1-3 days, then go without food for 4-10 days while their mothers are at sea feeding
  - Pups learn to eat fish and squid when they leave the rookery at 4 months



Lesson 4: *What do fur seals eat?* 6

Pups stay with their mom for one week after they are born, nursing every day. After the first week, the female goes out to sea to feed and to produce more milk; during that time, the pup stays in the rookery and fasts.

The female alternates feeding trips with one to three day visits ashore to nurse the pup.

After four months, the pup weans itself by leaving its mother; then it learns to hunt and feed itself.

Photo: nursing pup — Pam Goddard, www.thalassa-education.com

Traditional Knowledge

- Pribilof fur seals used to eat more seal-fish (Northern smoothtongue)
- Fur seals from different rookeries eat different fish
- Fur seal meat may taste different depending on the diet of the fur seal
- Sea lions taste different than fur seals



Lesson 4: *What do fur seals eat?* 7

Northern smoothtongue (Leuroglossus schmidti), also known as smoothtongue, was called seal-fish by the Unangan because the seals ate these fish. Elders in the Pribilof Islands told stories that the fur seals ate more seal-fish in the past.

An elder from St. George Island who moved to St. Paul Island said that fur seals from St. George Island tasted different (better) than the fur seals from St. Paul Island. Many years later, scientists studying the diet of seals from the different islands and different rookeries found that the diet of fur seals from St. George contained more squid and salmon than the diet of fur seals from St. Paul Island.

Food habits studies of fur seals have also confirmed that fur seals from different rookeries tend to eat different food.

Source of traditional knowledge: Aquilina Lestenkof and St. Paul community members

Photo: Richard Hibpshman, REFM/AFSC/NMFS/NOAA

How do we know?

- Traditional knowledge of fur seal food habits has been confirmed by scat collections
- Analysis of stomachs and intestines
- Analysis of fur, whiskers, and blood
- Observe nursing pups



Lesson 4: *What do fur seals eat?* 8

Historically, fur seals were killed for scientific purposes. Scientists collected stomachs from these seals to learn about their diets. Since the 1970s fur seals have not been killed for science.

Today fur seal diet information is collected while the seals are on the rookery.

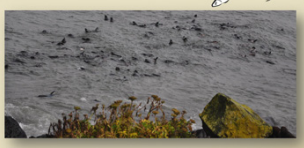
- Scientists collect seal scat (poop), then wash it through sieves to find bones and squid beaks in the scat. These are identified to find out what fur seals eat.
- Bones and beaks are also measured to determine the size of fish and squid that the seals eat.
- Fur seal throw up (spew) large bones and squid beaks that cannot pass through the digestive tract. Scientists examine spews to identify fish and squid that are eaten.
- Stomachs and intestines from harvested animals are examined to see their contents.
- Chemical and fatty acid analyses of fur, whiskers and blood can provide information on the types of food that fur seals eat.

Photos: Paul Hillman, NOAA Ocean Media Center

Summary



- Fur seals eat different types of fish and squid
- Breeding males don't eat while on land
- Females alternate feeding trips at sea with visits to the rookery to feed their pups
- Pups drink milk for the first 4 months





Lesson 4: *What do fur seals eat?* 9

Photos: Pam Goddard, www.thalassa-education.com

LESSON FOUR | SCIENCE ACTIVITY 4.1 | Grade Level K–2

Make A Food Chain

OBJECTIVE

Students will learn about marine food chains and where humans fit into a food chain.

TIME REQUIRED

15 minutes

BACKGROUND

Animals that eat other organisms are part of a food chain.

MATERIALS

- Worksheets with pictures:
  - Sun
  - Phytoplankton
  - Zooplankton
  - Small fish
  - Larger fish
  - Fur Seal
  - Harbor seal
  - Baleen whale
  - Killer whale
  - Human
- Optional – used stuffed animals instead of, or with, the cards

PROCEDURE

- Ask if students know what a food chain is. Describe how a food chain shows how energy is passed from one organism to another (or, another way to say it is "when an animal eats another animal and that animal is eaten by another animal"). Ask kids to talk about simple food chains that they know about (cat eats mouse eats grain seed, which gets its energy from the sun). Emphasize that plants make their own energy from the sun, and the sun is at the beginning of a food chain.
- Working with a group of five to six students, have them choose pictures from the worksheet. Line them up in order: sun, phytoplankton, zooplankton, small fish, larger fish, seal. Explain that phytoplank are tiny plants in the ocean that get their energy from the sun and zooplankton are tiny animals, and that the sun is at the beginning of a marine food chain.
- Repeat this exercise a few times, with different animals. Have the students line themselves up in the correct order. Sing a song about food chains – one option is a song that is adapted from a song called "Slippery Fish" (http://www.youtube.com/watch?v=g67pk7gXJLo&feature=related)

  Big round sun, big round sun, shining on the water,
  Big round sun, big round sun, shining on the water,
  Big round sun, big round sun, GULP GULP GULP!
  Oh no, it's been eaten by a.....

  Plankton, plankton, floating in the water....
  Zooplankton, zooplankton, wiggling in the water...
  Small fish, small fish, slipping in the water....
  Larger fish, larger fish, swimming in the water....
  Fur seal, fur seal, flying through the water....
  Sea lion, sea lion, playing in the water....
  And so on.
- Examples of food chains that you can make:
  - Sun, phytoplankton, zooplankton, small fish, fur seal
  - Sun, phytoplankton, zooplankton, baleen whale
  - Sun, phytoplankton, zooplankton, small fish, large fish, killer whale
  - Sun, phytoplankton, zooplankton, small fish, fur seal, person
  - Sun, phytoplankton, zooplankton, small fish, large fish, person

DISCUSSION

Discuss what all the food chains have in common (they all start with sun, phytoplankton, zooplankton)

Discuss what might happen if the phytoplankton or zooplankton disappeared.

The other anmals wouldn't have enough to eat.

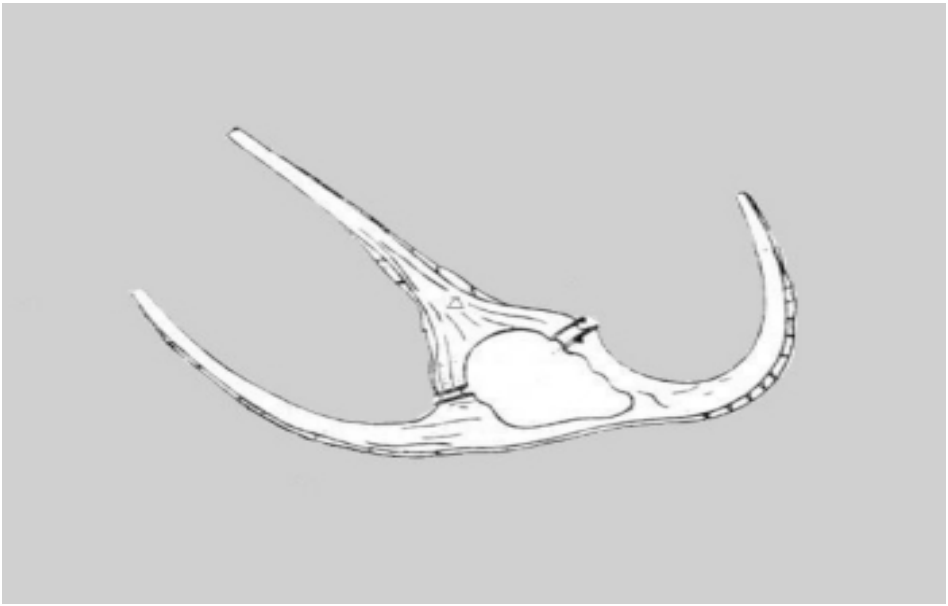
EXTENSION

Optional individual activity: make several copies of the food chain cards, mix them up and lay them on a table. Ask students to make their own food chains, and explain them to you.

- Optional extension: make a food chain of each student's favorite food.
  - Example: if the favorite food is macaroni and cheese, talk about what macaroni is made from (wheat) and where cheese comes from (milk, from a cow), and then draw a food chain:
    - Macaroni: Sun, wheat (which is made into pasta), STUDENT
    - Cheese: Sun, plants, cow (makes milk which is made into cheese), STUDENT



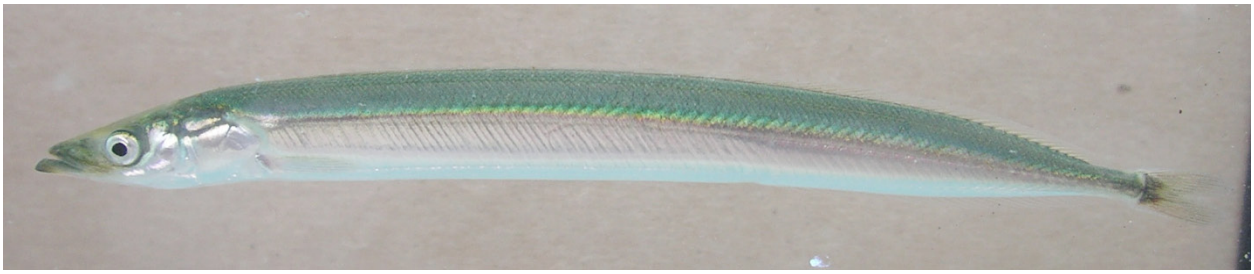
Sun



phytoplankton



zooplankton



Pacific sand lance



salmon



northern fur seal



harbor seal



killer whales



humpback (baleen) whales



human

LESSON FOUR | ACTIVITY 4.2 | Grade Levels K–2

Lunch Box Detective

OBJECTIVE

Students will learn how to create a frequency of occurrence graph using food from student lunch bags.

TIME REQUIRED

15 minutes

BACKGROUND

In this activity, students use lunches (either actual or created with paper images) to categorize and graph the contents. The activity prompts them to think about what kind of information they can obtain by looking at lunches much like a scientist would obtain by looking at fur seal scats.

MATERIALS

- Sack lunches
- Plastic bags
- Multi-colored Post-It notes (small)

PROCEDURES

GRADE LEVEL K-2

- Ask students to bring in a sack lunch the following day or make up your own sack lunches with plastic bags and the images provided below.
- Looking at what is inside the students' lunches is similar to looking at the fur seal scats.

Make a prediction chart.

1. Draw an X and Y-axis on a white board or poster paper.
2. Have the students predict the contents of the lunches.
3. Create four to six categories for lunch items. Examples: sandwiches, fruit, vegetables, sweets, drink, other.
4. Without looking at the lunches, ask students to raise their hand if they think an item is going to be in their lunch. Plot the data.

Analyze and plot the lunch data.

1. Create categories on the X-axis for lunch items using the categories the class chose.
2. Have each student empty his/her lunch bag on his/her desk.
3. Categorize the lunch items into groups; for example: fruit, sandwich, vegetable, sweets...
4. Make a bar chart of the lunch items.
    a. For each lunch item ask students to raise their hands if the item is in their lunch.
    b. Count the number of lunches with the item. Note: students may have more than one item from a category; only record the presence of an item ,not the number of items in each lunch. You are trying to figure out how many lunches contain items from a category not the number of times the item occurs.

Compare the predictions to the actual results.

NOTE: If you have Post-It pads of different colors, you can use the colors to represent the food categories and have each student put up one Post-it note for each type of food in their lunch, creating a bar graph on the board.

Example:

green = vegetable
red = fruit
purple = sweet
yellow = sandwich

The students use the Post-It notes to plot their data on the classroom bar chart.

DISCUSSION

- How close was your prediction to the actual data?
- What information can you gather from looking at lunches like this?
- What items are the most frequently found (e.g. most lunches had a sandwich)
- What was the least frequently found item?
- Think about how this activity might be different if you wanted to see what an animal eats.

EXTENSION

Within a category, have students graph the different items to see how frequently they were found (e.g. apples, pears, oranges within the "fruit" category).

ACTIVITY 4.2 EXAMPLE Lunch Box Detective

LUNCH #1
sandwich
apple
orange
cookie

LUNCH #2
sandwich
sandwich
carrots
celery
radishes

LUNCH #3
sandwich
carrots
broccoli
apple

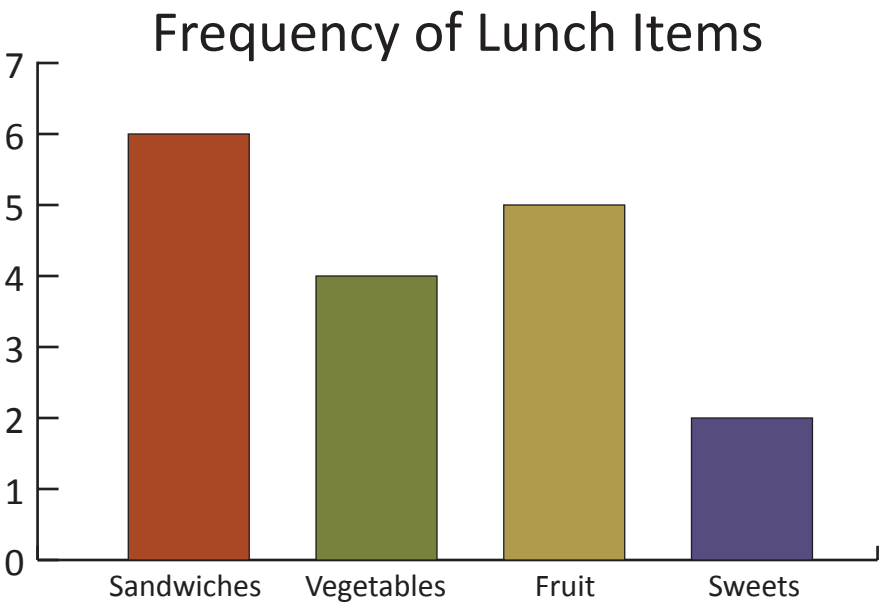
LUNCH #4
sandwich
pear
orange

LUNCH #5
sandwich
sandwich
carrots

LUNCH #6
sandwich
mango
candy

LUNCH #7
celery
carrots
apple

Total # of Lunches	**7**
Lunch Item	# of lunches with item
Sandwiches	6
Vegetables	4
Fruit	5
Sweets	2



ACTIVITY 4.2 LUNCH IMAGES

Lunch Box Detective

 JUICE	 JUICE	 JUICE	 JUICE	 JUICE	 JUICE
 COOKIE	 COOKIE	 COOKIE	 COOKIE	 COOKIE	 COOKIE
 CARROT	 CARROT	 CARROT	 CARROT	 CARROT	 CARROT
 PEAR	 PEAR	 PEAR	 PEAR	 PEAR	 PEAR
 APPLE	 APPLE	 APPLE	 APPLE	 APPLE	 APPLE
 ORANGE	 ORANGE	 ORANGE	 ORANGE	 ORANGE	 ORANGE

ACTIVITY 4.2 LUNCH IMAGES

Lunch Box Detective

 BANANA	 BANANA	 BANANA	 BANANA	 BANANA	 BANANA
 SANDWICH	 SANDWICH	 SANDWICH	 SANDWICH	 SANDWICH	 SANDWICH
 SANDWICH	 SANDWICH	 SANDWICH	 SANDWICH	 SANDWICH	 SANDWICH
 HOT DOG	 HOT DOG	 HOT DOG	 MILK	 MILK	 MILK
 MILK	 MILK	 MILK	 MILK	 MILK	 MILK
 WATER	 WATER	 WATER	 WATER	 WATER	 WATER

LESSON FOUR | SCIENCE ACTIVITY 4.3 | Grade Level 4–6

Scat Detective

OBJECTIVE

Students will examine scats, tally the data, and produce frequency histograms.

TIME REQUIREMENT

30 minutes

BACKGROUND

Fur seals eat many different types of fish and sometimes they eat birds. One of the ways scientists study fur seal food habits is by examining their scat. (Scat is also called feces or poop.) Each summer, scat is collected from the rookery, frozen, and then shipped back to the lab for further examination. After all of the organic material has been washed away the bony parts of the fur seal's prey is left behind. Many of the bony or hard parts can be traced back to a specific species of fish, squid, or octopus. The parts that survive traveling through the digestive tract of a fur seal are:

- otoliths (fish earbones)
- vertebrae (fish bones)
- eye lens
- squid or octopus beaks (mouth parts)

By using extensive reference collections located at the Alaska Fisheries Science Center, scientists are able to identify species of fish, squid, or octopus that the bones, otoliths, lenses, or beak come from. We call the scientists Scat Detectives.

MATERIALS

- Images of prey items—Appendix II
- Plastic or cloth bags, envelopes
- Otolith, bone, and fish reference keys

PROCEDURE

Preparing the scats

This should be completed at least one day before you teach the lesson.

1. Print several single sided copies of the otoliths/beaks and bones. Sixty percent of your images should be pollock bones or otoliths. If you have access to a laminating machine, laminate the images of otoliths/beaks and bones before proceeding.
2. Cut out the individual images and mix them up.
3. Obtain enough bags or envelopes for each student or pair of students to have one bag. Number each bag. If you are feeling really ambitious, label each prey item that goes into the bag with the same number. This allows you to have the same data from year to year.
4. Fill the bags with the different prey items. Remember that pollock is the most frequently consumed prey item. Almost all of the scats should have pollock otoliths or bones in them.
5. Distribute the bags around the classroom to simulate a rookery.
6. Have the students find a scat and open it up.

Analyze the data using a frequency histogram

1. Using the reference keys, ask the students to identify the bones, otoliths, and beaks in their bags.
2. Complete Worksheet 4.3.1
3. Have each student graph the result for his or her bag. The x-axis should be the species and the y-axis is the frequency or total number of items for that species.
4. Now consolidate the data for the class and make another graph.

DISCUSSION

Did all of the scats have the same species? How were the individual scats different from the class total? Why do you think the seals would eat different prey?

EXTEND AND EXPLORE

Research the species on the reference keys and answer some of the following questions. A good place to start is FishBase, www.fishbase.org.

1. Where is the species found?
2. How big does it get? How many would a fur seal have to eat to fill up?
3. Is the species commercially harvested in Alaska or off the West Coast? If yes, what time of the year is it harvested? What size fish are the fishermen targeting?

NOTE: It takes time to cut out all of the images and put them in bags. Start the preparation for this activity one or two days before you plan on teaching it. Save it for future years

ACTIVITY 4.3 WORKSHEET 4.3.1 Scat Detective–Frequency Data

Student Name:_____

Scat Bag #: _____

Place a tally mark for each item that is present in your bag.

Species Name	bones	otoliths or beaks	Total
walleye pollock			
Pacific cod			
Atka mackerel			
Pacific herring			
Pacific sand lance			
Northern smoothtongue			
coho salmon			
squid			

Class Total

Total # of scat bags: _____

Species Name	# bones	# otoliths or beaks	Total
walleye pollock			
Pacific cod			
Atka mackerel			
Pacific herring			
Pacific sand lance			
Northern smoothtongue			
coho salmon			
squid			

ACTIVITY 4.3 TEACHER KEY 4.3.1 Scat Detective–Frequency Data*

Student Name: Sample Data

Scat Bag #: 32

Place a tally mark for each item that is present in your bag.

Species Name	bones	otoliths or beaks	Total
walleye pollock	𝍸 I	II	𝍸 III
Pacific cod			
Atka mackerel			
Pacific herring	I		I
Pacific sand lance	I		I
Northern smoothtongue			
coho salmon			
squid		II	II

Class Total

Total # of scat bags: 10

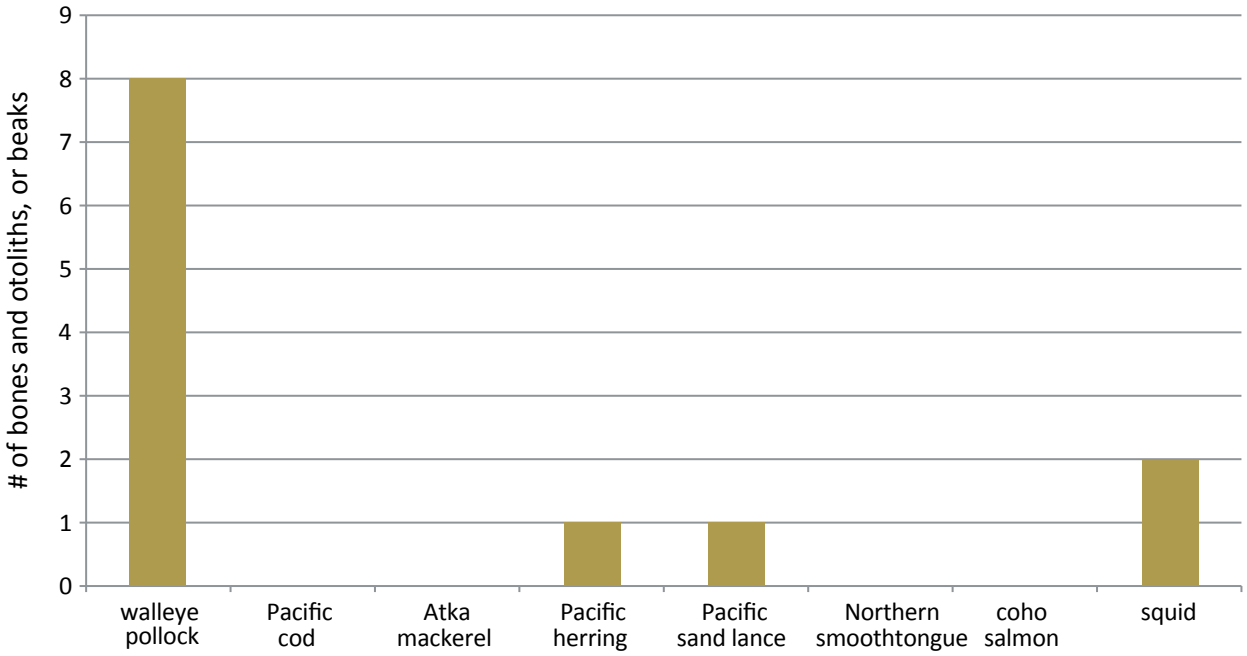
Species Name	# bones	# otoliths or beaks	Total
walleye pollock	42	28	70
Pacific cod	5	2	7
Atka mackerel	3	4	7
Pacific herring	6	2	8
Pacific sand lance	5	3	8
Northern smoothtongue	3	3	6
coho salmon	2	1	3
squid		15	15

**** Sample, answers will vary***

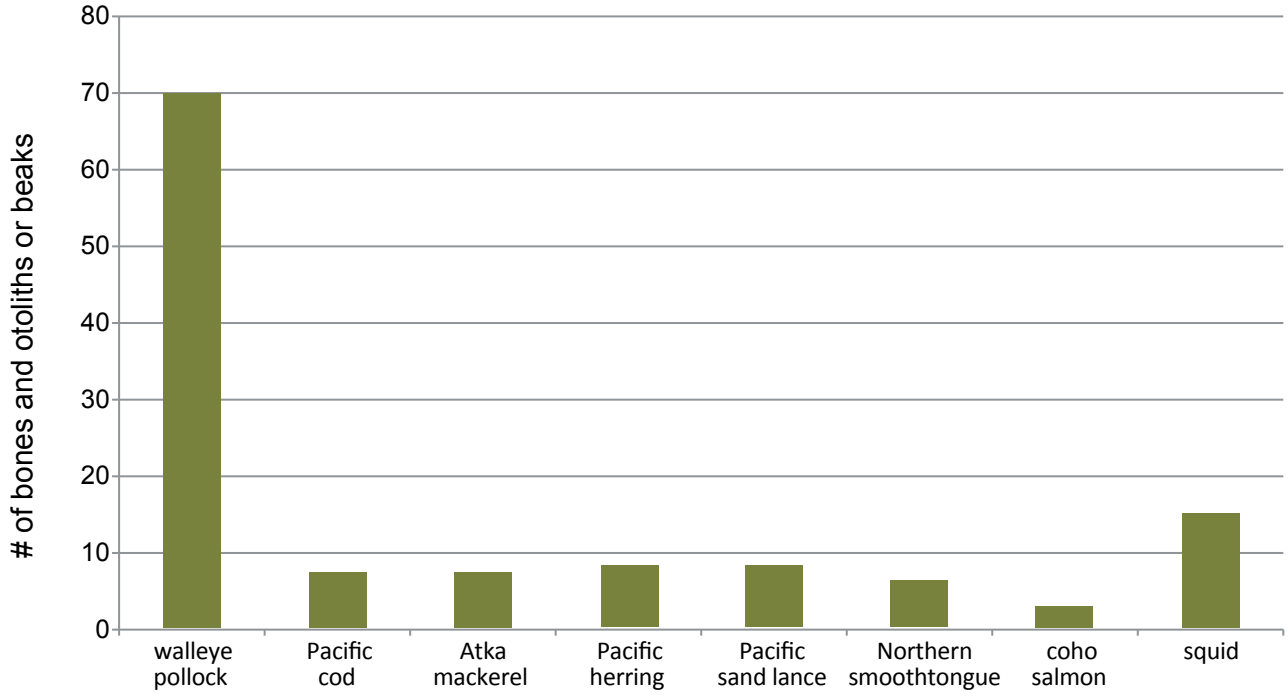
ACTIVITY4.3 TEACHER KEY Scat Detective*

Sample Data

Scat #32



Class Total



**** Sample, answers will vary***



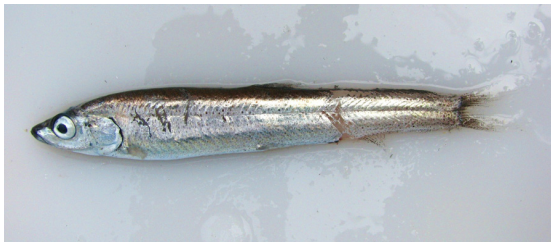
squid



walleye pollock (*Theragra chalcogramma*)



Pacific cod (*Gadus macrocephalus*)



northern smoothtongue (*Leuroglossus schmidti*)



Pacific herring (*Clupea pallasii*)



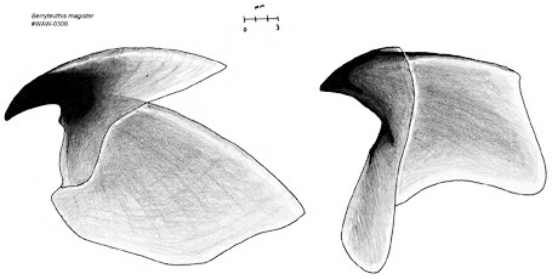
coho salmon (*Oncorhynchus kisutch)*



Pacific sand lance (*Ammodytes hexapterus*)



Atka mackerel (*Pleurogramma monopterygius*)



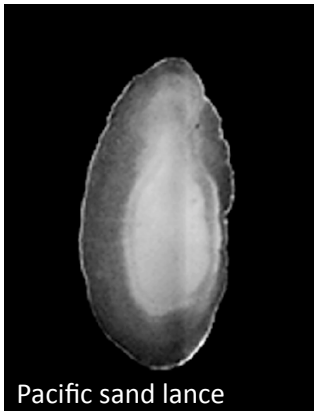
squid beak



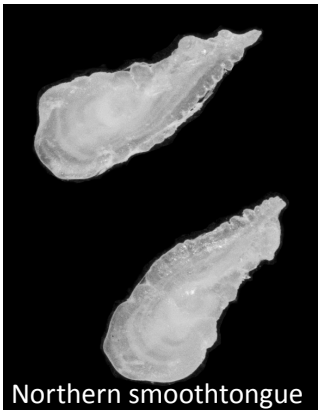
Pacific cod
Gadus macrocephalus



walleye pollock
Theragra chalcogramma



Pacific sand lance
Ammodytes hexapterus



Northern smoothtongue
Leuroglossus schmidti



Pacific herring
Clupea pallasii



coho salmon
Oncorhynchus kisutch



Atka mackerel
Pleurogramma monopterygius

ACTIVITY 4.3 REFERENCE KEY Scat Detective


Pacific cod
Gadus macrocephalus


Pacific cod
Gadus macrocephalus

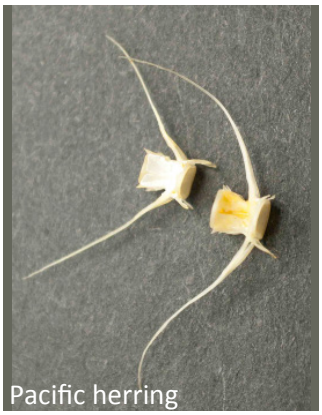

walleye pollock
Theragra chalcogramma


walleye pollock
Theragra chalcogramma


walleye pollock
Theragra chalcogramma


Northern Smoothtongue
Leuroglossus schmidti


Northern Smoothtongue
Leuroglossus schmidti


Pacific herring
Clupea pallasii


Pacific herring
Clupea pallasii


Pacific herring
Clupea pallasii


Pacific sand lance
Ammodytes hexapterus


Pacific sand lance
Ammodytes hexapterus


coho salmon
Oncorhynchus kisutch


coho salmon
Oncorhynchus kisutch


Atka mackerel
Pleurogramma monopterygius


Atka mackerel
Pleurogramma monopterygius

LESSON FOUR | SCIENCE/WRITING ACTIVITY 4.4 | Grade Level K–6

Microworlds: What do Marine Mammals Eat?

OBJECTIVE

Students will learn why it is difficult to study what marine mammals eat.

TIME REQUIRED

15 minutes

BACKGROUND

Fur seals spend most of their lives at sea. When they are on land they do not eat. Scientists have used many different ways to study fur seal food habits. This video of Dr. Tony Orr from the Alaska Fisheries Science Center's National Marine Mammal Lab explains how Tony studies what fur seals eat.

MATERIALS

- NOAA Microworlds: What do Marine Mammals Eat? DVD or website

PROCEDURES

Watch "What do marine mammals eat?"

DISCUSSION

Discuss or write about the following.

- Why is it so hard to study what marine mammals eat?
  - instruments are expensive: underwater video cameras, satellite tags
  - marine mammals move quickly: very hard to follow under water, dive to great depths
  - marine mammals eat underwater: do not bring food to the surface, feed at night or in deep water

In the video Tony mentions he studies northern fur seal food habits by using scats, spews, and hair.

- What are different ways scientists study northern fur seals diets?
  - DNA from scat
  - animal tissue (whiskers, blood, hair, blubber)
- Why is it so important to know what they eat?
  - fishing pressure
  - competing with humans for food
  - learn why population is declining
  - changes in diet could indicate changes in ecosystem

RESOURCES

NOAA Microworlds: What do Marine Mammals Eat? DVD or website
http://www.youtube.com/watch?v=Ntu_x9JkrxI

Microworlds: What do Marine Mammals Eat?

1. Name three reasons why it is hard to study what marine mammals eat.

2. Describe methods that scientists use to study northern fur seal diets.

3. Why is it important to know what northern fur seals eat?

Microworlds: What do Marine Mammals Eat?

1. Name three reasons why it is hard to study what marine mammals eat.

   Marine mammals feed underwater. It is hard to see what they eat.

   Putting cameras on the animals is very expensive.

   The environment where they eat is often deep and dark.

2. Describe methods that scientists use to study northern fur seal diets.

   Radio and satellite tags.

   Scat analysis. DNA from scat.

   Animals tissue: blubber, hair, whiskers, blood

3. Why is it important to know what northern fur seals eat?

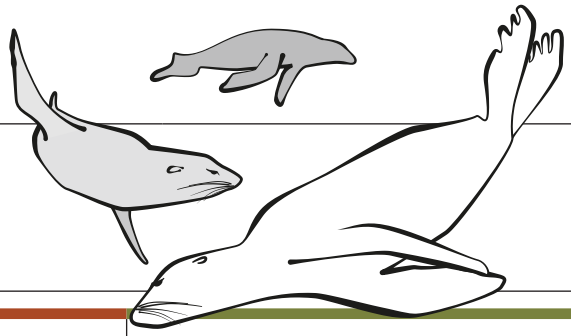
   Northern fur seals compete with humans for the same fish.

   The northern fur seal population is declining. Scientists need to figure out why the population is not stable.

   Northern fur seals are part of a complex ecosystem. Changes in the fur seals diet could indicate changes in the larger ecosystem.

LESSON FIVE

How do fur seals dive?



Subject Area(s): Life science	**Grade Levels:** K-6	Presentation – 10 minutes Activities – variable

Lesson Topics:	Fur seal diving
Learning Objectives:	Students will: • investigate adaptations of seals to water • compare insulating qualities of air and blubber

Focus Questions	• How are pinnipeds adapted to the water? • How do they dive? • Why do we want to know how deep fur seals dive?
Key words:	blubber, body shape, forage, adaptation

ACTIVITIES		ALASKA STANDARDS				
		Math K–3	Math 4–6	Science 3–6	Minutes	Grades
Activity 5.1	Blubber Mitt	1.MD.7 2.MD.9 3.MD.4, 3.MD.6	4.MD.6 5.MD.4 6.SP.1-5	SA1.1–1.2 SA2.1 SC2.2 SG2.1	10	K–6
Activity 5.2	Waiting to Inhale	3.MD.4 3.MD.6	4.MD.6 5.MD.4 6.SP.1-5	SA1.1–1.2 SA2.1 SC2.2 SG2.1	10	3–6
Activity 5.3	Exhale and Dive	3.MD.4 3.MD.6	4.MD.6 5.MD.4 6.SP.1-5	SA1.1–1.2 SA2.1 SC2.2 SG2.1	10	K–6

NOTE: It works well to set each activity up as a station; divide the class into three groups and have the groups rotate through the stations. Afterwards, the class can discuss their results.

Targeted Alaska Grade Level Expectations (GLEs)

Math

MD Measurement and Data

SP Statistics and Probability

Science

Science as Inquiry and Process

SA1 Students develop an understanding of the processes of science used to investigate problems, design and conduct repeatable scientific investigations, and defend scientific arguments.

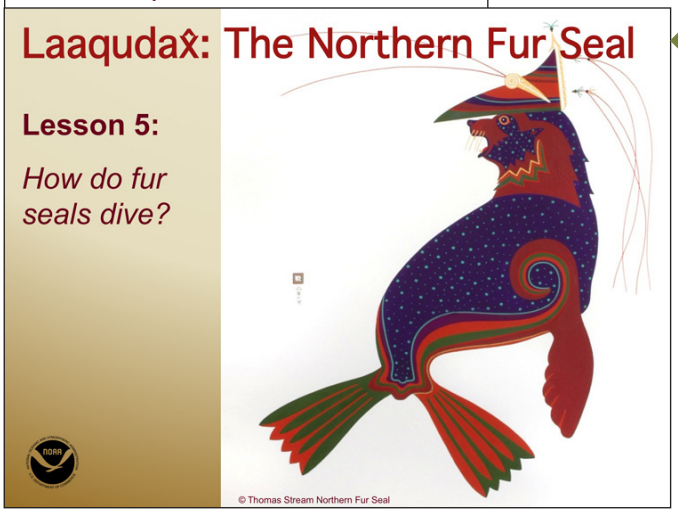
SA2 Students develop an understanding that the processes of science require integrity, logical reasoning, skepticism, openness, communication, and peer review.

Concepts of Life Science

SC2 Students develop an understanding of the structure, function, behavior, development, life cycles, and diversity of living organisms.

History and Nature of Science

SG2 Students develop an understanding that the advancement of scientific knowledge embraces innovation and requires empirical evidence, repeatable investigations, logical arguments, and critical review in striving for the best possible explanations of the natural world.



Lesson 5 contains a brief overview of how seals are adapted to the water and how they are adapted to dive, how deep they dive, and what we can learn from this information.

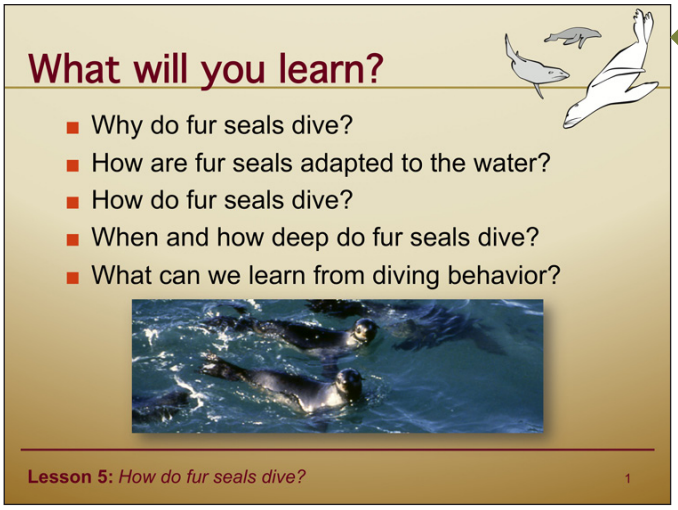
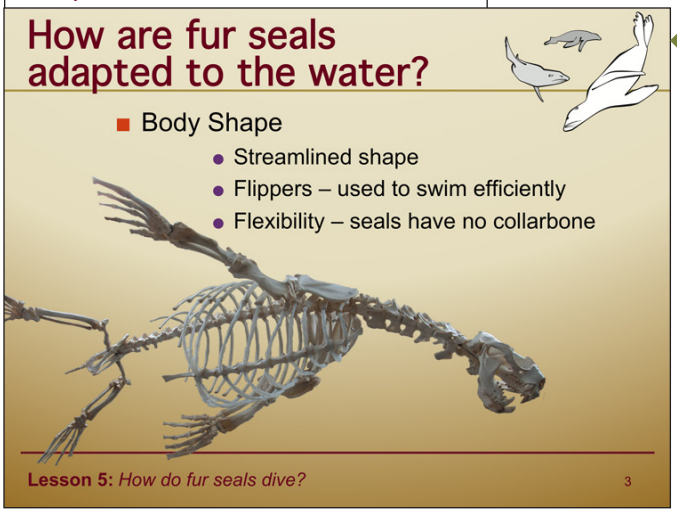


Photo: NOAA/NMFS/AFSC/NMML, Observer Training PowerPoint



Fur seals dive primarily to search for food, and while traveling.

Photo: Paul Hillman, NOAA Ocean Media Center

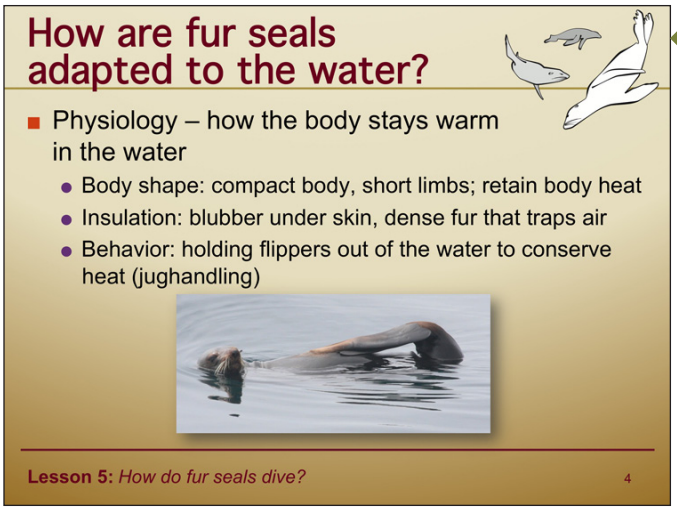


Pinnipeds spend over half their lives in the water, so their bodies are adapted to the water in many ways. The next several slides give an overview of some of the major adaptations to the water: body shape, ability to stay warm in water and cool on land, ability to see and hear underwater.

Pinnipeds have a streamlined body shape with relatively short, wide flippers (compared to the legs of a terrestrial animal like a horse). The body is also very flexible.

- Because of the sleek, streamlined body, seals can move swiftly through the water with little drag. The ears and tail are small so that they don't cause resistance in the water.
- Flippers help efficiently propel the body through water, which is denser than air (and therefore requires more effort to move through).
- Because the seal's body is extremely flexible, it can maneuver easily when swimming underwater. This flexibility also helps seals be effective underwater predators.

Source: Riedman, M. 1990. The Pinnipeds.
Photo by: Lisa Hiruki-Raring, NOAA/AFSC (edited by Rebecca White, NOAA/AFSC)

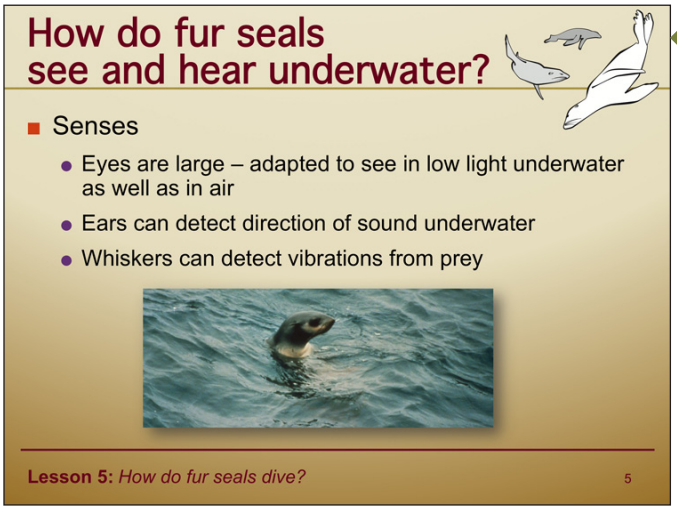


Ocean water is cold – the body loses heat 25 times faster in water than it does in air. Pinnipeds must keep their body temperature close to 100° F (38° C) in ocean water that may be only 30°-40° F (0-5° C).

To allow pinnipeds to regulate their temperature in water and to conserve heat, they have the following adaptations:

- **Compact body and short limbs** – body size is also relatively large (there are no seals as small as a mouse), as large bodied mammals chill less quickly than small ones. Less heat is lost from a compact body with short limbs.
- **Blubber and dense fur** – minimizes heat loss in the water. Fat insulates animals from cold and stores energy for when seals fast. Fur seals have two layers of fur: flattened protective outer guard hairs and thick, fine underfur to protect against cold. The underfur traps air, which insulates the body from cold.
- **Behavior** – fur seals hold their flippers out of the water (called "jughandling") to conserve heat in the cold water. Seals also have a network of small blood vessels in their flippers that allow heat to be kept close to the core of the body.

Source: Riedman, M. 1990. The Pinnipeds.
Photo: Robert Pitman, Protected Resource Division/SWFSC/NOAA



Seals can see well both underwater and in air. Their eyes are large in relation to their body size and are adapted to seeing in low light levels.

Seals have good underwater hearing. They can tell which direction a sound is coming from, the same way that people do.

Long, sensitive whiskers appear to help pinnipeds "feel" vibrations of prey in the water, especially when visibility is poor. Whiskers may also help seals navigate underwater.

Source: Riedman, M. 1990. The Pinnipeds.
Photo: NOAA/NMFS/AFSC/NMML Observer training PowerPoint

How do fur seals dive?



- Seals exhale and hold their breath during dives
- Nostrils automatically close
- Heartbeat slows
- Eyes stay open
- Ears close

Lesson 5: *How do fur seals dive?* 6

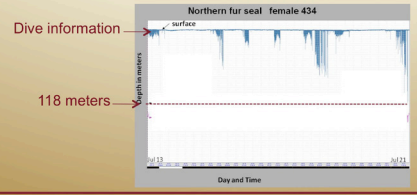
Air-breathing mammals like pinnipeds must be able to take in enough oxygen while they dive for food. Most eared seals dive to relatively shallow depths of 150-200 meters (compared with 1000-1200 meters for other seals and cetaceans). Seals have to adapt to the pressure of deep dives (as depth increases, the water pressure increases) and conserve oxygen while diving.

- A seal exhales at the beginning of a dive and holds its breath during a dive. That way, its lungs are only partially filled with air, and it can dive more easily. A seal also does not have many air spaces in the body, and its ribs are flexible and can flatten the lungs during a dive.
- The seal's nostrils automatically close.
- The seal's blood circulation becomes restricted to only essential organs and tissues: the brain, the heart, and a few other vital organs, and the heartbeat slows down.
- The seal's muscles have a large amount of myoglobin, a substance that stores oxygen.
- The seal's eyes stay open so that it can see prey underwater.
- Ears close during a dive.

Source: Riedman, M. 1990. The Pinnipeds.
Photo: Paul Hillman, NOAA Ocean Media Center

When and how deep do fur seals dive?

- Fur seals dive to 150-200 m (492-656 ft)
- Average dives are 2.2 minutes
- Longest dive is 7.6 minutes
- At night most fur seals dive to shallow depths



Lesson 5: *How do fur seals dive?* 7

Fur seals dive to different depths depending on their prey.

This graph shows dive data from a recorder placed on a female northern fur seal. The x-axis along the bottom is date and time. The y-axis is depth in meters with the surface (0 meters) at the top. The data show that this fur seal dove mostly at night.

Source: Gentry, R. 1998. Behavior and ecology of the northern fur seal.

How do fur seals stay cool on land?

- Seals are adapted to stay warm in the water
- On land they need to cool themselves.
  - Pant to cool
  - Flippers have no insulating fur
  - Hind flippers are very long – more surface area to lose heat
  - Hind flippers are held up in the air and waved
  - Flippers are waved to cool the blood, not to fan the body



Lesson 5: *How do fur seals dive?* 8

On land, pinnipeds have the problem of keeping cool, while still having all the adaptations that allowed them to stay warm in the water.

Fur seals cool off in several ways:

Panting - Most mammals have sweat glands which allow them to cool the body by evaporation of sweat. Panting is a form of sweating. The tongue is cooled as water evaporates off the surface. Northern fur seals are the only marine mammal that pants.

Flippers – the hindflippers are very long, and neither hind nor foreflippers have fur. A fine network of blood vessels in the flippers allows for exchange of heat; when the seal is in cold water, heat in the blood can be kept near the core of the body, but when the seal is hot, the warmth in the blood goes out to the flippers and can be released to the environment when the seal waves its flipper in the air. When the seal waves its flipper, the blood is cooled and heat is released from the body. The cooled blood then goes back into the body from the flipper.

Source: Riedman, M. 1990. The Pinnipeds., p. 19 (panting), 20 (flippers)
Photo: Rolf Ream, NOAA/NMFS/AFSC/NMML

What can we learn from diving?

- When, where, how often, and how deep seals are diving
- Competition with fisheries and risk of bycatch of seals in fisheries





Lesson 5: *How do fur seals dive?* 9

By attaching instruments to seals, scientists can find out location of dives (where seals are foraging, or where they travel), time of day (when seals are diving), frequency of diving (some seals dive more often at night than during the day), depth of dives (depth can give information on the prey targeted by seals).

From dive locations and depths, scientists and managers can see if seals are feeding in areas where fisheries are active.

Photos: adult male — Jeremy Sterling, NMML/AFSC/NMFS/NOAA
pup – Jason Baker, NMML/AFSC/NMFS/NOAA

How do we know?

- Instruments on seals
  - **Time-depth recorders** (TDRs) give time and the depth of dives
    - instrument must be retrieved
    - less expensive but doesn't collect location information
  - **Satellite-linked instruments** transmit dive and location data via satellites to computers
    - no instrument retrieval
    - more expensive
  - **GPS tags** record location
    - Must be combined with TDR
  - **Cell phone tags**
    - Can be used in more populated areas (not the Bering Sea!)



Lesson 5: *How do fur seals dive?* 10

Things to think about when putting an instrument on an animal:

- Size of instrument compared to the size of the animal (scientists couldn't tag pups until the tags were small enough that they wouldn't affect the pup's ability to swim). If the tag is too big, the animal's ability to move around (swim, walk) is affected.
- Attachment method. The first instruments were attached by harnesses on the animals, which were bulky and caused a lot of drag in the water. Currently, instruments are attached with glue to the fur of the seal.

Photo: Rolf Ream, NMML/AFSC/NMFS/NOAA

Summary

- Fur seals dive to eat
- Fur seals can see and hear underwater
- Their bodies are adapted to being in cold water
- The average dive is 2.2 minutes

Lesson 5: *How do fur seals dive?* 11

LESSON FIVE | SCIENCE/MATH ACTIVITY 5.1 | Grade Level K–6

Blubber Mitt

OBJECTIVE

Students will investigate how blubber helps marine mammals stay warm in cold water by experiencing first hand the discomfort of cold water and the insulating properties of a blubber mitt.

TIME REQUIRED

10 minutes

BACKGROUND

Like humans, marine mammals are warm-blooded animals. Although they live in some of the coldest environments on earth they still maintain a constant body temperature. Most marine mammals have blubber. Blubber is a thick layer of fat under the skin that acts as insulation against the cold ocean water. Almost all marine mammals need the insulating properties of blubber to stay warm. Blubber is firmer and far thicker than the fatty tissue of land mammals and is laced with connective tissue. Unlike fur, blubber does not compress when the animals dive deep to feed. Whales, dolphins, and walrus depend primarily on blubber to keep warm; sea lions and seals depend on both blubber and fur.
Blubber is such an effective insulator that marine mammals must guard against overheating.

MATERIALS

For each team of 3 students:

- 2 one-gallon or one-quart resealable freezer bags (no zipper bags)
- 36 oz. of vegetable shortening
- spatula
- duct tape
- towels
- ice
- 2 digital thermometers
- bucket or tub
- water
- graph paper
- bubble wrap

Optional

- feathers
- wool
- sweatshirt
- fleece
- Styrofoam packing peanuts

Introductory Discussion

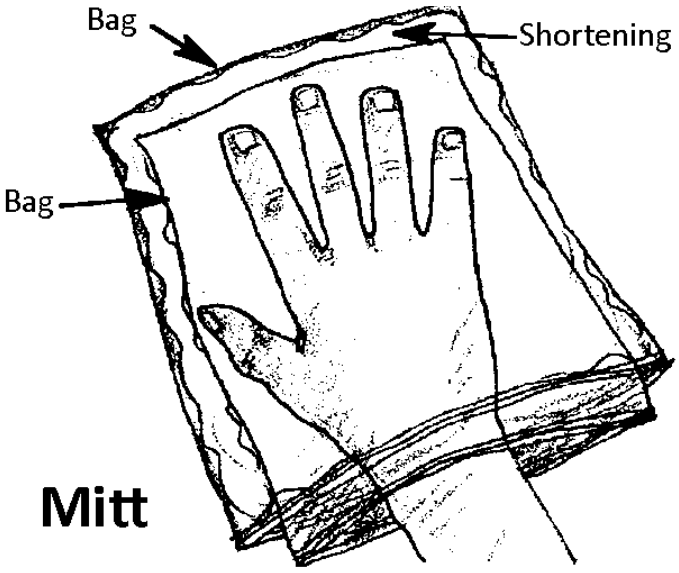
- Ask students how marine mammals stay warm in the water.
- Talk about how humans stay warm in cold water.
  - Divers wear wet suits or dry suits.
- Introduce the concept of blubber and fur that marine mammals use to keep warm.

PROCEDURES

Either you or your students will need to make blubber mitts. If you can stand the mess, consider having your students make the mitts. Once a class set of mitts is constructed, you can use them year after year. Students can work in groups of 3 or more.

Make the blubber mitts

1. Fill one plastic bag with enough shortening to coat all of the surfaces.
2. Turn the second bag inside-out and insert it into the first bag. Try to keep the seals free of shortening to allow for a better grip. Zip the tops together.
3. Use duct tape on the seals to prevent water from entering the blubber mitt.



Make the control mitts

- Follow the procedure above but leave out the shortening.

Prepare the cold water.

- Fill a bucket or cooler with ice water. The container should be large enough to hold two mitts at the same time.

PROCEDURES continued

K-1

Test how well each mitt insulates against the cold water.

1. Put one hand in each mitt.
2. Place both mitts in the cold water for 60 seconds.

Record which hand feels colder.

Grades 2-6

Measure the temperature in the blubber mitt and in the control

Worksheet 5.1.1 (see below) in groups of three.

1. Have students predict which mitt will be warmer.
2. Put the blubber mitt and control mitt in the ice water. Make sure the ice water does not get inside the mitts.
3. Assign tasks or allow students to volunteer for a task.

   Tester — holds the blubber mitt and control mitt so that the temperature can be measured in each.

   Temperature measurer — uses the digital thermometer to record the temperature.

   Data recorder — records the temperature on the data sheet.
4. Rotate roles among students so that the group gets three measurements and each student has a turn in each role.
5. Have students calculate the average temperatures from their three trials, compare the results from the blubber and control mitt, and write a conclusion about which mitt provides the most insulation.

DISCUSSION

- Discuss the results. Which material provided the best insulation and why?
- Were there any surprises? Did the students predict that a material would not provide insulation when it actually did?
- What are other materials that could be used? How do other animals stay warm?
- Was there anything that affected the outcome? (For example, if cold water got into the blubber mitt, it would affect the temperature recorded in the mitt). Think about how this could happen in an animal with blubber (e.g. the animal gets an injury and coldwater gets past the blubber).

EXTENSION

1. Have students create their own ‘survival mitt’ by substituting other materials for the shortening in the mitt, such as Styrofoam packing peanuts, feathers, or wool, etc. retry the experiment, and compare results.
2. Create a mitt that has air or bubble wrap between the two layers of plastic bag. Compare results to the blubber. Northern fur seals and sea otters trap bubbles of air in their fur to insulate them against the cold water.
3. Grades 5-6: Research how northern fur seals stay cool on land. See also Lesson 5 PowerPoint slide #8.

The Blubber Mitt activity is a lesson adapted with permission, from the award-winning FOR SEA family of curriculum guides for grades 1–2, available from FOR SEA Institute of Marine Science, Indianola, Washington 98342 (http://www.forsea.org)

ACTIVITY 5.1 WORKSHEET 5.1.1 Blubber Mitt

Student 1 name: _____

Student 2 name: _____

Student 3 name: _____

Prediction: Which mitt will provide the most insulation? (Which mitt will be warmer?)

_____

Data Table: Temperature inside mitt

	Blubber Mitt Temperature	Control Mitt Temperature
Trial 1		
Trial 2		
Trial 3		
Average		

Conclusion:

_____

_____

_____

Additional observations (What affected the outcome?)

_____

_____

_____

LESSON FIVE SCIENCE/MATH ACTIVITY 5.2 Grade Level 3–6

Waiting to Inhale!

OBJECTIVE

Students will learn how long fur seals hold their breath when they dive.

TIME REQUIRED

10 minutes

BACKGROUND

INSTRUCTOR: This is an activity that should not be done at home or unsupervised. Instructors should take precautions to warn students that this activity should be done only at school.

Air-breathing mammals like pinnipeds (seals, eared seals and walruses) must be able to take in enough oxygen to survive while they are underwater diving for food. Most eared seals (fur seals and sea lions) dive to depths of 150-200 meters while other seals can dive to 1,000-1,200 meters. Fur seal dives are short for pinnipeds, averaging two to nine minutes. Because they have larger bodies, males can dive longer than females.

MATERIALS

- Worksheet 1 (grades 3-6)
- Table 1 (grades 5-6)
- Worksheet 2 (grades 5-6)
- Worksheet 3 (grades 5-6)
- Timer (clock with second hand, or stopwatch)
- Student basic 4 function calculators

PROCEDURE FOR GRADES 3-4

1. Ask what kinds of adaptations pinnipeds have for diving. Ask the students what they do when swimming (e.g. hold breath, open eyes underwater, use arms to propel, use legs to push).
2. Hand out Activity 5.2 Worksheet 1. Each student makes a prediction: how long can they hold their breath? Record the prediction on their worksheet.
3. Have students work in pairs. One student will hold his or her breath; the other student will record the length of time that the first student can hold his or her breath. Repeat three times, then switch.
4. Graph results as a class.
5. Compare predictions to their actual results
6. Discuss and write a conclusion sentence. "I conclude that I held my breath 10 seconds longer than I predicted…"
7. Show the students Table 1 (average and maximum dive duration of male northern fur seals) and talk about whether the students were able to hold their breath as long as fur seals hold their breath to dive.

PROCEDURE FOR GRADES 5-6

Follow steps 1-6 above.

8. Once all students have compared their predictions to their results, hand out Activity 5.2 Worksheet 2. Have students write down their average and maximum breath-hold durations and make a prediction about whether they can hold their breath longer than a fur seal.
9. Hand out Table 1 or show it on the overhead projector. Have students compare their individual breath-hold duration with male fur seal dive durations and write a conclusion based on their prediction. Have students calculate mean and median dive durations of the fur seal data.
10. The class will fill out Activity 5.2 Worksheet 3 as a group, either on the whiteboard or as an overhead projection. Students will have to convert their times to decimal minutes if they recorded them as minutes and seconds.
    a. For times recorded as Minutes:Seconds (MM:SS) , take the seconds (SS) and divide by 60, then add to the minutes (MM).
    b. Example:
        i. 89 seconds = 1 minute 29 seconds
        ii. Divide seconds by 60: 29÷60=0.48
        iii. the amount would be written 1.48 minutes
11. Calculate a class average breath-holding duration (average of all the students) and maximum breath-holding duration (average of the students' individual maximum durations). Compare with the average and maximum dive duration of the fur seals.

DISCUSSION

- What was the class average for breath-holding?
- How did it compare to the average northern fur seal breath-holding?
- Why can fur seals hold their breath so much longer than humans?

Most mammals have hemoglobin, a molecule in red blood cells that carries oxygen. Seals and cetaceans also store oxygen in a molecule called myglobin which is in the muscles. Seals also have a lot of blood compared to other mammals (about 12% of their body weight; a person has about 7% of their body weight composed of blood). So, seals have lots of hemoglobin and myoglobin to carry oxygen, which they use when they are diving.

EXTENSION

- Have the students look up dive durations of other animals (otters, whales, other seals) and compare them to their own breath-holding durations.
- If several classes do the same exercise, have them compare results. Bigger fur seals can dive longer and deeper because they have bigger bodies (and therefore more capacity to hold oxygen in their blood). Does this pattern hold with students, too?

RESOURCES

Video camera reveal marine mammals take a laid-back approach to deep diving
UC Santa Cruz Currents online, http://www1ucsc.edu/currents/99-00/04-10/dive.html

Marine Mammals–Marinebio.org
http:/marinebio.org/oceans/marine-mammals.asp

ACTIVITY 5.2 WORKSHEET 5.2.1 Waiting to inhale!

Student 1 name:_____

Student 2 name: _____

Prediction: How long can you hold your breath?

Student 1:_____

Student 2:_____

Data Table: Length of time holding breath (in seconds)

	Student 1 Name:	Student 2 Name:
Trial 1		
Trial 2		
Trial 3		
Average		

Conclusion:

Student 1:_____

_____

_____

Student 2:_____

_____

_____

ACTIVITY 5.2 EXAMPLE 5.2.1 Waiting to inhale!

Student 1 name: Student 1

Student 2 name: Student 2

Prediction: How long can you hold your breath?

Student 1: Student 1 60 seconds

Student 2: Student 2 75 seconds

Data Table: Length of time holding breath (in seconds)

	Name: Student 1	Name: Student 2
Trial 1	49	79
Trial 2	56	85
Trial 3	58	89
Average	54 seconds	84 seconds

Conclusion:

Student 1: I conclude that my prediction was very close to how long I could actually hold my breath.

Student 2: I conclude that I could hold my breath longer than I predicted.

ACTIVITY 5.2 **TABLE 5.2.2** Waiting to inhale!

How long do male northern fur seals dive?

Average and maximum dive durations for male northern fur seals. Dive durations are shown in two units: in minutes and seconds, and in decimal minutes. Decimal minutes are used by scientists for calculating mean and median durations.

Male #	Average dive duration (minutes:seconds)	Maximum dive duration (minutes:seconds)	Average dive duration (decimal minutes)	Maximum dive duration (decimal minutes)
1	3:40	6:17	3.67	6.28
2	5:25	8:14	5.42	8.23
3	5:39	8:59	5.65	8.99
4	3:34	5:10	3.56	5.17
5	2:56	5:16	2.94	5.26

ACTIVITY 5.2 WORKSHEET 5.2.2 Waiting to inhale!

Comparing your results to northern fur seal dive durations.

What was your average breath-holding duration? _____

What was your maximum breath-holding duration? _____

Prediction 1: Do you think you can hold your breath longer than a fur seal? _____

Look at Table 5.2.2.
Calculate the mean and the median duration for the following:

	Mean duration (decimal minutes)	Median duration (decimal minutes)
Male fur seals — Average dive duration		
Male fur seals — Maximum dive duration		

Conclusion: _____

_____

_____

_____

ACTIVITY 5.2 **EXAMPLE 5.2.2** Waiting to inhale!

Comparing your results to northern fur seal dive durations.

What was your average breath-holding duration? 54 seconds (0:54)

What was your maximum breath-holding duration? 58 seconds (0:58)

Prediction 1: Do you think you can hold your breath longer than a fur seal? NO

SHOW THIS TABLE TO STUDENTS – available on separate page

Table 5.2.2. How long do male northern fur seals dive?

Average and maximum dive durations for male northern fur seals. Dive durations are shown in two units: in minutes and seconds, and in decimal minutes. Decimal minutes are used for calculating mean and median durations.

Male #	Average dive duration (minutes:seconds)	Maximum dive duration (minutes:seconds)	Average dive duration (decimal minutes)	Maximum dive duration (decimal minutes)
1	3:40	6:17	3.67	6.28
2	5:25	8:14	5.42	8.23
3	5:39	8:59	5.65	8.99
4	3:34	5:10	3.56	5.17
5	2:56	5:16	2.94	5.26

Calculate the mean and the median duration for the following:

	Mean duration (decimal minutes)	Median duration (decimal minutes)
Male fur seals — Average dive duration	4.25	3.67
Male fur seals — Maximum dive duration	6.79	6.28

Conclusion: My prediction that I could not hold my breath longer than a fur seal was correct. My maximum breath- hold duration was 58 seconds and some male fur seals can hold their breath over 8 minutes.

ACTIVITY 5.2 WORKSHEET 5.2.3 Waiting to inhale!

Comparing students' breath-holding duration with fur seals' dive duration.

Fill out the following table as a class. For fur seal dive durations, use data from Table 5.2.2.

Male #	Average dive duration (decimal minutes)	Maximum dive duration (decimal minutes)	Student Name	Average breath-holding duration (decimal minutes)	Maximum breath-holding duration (decimal minutes)
1					
2					
3					
4					
5					
Average:			**Average:**		

ACTIVITY 5.2 EXAMPLE 5.2.3

Comparing students' breath-holding duration with fur seals' dive duration.

Fill out the following table as a class. For fur seal dive durations, use data from Table 5.2.2.

Male #	Average dive duration (decimal minutes)	Maximum dive duration (decimal minutes)	Student Name	Average breath-holding duration (minutes:seconds converted to decimal minutes*)		Maximum breath-holding duration (minutes:seconds converted to decimal minutes*)	
1	**3.67**	**6.28**	Student 1	0:54	**0.95**	0:58	**0.97**
2	**5.42**	**8.23**	Student 2	1:24	**1.40**	1:29	**1.48**
3	**5.65**	**8.99**	Student 3	1:05	**1.08**	1:10	**1.17**
4	**3.56**	**5.17**	Student 4	1:00	**1.00**	1:10	**1.17**
5	**2.94**	**5.26**	Student 5	1:15	**1.25**	1:30	**1.50**
Average:	**4.25**	**6.79**	**Average:**		**1.14**		**1.26**

**** decimal minutes are in bold***

LESSON FIVE SCIENCE/MATH ACTIVITY 5.3 Grade Level 3–6

Exhale and Dive!

OBJECTIVE

Students will investigate adaptations that seals use when they dive

TIME REQUIRED

10 minutes

BACKGROUND

Air-breathing mammals like pinnipeds (seals, eared seals and walruses) must be able to take in enough oxygen to stay conscious while they dive for food. Most eared seals dive to depths of 150-200 meters (shallow compared to other pinnipeds that can dive to 1,000-1,200 meters, but deep compared to humans!). Pinnipeds have to adapt to pressure of deep water as well as conserve oxygen while they dive.

MATERIALS

5 gallons bucket of water or large chest cooler
1-quart sealable plastic sandwich bags (2 per group)
Yardstick (optional)

PROCEDURE

- Hand out worksheet.
- Mark the bucket or cooler with marks showing ¼, ½, ¾ full, or use a yardstick in the bucket
- Fill the bucket or cooler with water
- Blow up one plastic bag with air, then seal it closed. It helps to tape the bag closed.
- Seal the second plastic bag without putting any air in it.
- Ask the students to predict which bag can be pushed farther under the water, and to write their prediction in the worksheet.
- Do three trials of pushing each bag into the bucket, and recording how far down it can be pushed down
- Have students write their conclusions
- Discuss results (see below)

DISCUSSION

- What were the results that were seen?

  Bag #2, the empty bag, went underwater easier than bag #1.

- Ask students if they have ever dived underwater. Did they take a big breath and hold it when they went underwater?
- Tell students that seals don't take a big breath and hold it. Instead, they exhale and empty their lungs when they dive, so they can go down easier. The lungs are like the plastic bags; when you fill your lungs and hold your breath, it's like the bag full of air. Seals' lungs when they exhale are like the empty bag.
- So what do seals use for air?

  Most mammals have hemoglobin which is a molecule in red blood cells that carries oxygen. Pinnipeds and cetaceans also store oxygen in a molecule called myglobin which is in the muscles and also have a lot of blood compared to other mammals (about 12% of their body weight, compared to a person who has about 7% of their body weight composed of blood). Seals can store 3 times as much oxygen in their bodies as humans, because of:

  - more hemoglobin in the blood
  - myoglobin in muscle
  - more blood in the body (up to twice as much as humans).

- Would you be able to dive for very long if you exhaled before diving?

  No, because humans do not have as much hemoglobin in their blood as seals do, and humans have very little myoglobin in their muscles to store oxygen.

ACTIVITY 5.3 WORKSHEET 5.3.1 Exhale and Dive!

Bag 1: full of air

Bag 2: empty

Which bag can be pushed farther underwater?

Prediction: _____

Data:

	Distance underwater	
Trial #	**Bag # 1**	**Bag #2**
1		
2		
3		

Conclusion: _____

ACTIVITY 5.3 **EXAMPLE 5.3.1** Exhale and Dive!

Bag 1: full of air

Bag 2: empty

Which bag can be pushed farther underwater?

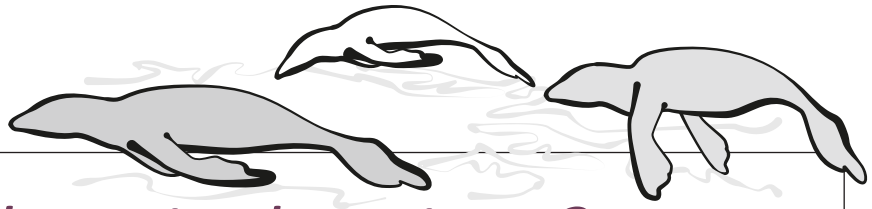
Prediction: I predict that bag #2 can be pushed farther underwater because the air in the other bag will make it float.

Data:

	Distance underwater	
Trial #	**Bag # 1**	**Bag #2**
1	¼	All the way to the bottom
2	¼	All the way to the bottom
3	½	All the way to the bottom

Conclusion: My prediction was correct – bag #2 was pushed to the bottom each time while bag #1 only went part way down the bucket.

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).

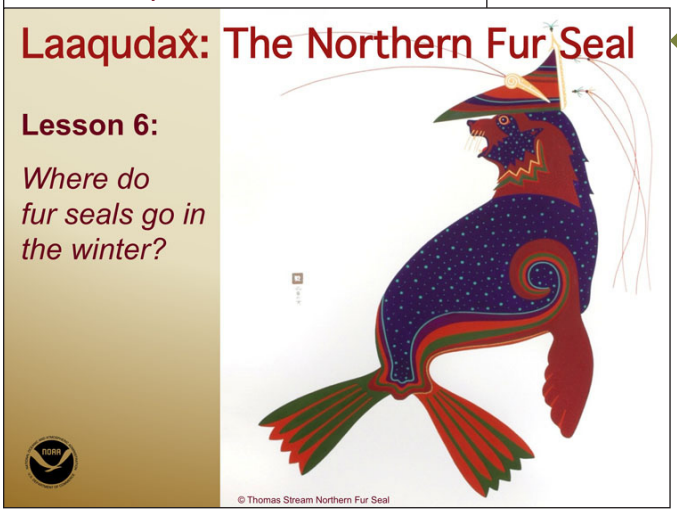
SG4 Students develop an understanding that advancements in science depend on curiosity, creativity, imagination, and a broad knowledge base.

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.

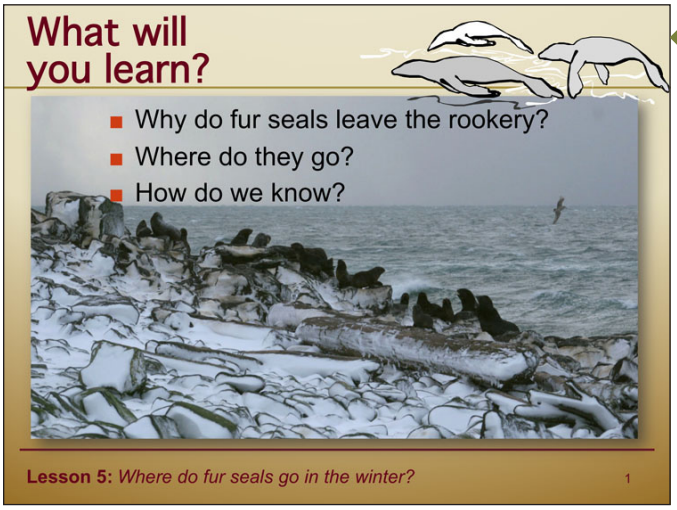
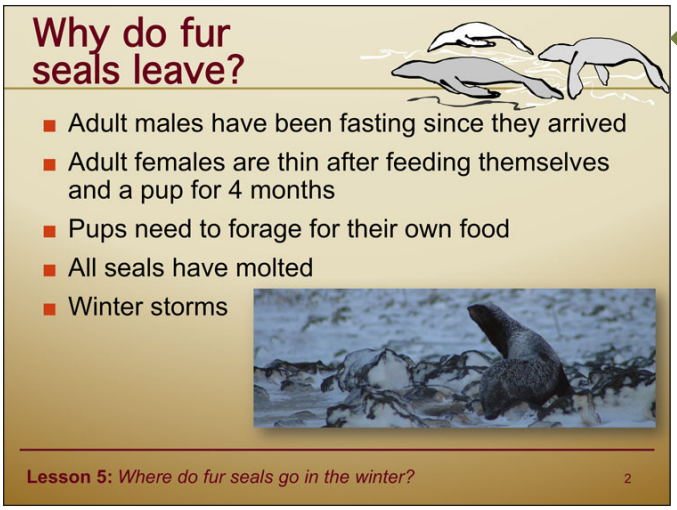


Photo: Jeremy Sterling, NMML/AFSC/NMFS/NOAA



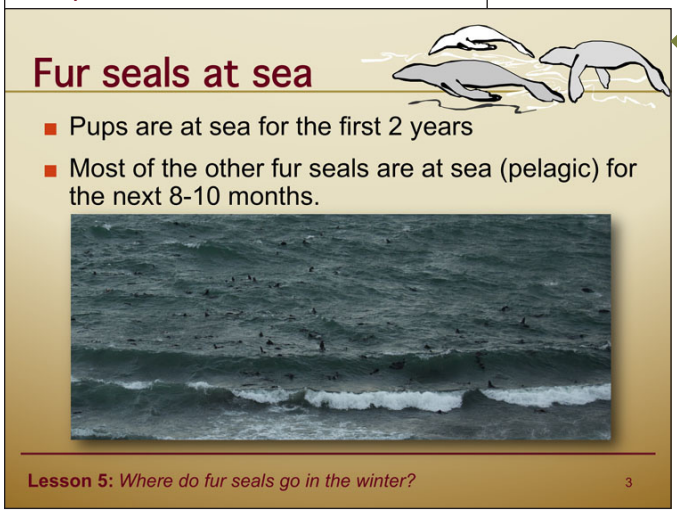
Northern fur seals use the winter months to feed and gain energy reserves for the following summer and the next year's breeding season.

- 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

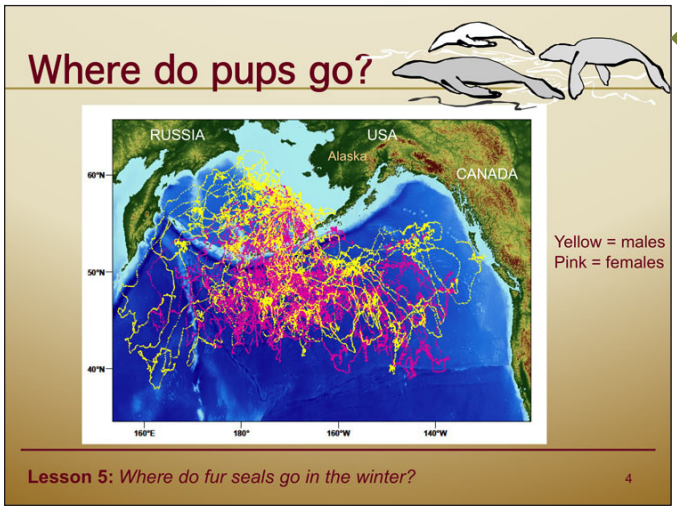


The pups who have just weaned and are headed to sea for the first time will stay at sea for 18-20 months, and return to the rookery as a 2-year-old.

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



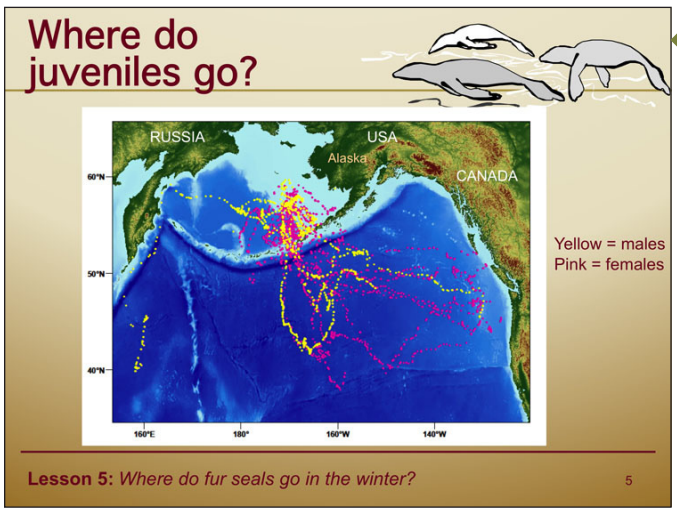
Scientists at NOAA have been tagging pups for years trying to figure out where they go in the winter. The next four slides display geographical data collected by satellite tags placed on northern fur seals by NOAA scientists. Almost all of the animals headed south of the Aleutian Islands.

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.

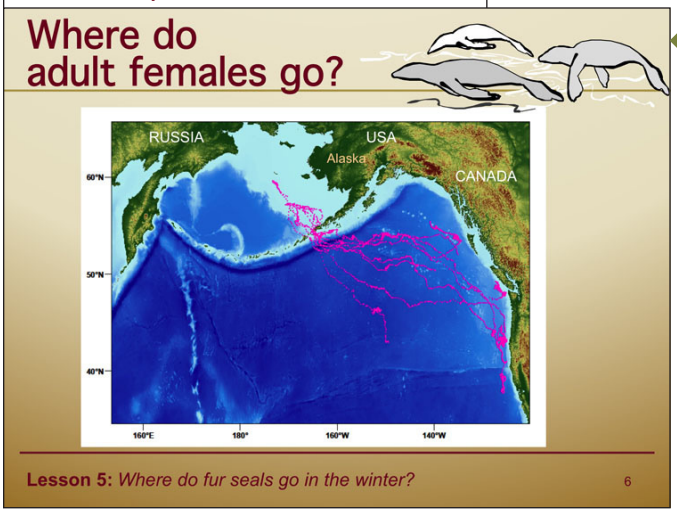
Source: NOAA/NMFS/AFSC/NMML Alaska Ecosystem Program



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).

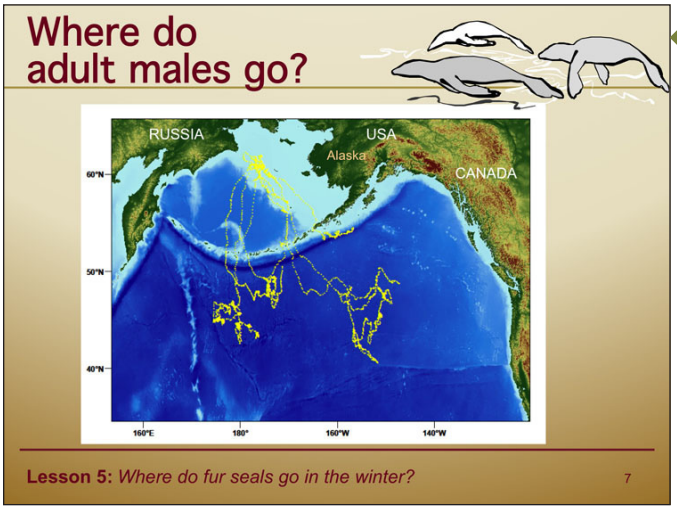
Source: NOAA/NMFS/AFSC/NMML Alaska Ecosystem Program



Slide 3

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

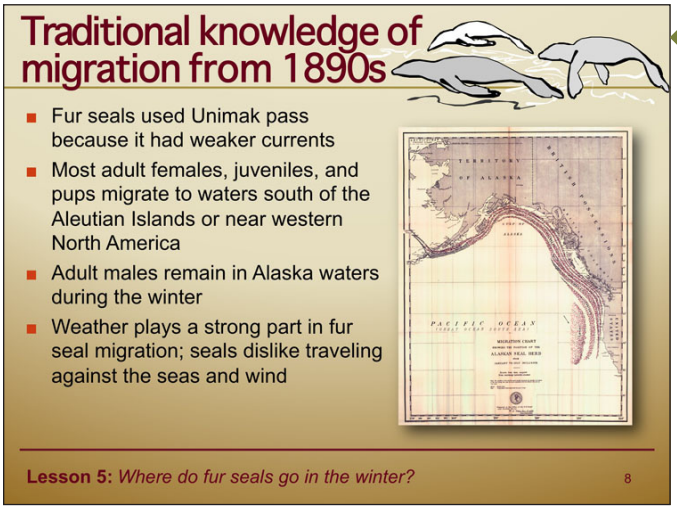
Source: NOAA/NMFS/AFSC/NMML Alaska Ecosystem Program



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

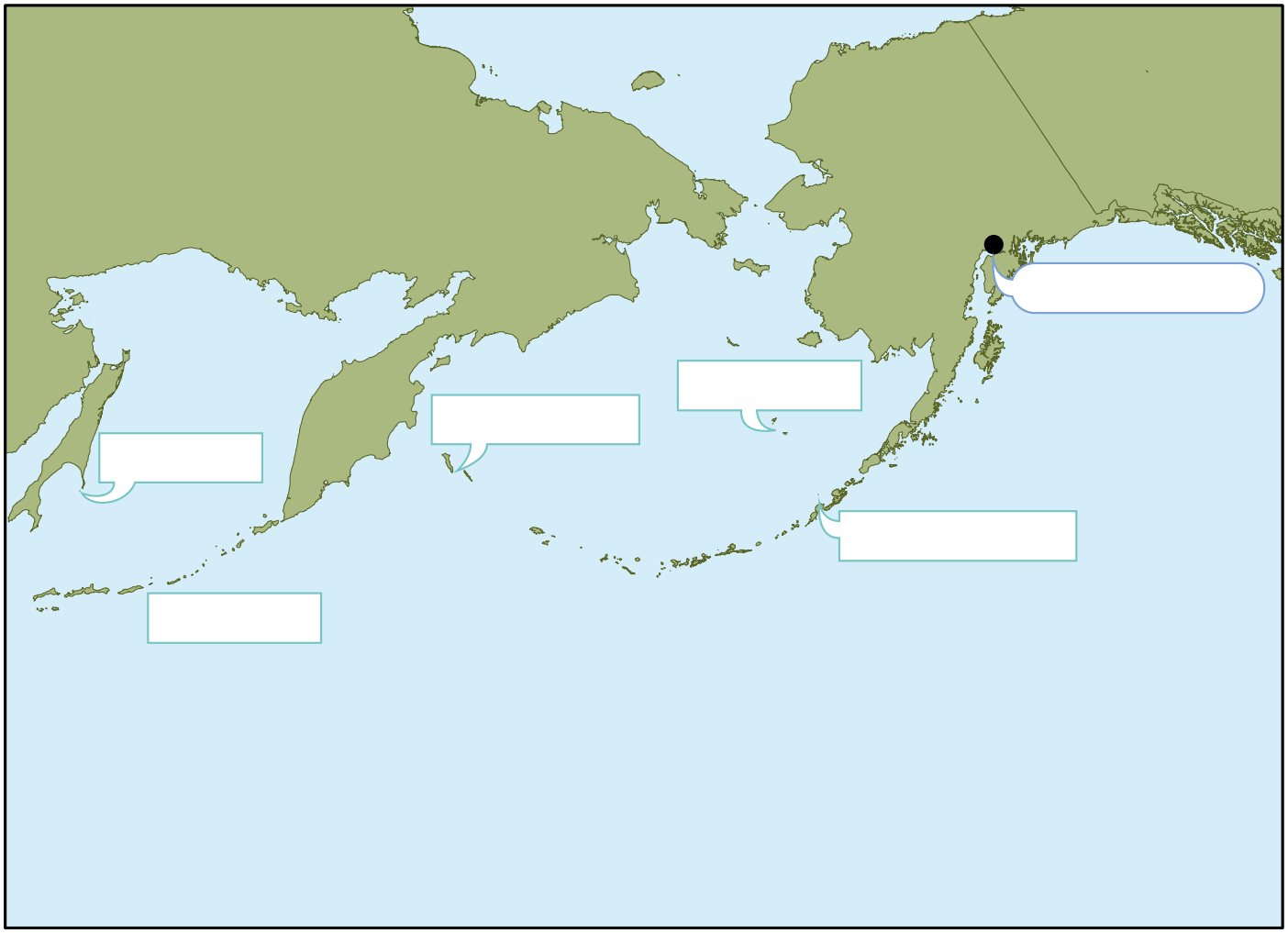
Label the countries:
- Russia
- USA
- Canada

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

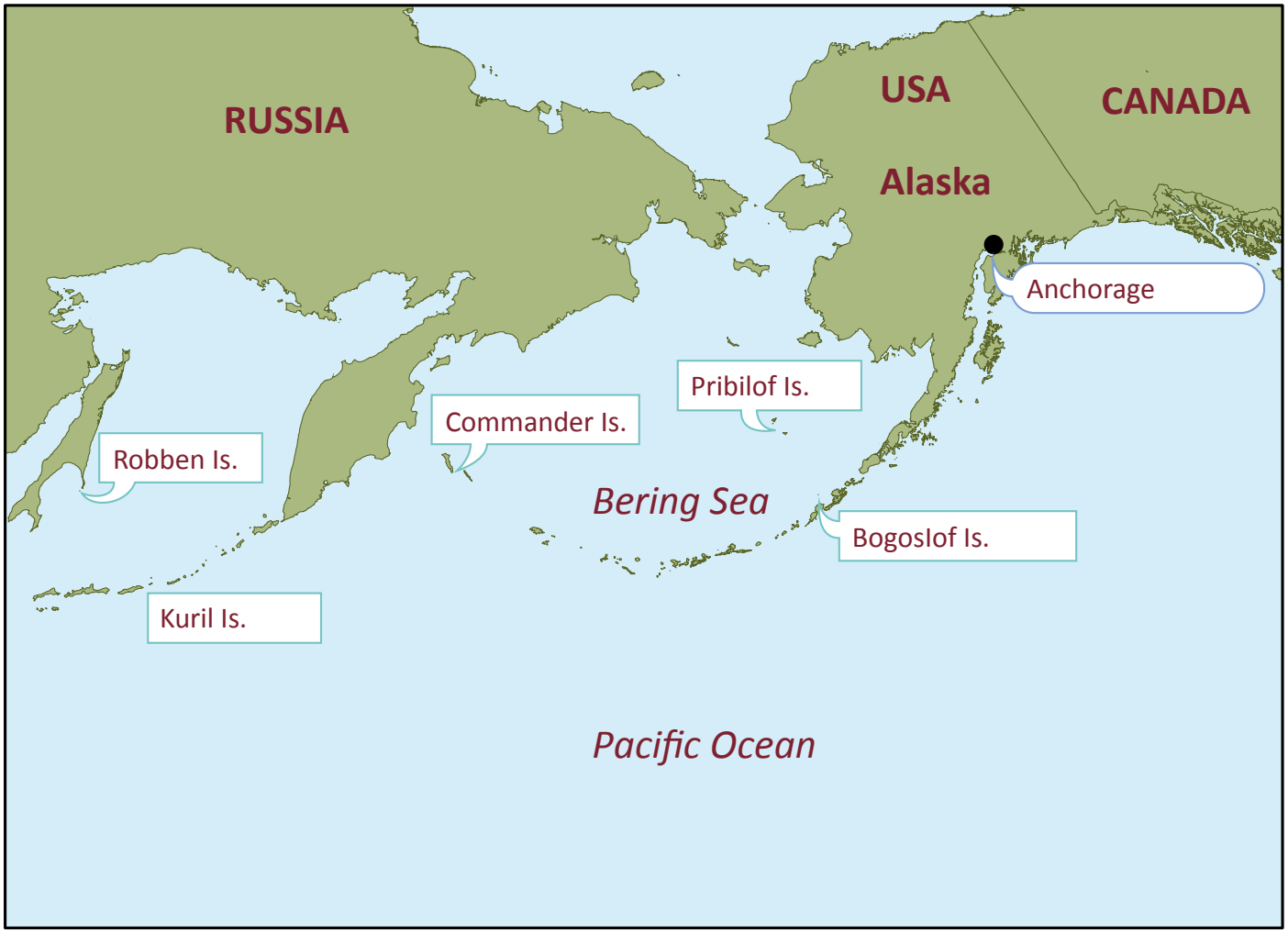
Label the countries:
- Russia
- USA
- Canada

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
- Kuril Islands
- Pribilof Islands
- 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:

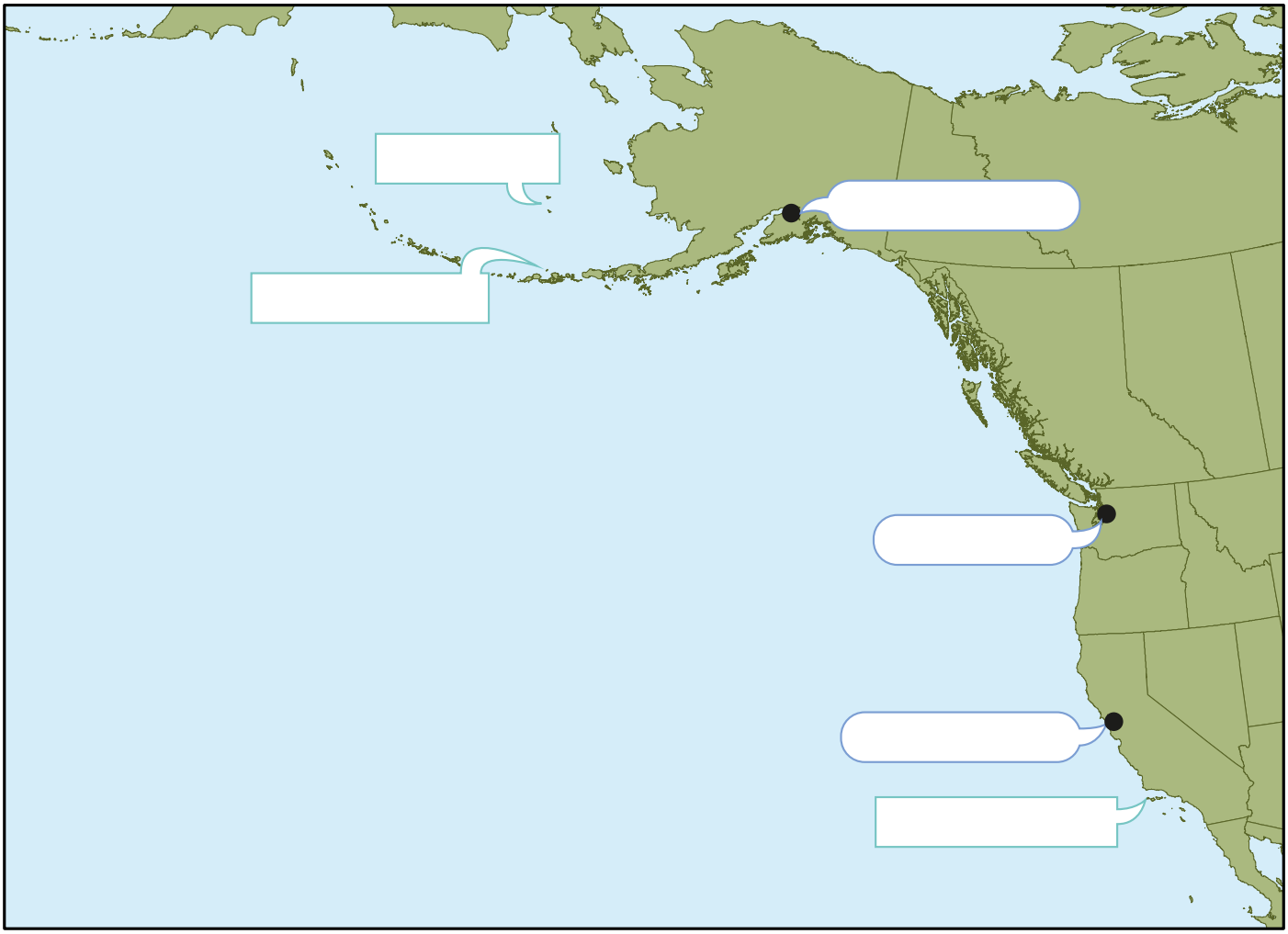
- Alaska
- Washington
- Oregon
- California

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.

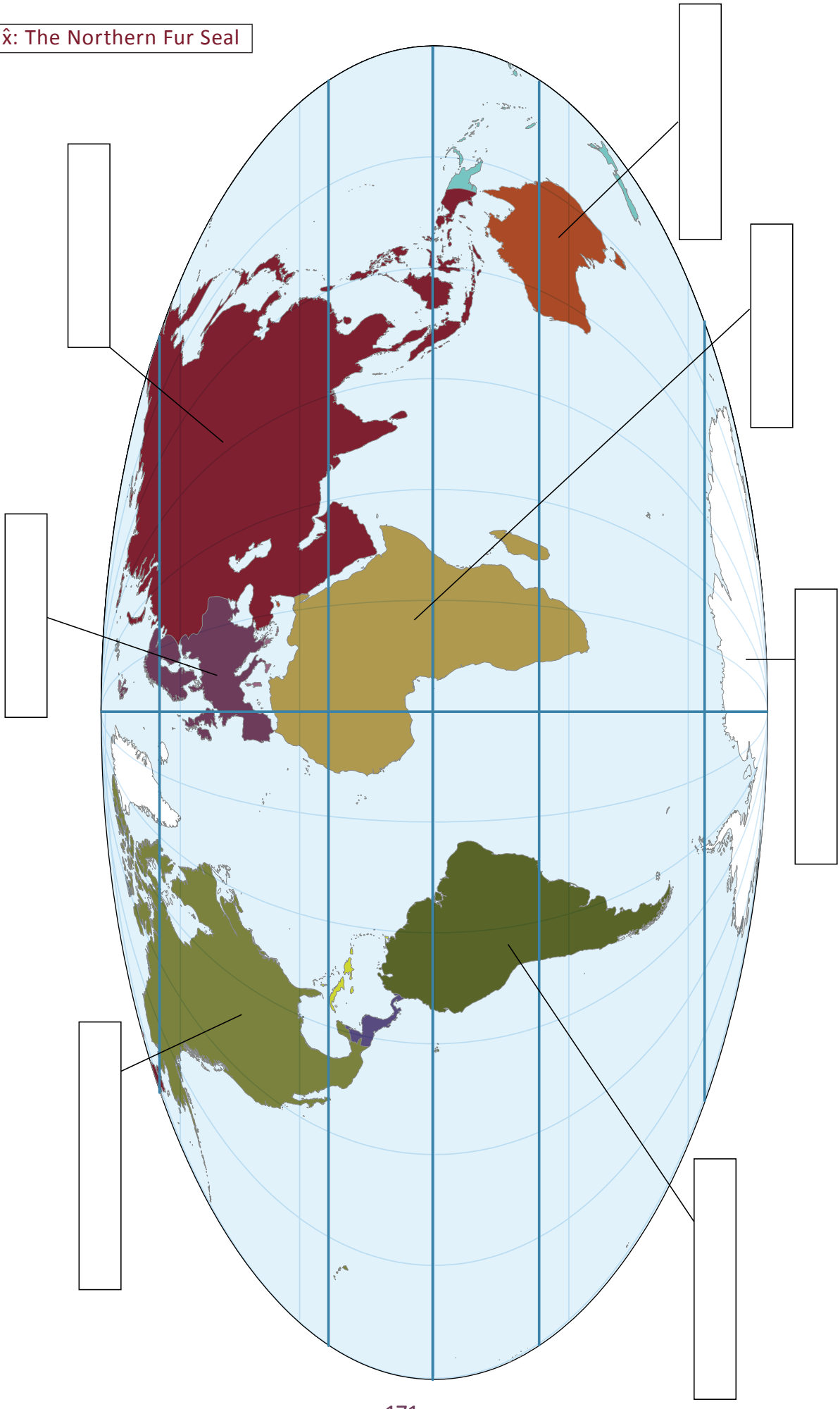
  Roughly 2,600 miles.

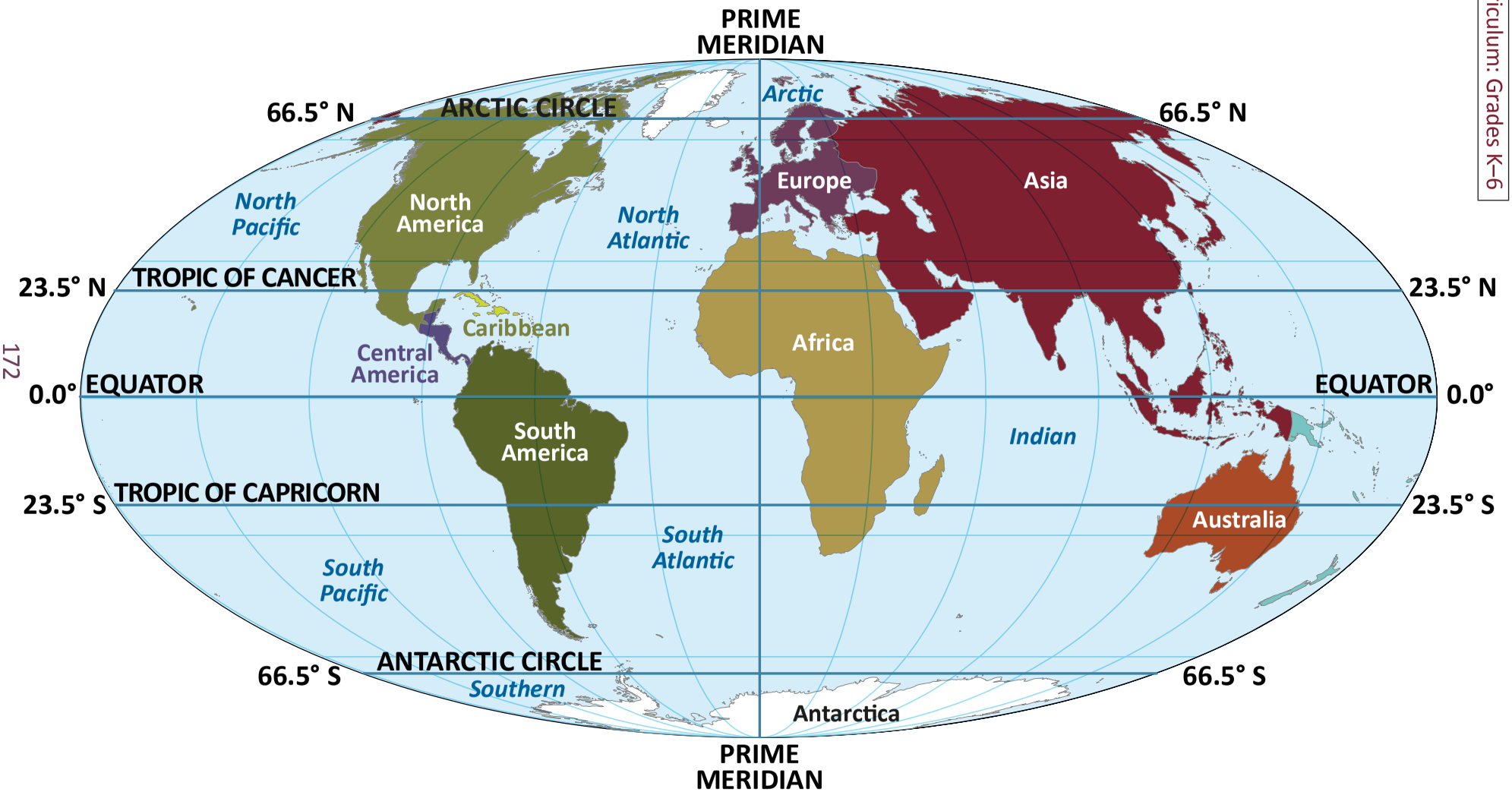
EXTENSION

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

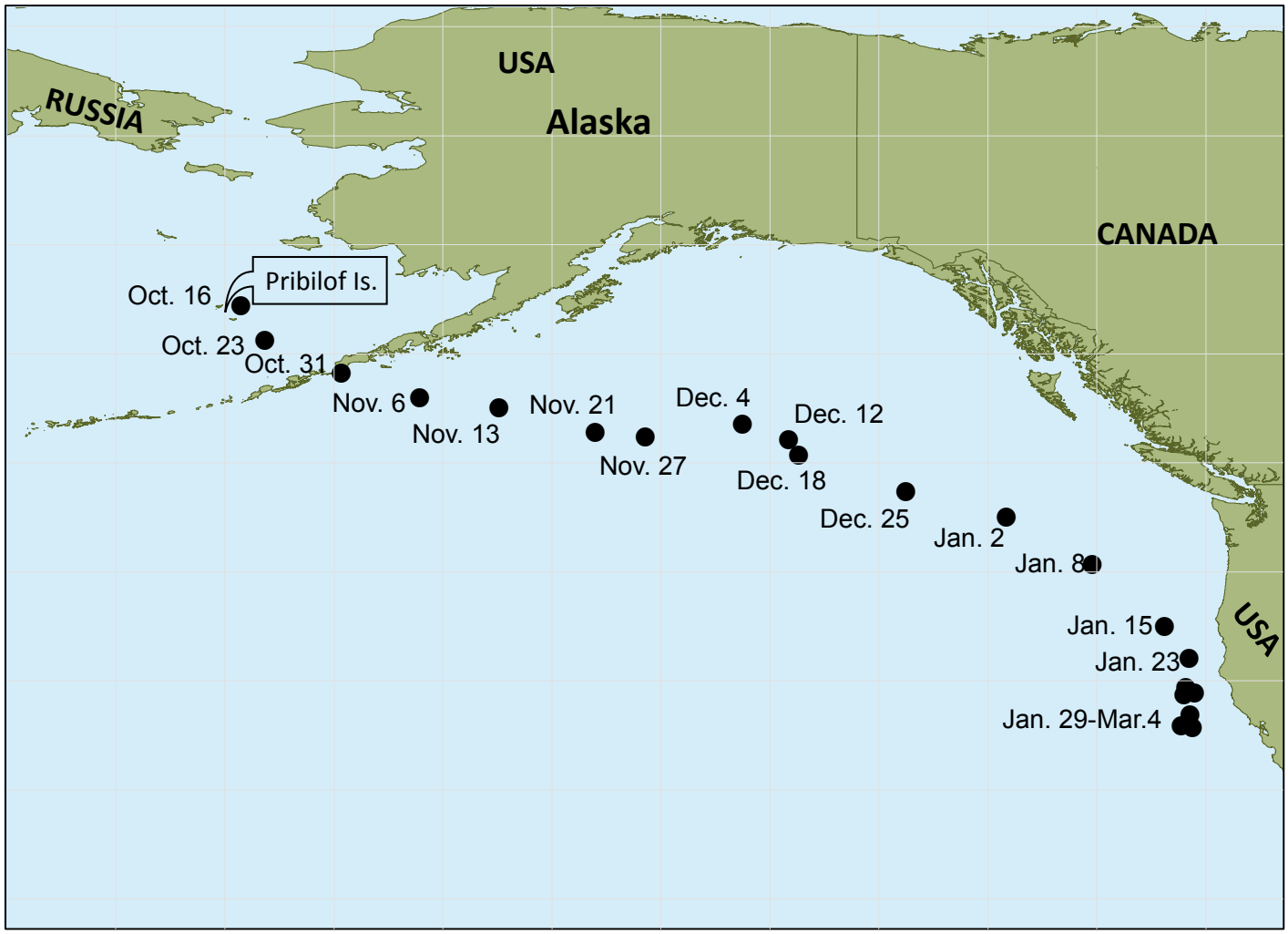
ACTIVITY 6.3

MAP 6.3.1

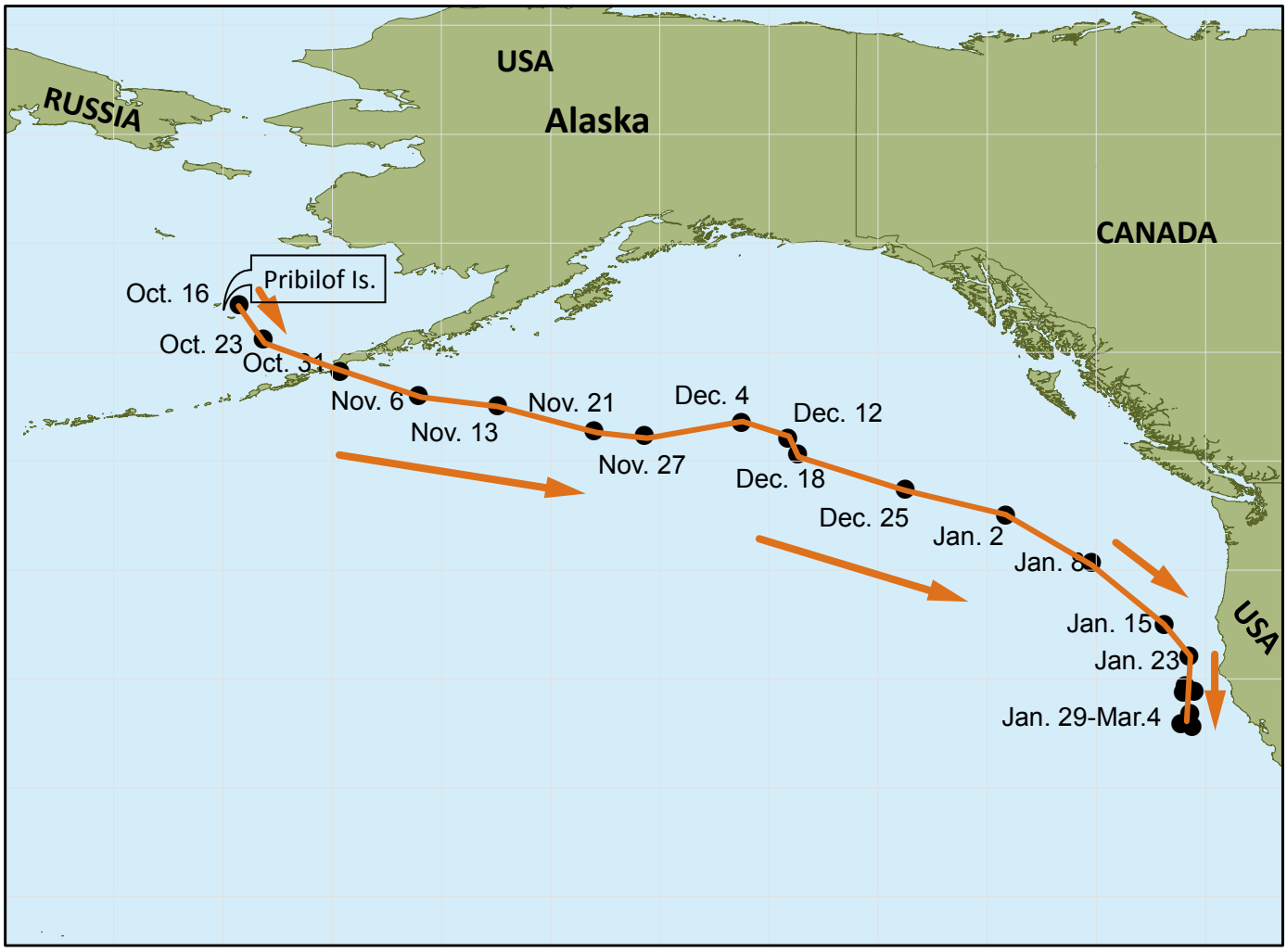



PRIME MERIDIAN
66.5° N
ARCTIC CIRCLE
Arctic
North Pacific
North America
North Atlantic
Europe
Asia
23.5° N
TROPIC OF CANCER
Caribbean
Central America
Africa
0.0°
EQUATOR
South America
Indian
23.5° S
TROPIC OF CAPRICORN
Australia
South Atlantic
South Pacific
66.5° S
ANTARCTIC CIRCLE
Southern
Antarctica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



APPENDIX I GLOSSARY

adaptation Any change in the structure or functioning of an organism that makes it better suited to its environment. (Oxford Dictionary of Science)

Aleut Name used by Russian fur traders in the 1700s when referring to people who inhabited the islands now known as the Aleutian Islands.

Antarctic Circle The line of latitude 66.5° south of the equator. Along this line in the southern hemisphere the sun does not set on the day of the summer solstice (usually 21 December) and does not rise on the winter solstice usually 21 June).

archipelago An extensive group of islands.

Arctic Circle The line of latitude 66.5° north of the equator. Along this line in the northern hemisphere the sun does not set on the summer solstice (usually 21 June) and does not rise the winter solstice (usually 21 December).

baleen A fibrous structure made of keratin found in the mouths of filter-feeding whales such as humpback and gray whales. In humans, keratin can be found in fingernails and toenails.

baleen whale A whale with baleen in its mouth instead of teeth. There are 11 species of baleen whales; three examples are blue whale, humpback whale, and gray whale. Also called a mysticete.

blind A shelter used for observing or hunting animals.

blubber A thick layer of fat underneath the skin of marine mammals that provides insulation from the cold and a source of energy when food supplies are low.

cetacean A marine mammal of the order Cetacea, which includes whales, dolphins, and porpoises.

cold-blooded Having a body temperature that is dependent on the surrounding environment. A cold-blooded animal is hot when its environment is hot and cold when its environment is cold.

conservation The act of protecting or preserving natural resources in order to prevent depletion or loss.

eared seal A pinniped of the family Otariidae, which includes sea lions and fur seals. Unique characteristics include an external ear flap and flexible hindflippers that can be rotated forward under the body allowing the animal to walk on all four when on land.

ecosystem A community of living organisms and their environment, and the interactions between the two.

equator The line of latitude that is an equal distance from the North Pole and the South Pole, designated as 0° latitude.

eye lens A transparent structure in the eye used to focus light.

feces Bodily waste discharged from animals; also called stool or scat.

fissiped land carnivore. Fissiped is latin for "split-foot." Foxes, bears, polar bears, dogs, and cats are f

food chain A food pathway that links different plants and animals within a community or ecosystem. Nutrients and energy are passed from creature to creature through the food chain.

food web A network of food chains in an ecosystem

foraging The act of searching and hunting for food.

harbor seal A true seal with a spotted coat, commonly found in coastal waters of the northern hemisphere. See *true seal* definition for characteristics.

haulout Areas on land or ice where pinnipeds (seals, sea lions and walruses) can temporarily leave the water to rest.

hemoglobin The protein in red blood cells that carries oxygen. Similar to myoglobin in muscles.

insulate To prevent the transfer of heat.

Laaqudax̂ Unangam word for northern fur seal.

Laaqudaax̂ Unangam word for northern fur seal pup. Note that the last syllable is longer than the word for northern fur seal.

latitude or line of latitude Imaginary line that runs east to west around the globe parallel to the equator. A latitude line measures the distance north or south of the equator.

longitude or line of latitude Imaginary line that runs from the North Pole to the South Pole. It measures distances east and west from a base longitude line or prime meridian.

mammal Warm-blooded vertebrate that has hair or fur, gives birth to live offspring, and produces milk to nurse its offspring.

midden A mound or deposit containing shells, animal bones and other trash that indicates the presence of humans.

migration The long distance movement of animals on a seasonal basis.

molt To shed old fur and grow new fur.

mortality Death.

myoglobin The protein in muscle that carries oxygen. Similar to hemoglobin in blood.

APPENDIX I GLOSSARY

NOAA An abbreviation for the National Oceanic and Atmospheric Administration, a federal government agency in the Department of Commerce, created in 1970. NOAA scientists conduct research on the world's oceans and atmosphere.

northern fur seal A pinniped with ear flaps (an "eared seal"), long front flippers, the ability to walk on all four flippers on land, and with dense underfur. Northern fur seals are found in the North Pacific Ocean, the Bering Sea and the Sea of Okhotsk.

northern fur seal: adult female A female northern fur seal that is old enough to have pups. Usually three years or older.

northern fur seal: adult male A male northern fur seal that is old enough to mate. Usually seven years or older.

northern fur seal: breeding male An adult male who defends a territory on the rookery containing females. Usually nine years or older.

northern fur seal: idle male An adult male who may hold a territory on the rookery but does not hold females on the territory.

northern fur seal: juvenile A northern fur seal from December of its birth year until it is old enough to mate.

northern fur seal: pup A northern fur seal from birth to December of its birth year.

odobenid Scientific name for walrus.

otariid (Otariidae) Scientific name for an eared seal such as a northern fur seal or Steller's sea lion.

otolith Otoliths or "earstones" are found in the heads of all fishes except sharks, rays, and lampreys. The otolith of each fish species has a distinctive shape. Scientists use otolith shape to identify the species of fish eaten by seals and sea lions.

pelage Fur, hair, or wool of a mammal.

pelagic Relating to, or living in, the open ocean or seas.

philopatry When an animal returns to the site where it was born, to breed or give birth.

phocid (Phocidae) Scientific name for a true seal such as a harbor seal.

phytoplankton Tiny plants that form the beginning of the food chain for aquatic animals.

pinniped Semi-aquatic marine mammals; pinnipeds leave the water to rest, molt, and reproduce. Pinniped is Latin for "fin-foot." Seals, sea lions and walruses are all pinnipeds.

plankton Tiny plants and animals that live in the water and float with currents. Most plankton can only be seen with a magnifying glass or microscope.

population A group of organisms that live in the same place at the same time.

prey An animal hunted and eaten for food.

Pribilof Islands A group of four volcanic islands in the Bering Sea. The Pribilof Islands are home to the largest population of northern fur seals in the world, as well as large seabird rookeries.

prime meridian A line of longitude defined to be 0°.

pup wad A group of northern fur seal pups on a rookery.

rookery A colony of breeding animals. A rookery can be a nesting place for birds (especially birds that nest in large groups), or breeding grounds for pinnipeds (seals, sea lions and walruses).

satellite tag Scientific instrument used to track the location of an animal in real time. The instrument sends location data through a satellite to a personal computer.

scat Bodily waste discharged from animals; also called stool, feces, or poop.

sea lion A pinniped with external ear flaps, long front flippers, the ability to walk on all four flippers on land, and with no dense underfur. Sea lions and fur seals make up the "eared seal" group of pinnipeds.

seal see definition for true seal

sirenian Manatees and dugongs. Marine mammals found in warm water that only eat seagrass and aquatic vegetation.

site fidelity Returning to the same area each year.

snout The part of an animal's face that projects forward and includes nose, mouth and jaws.

subsistence hunt Harvesting of wildlife by indigenous people for consumption and traditional or cultural requirements.

toothed whale A whale with teeth, instead of baleen. Also called odontocete.

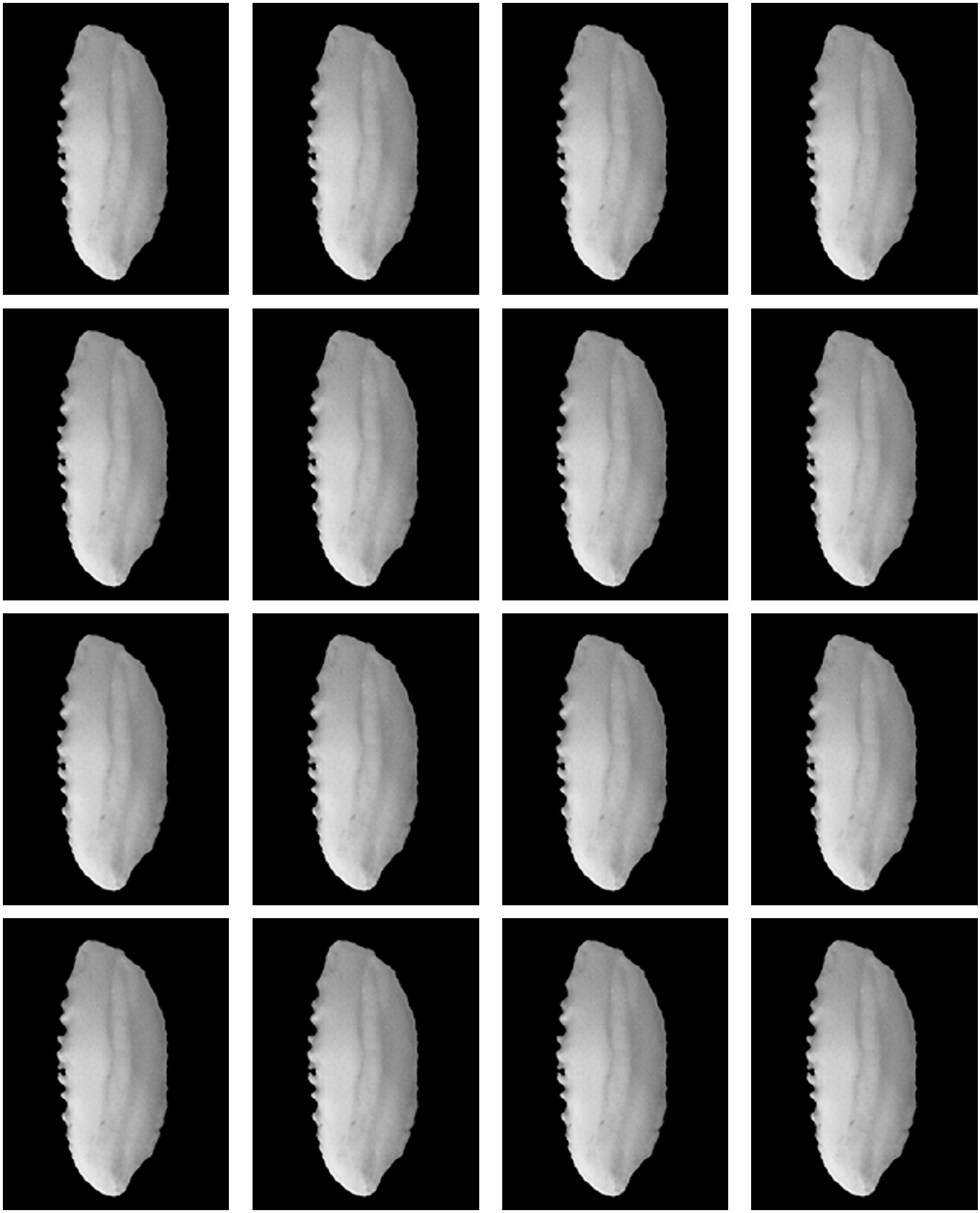
topography The physical or natural features of an area.

APPENDIX I GLOSSARY

Tropic of Cancer An imaginary latitude line that lies approximately 23.5° north of the equator. It is the circle of latitude on the earth that marks the most northerly position at which the sun may appear directly overhead.
Tropic of Capricorn An imaginary line that lies approximately 23.5° south of the equator. It marks the most southerly latitude on the earth at which the sun can be directly overhead.
true seal A pinniped of the family Phocidae, which includes harbor seals and spotted seals. Unique characteristics include no external ear flaps and a sleek, streamlined, sausage-shaped body. A true seal cannot walk on all four flippers, but moves on its stomach when on land or ice. Other names include seal, hair seal or phocid seal.
Unangam (adjective) Proper adjective, for example "the Unangam People" or "Unangam culture." http://alaska.si.edu/culture_unangan.asp?continue=1
Unangan (noun) Name the people of the Aleutian and Commander Islands use for themselves. Eastern dialect. http://alaska.si.edu/culture_unangan.asp?continue=1
Unangas Name the people of the Aleutian and Commander Islands use for themselves in the western Aleutian dialect.
vertebra (plural: vertebrae) An individual bone in the backbone or vertebral column. If you run your finger down your backbone, you will feel bumps. Each of these bumps is from one vertebra
vocalizations The sounds that an animal makes fur seals use calls to communicate with other fur seals.
walrus (*Odobenus rosemarus*) A pinniped of the family Odobenidae. Unique characteristics include no external ear flaps, large tusks, thick leathery hide, and hindflippers that rotate forward underneath the body allowing the animal to walk on all fours when on land. Its scientific name translates to "tooth-walking sea horse."
warm-blooded Having a high constant body temperature independent of the surrounding temperature
zooplankton Animal plankton (tiny animals) that live in the water. Zooplankton are microscopic animals that eat other plankton (both plant and animal plankton).

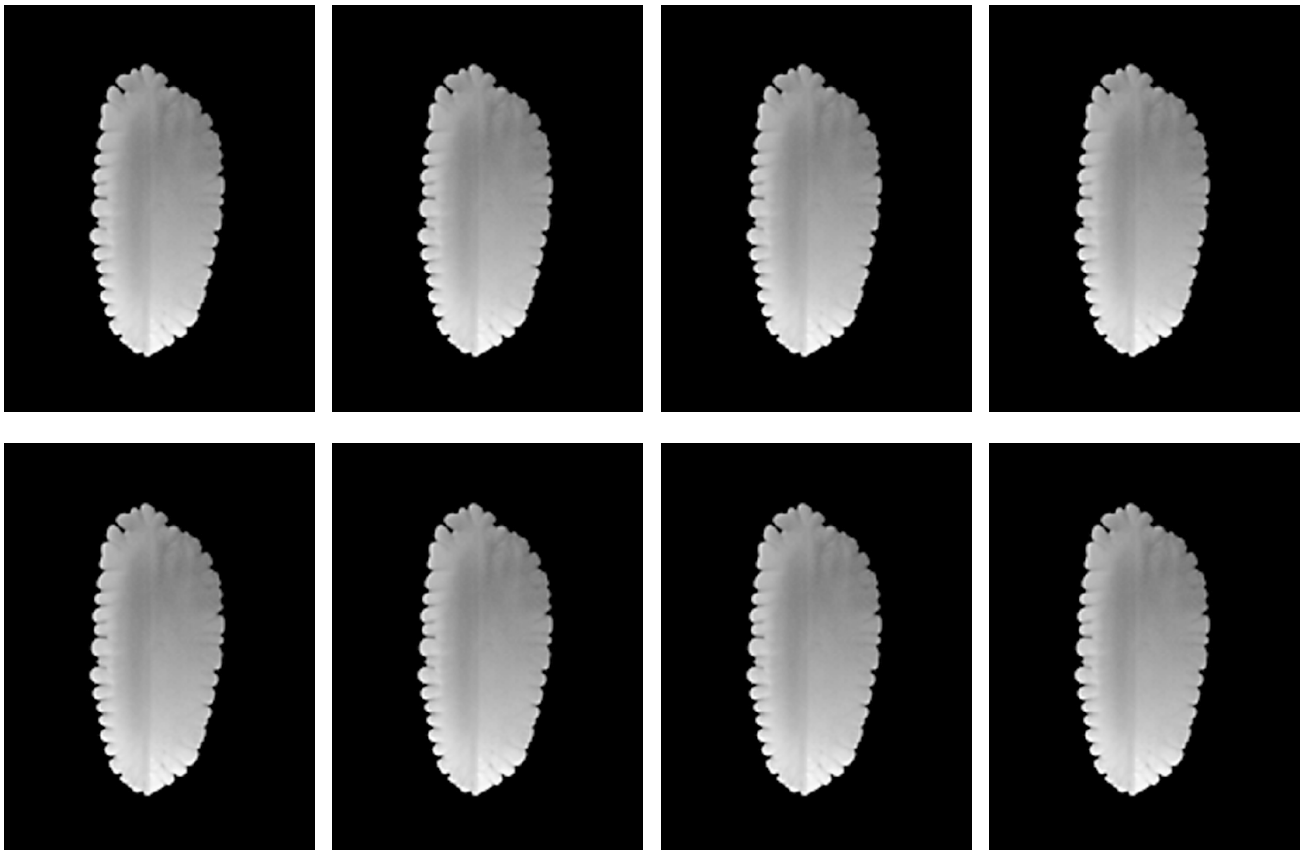
APPENDIX II SCAT DETECTIVE IMAGES

walleye pollock, *Theragra chalcogramma*

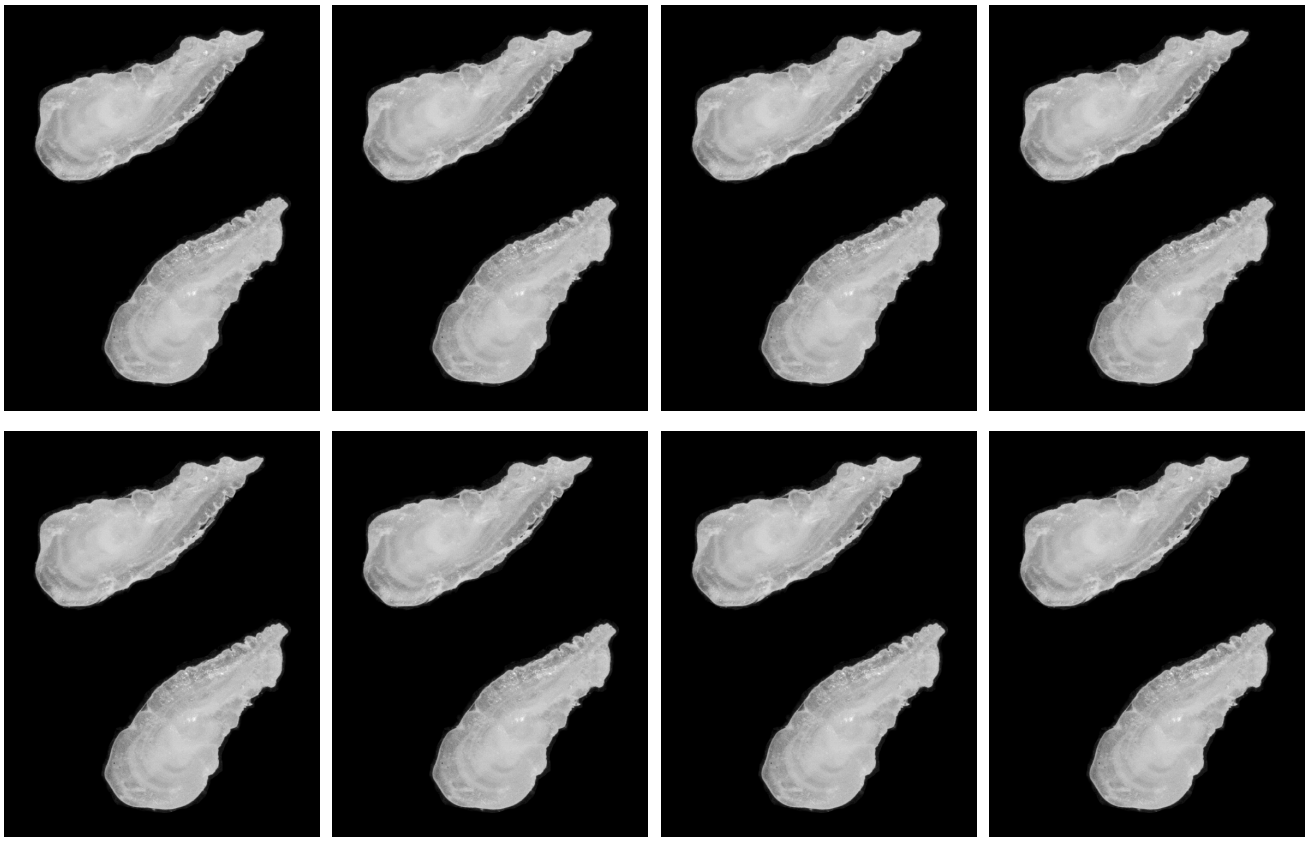


APPENDIX II SCAT DETECTIVE IMAGES

Pacific cod, *Gadus macrocephalus*

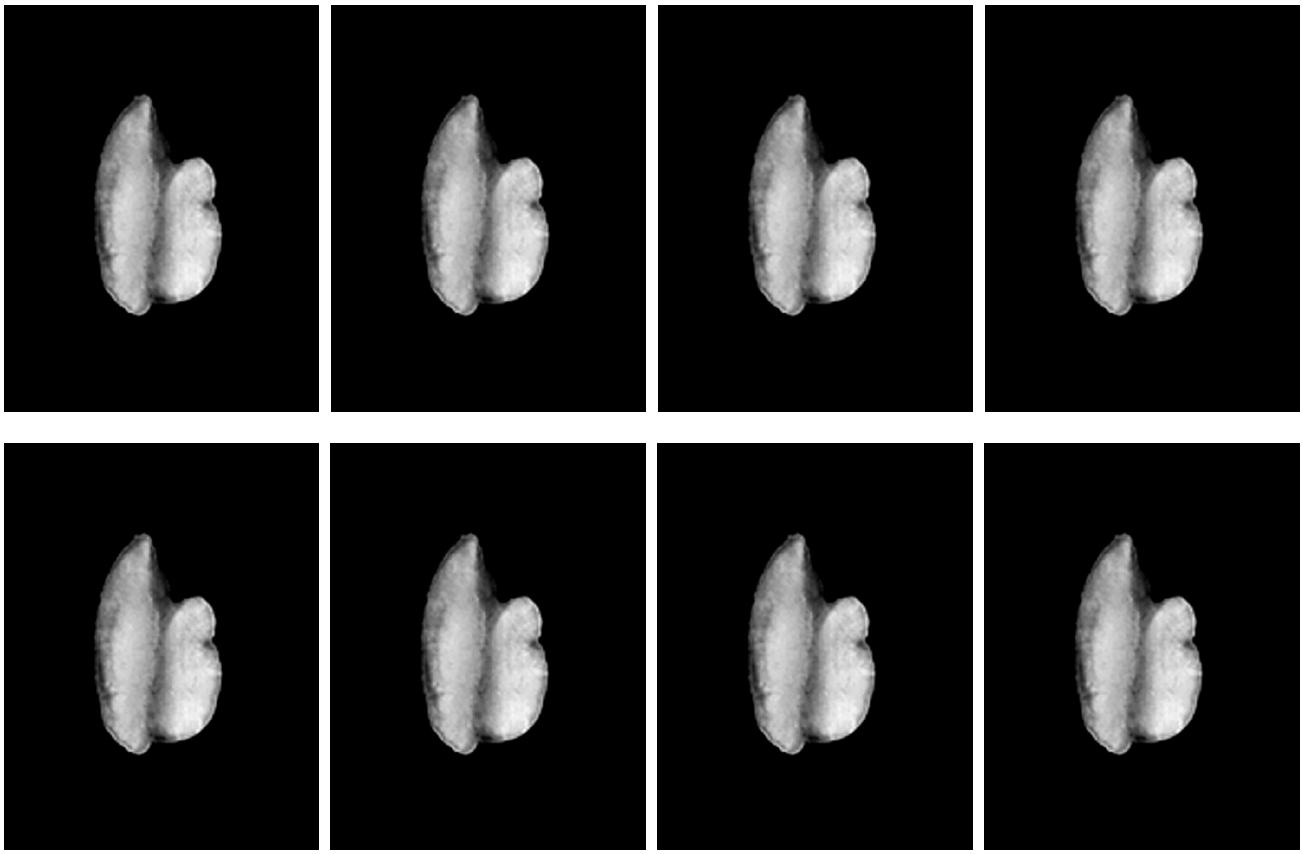


Northern smoothtongue, *Leuroglossus schmidti*

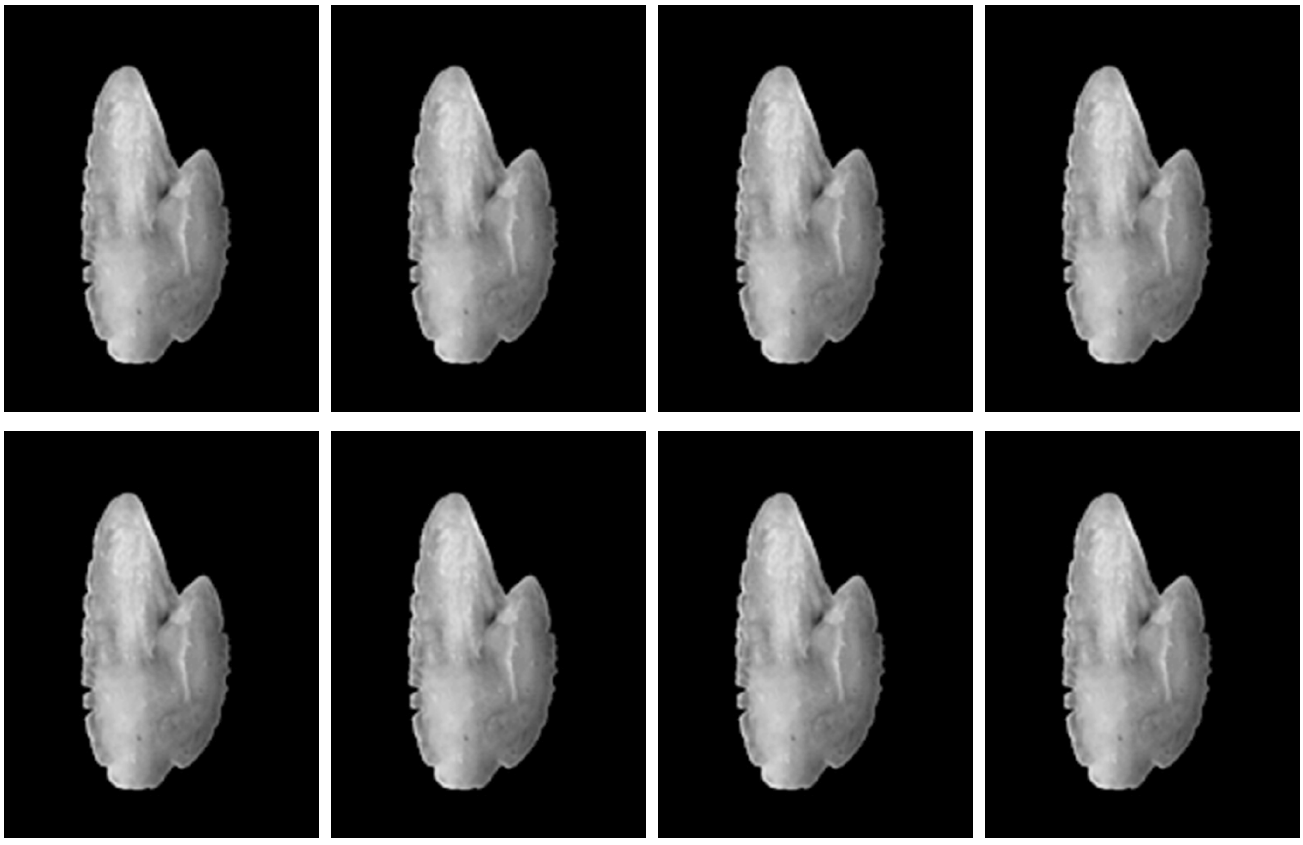


APPENDIX II SCAT DETECTIVE IMAGES

coho salmon, *Oncorhynchus kisutch*

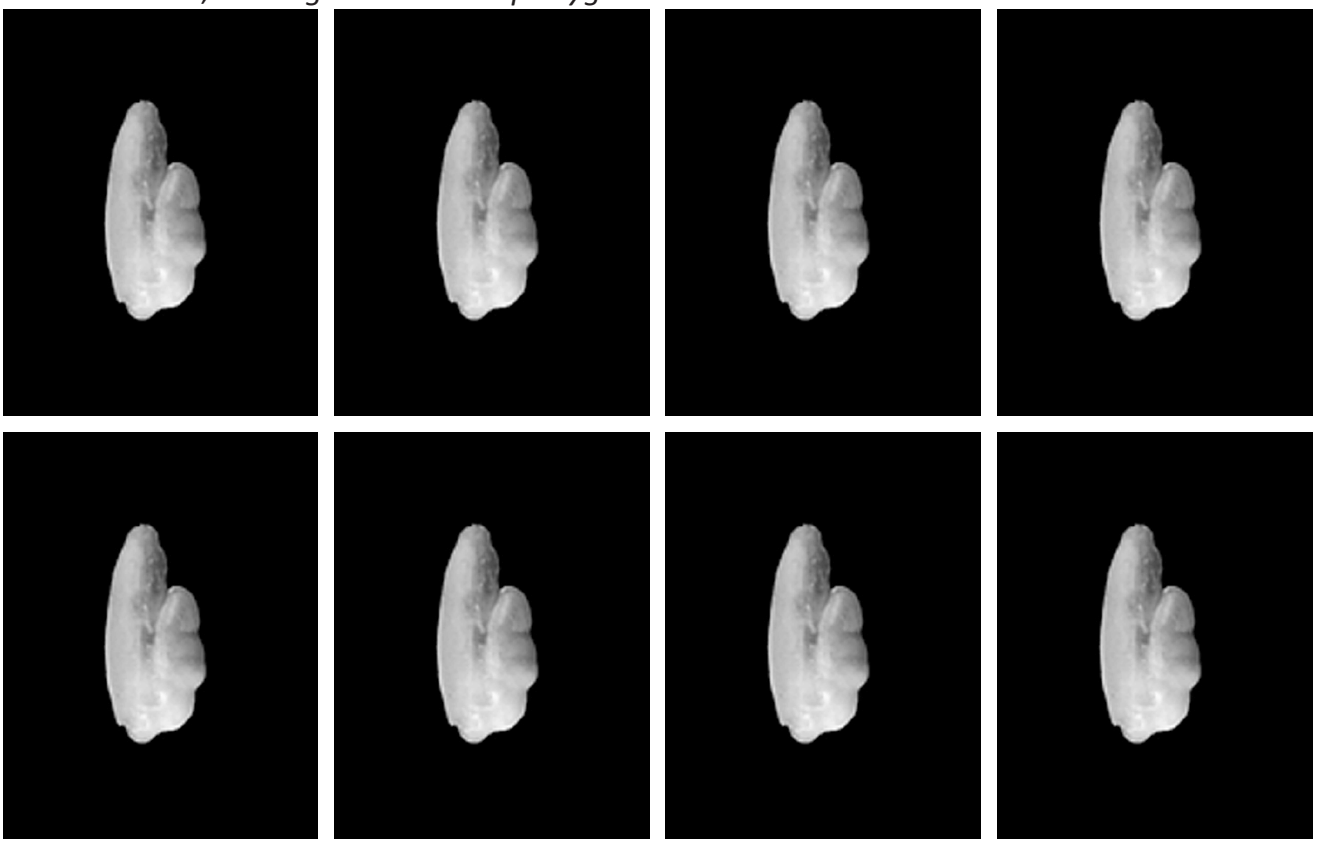


Pacific herring, *Clupea pallasii*

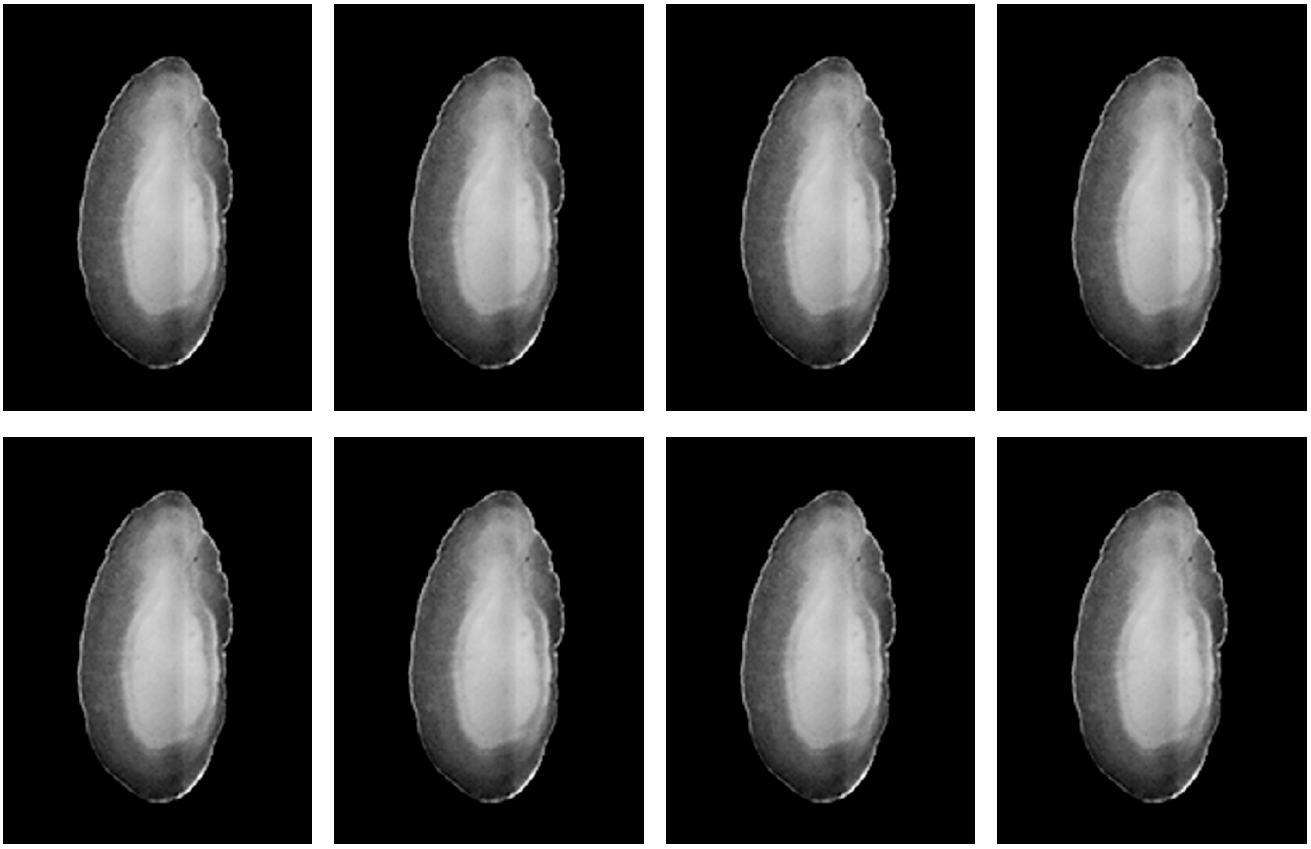


APPENDIX II SCAT DETECTIVE IMAGES

Atka mackerel, *Pleurogramma monopterygius*

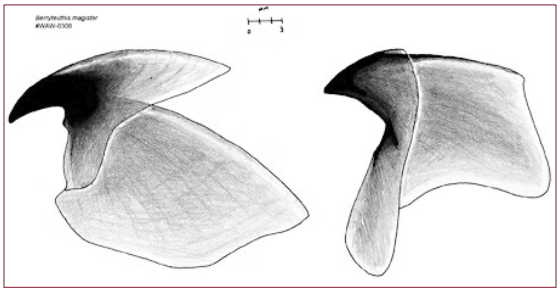
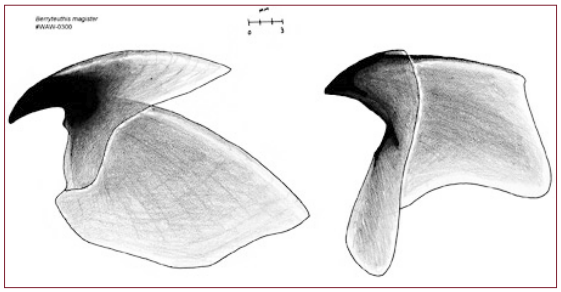
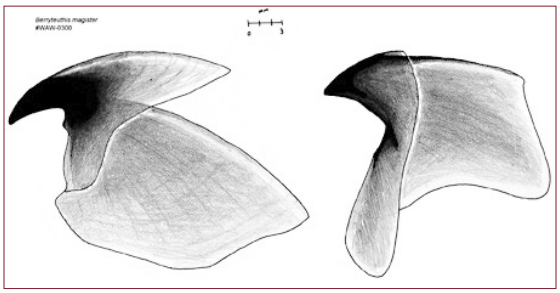
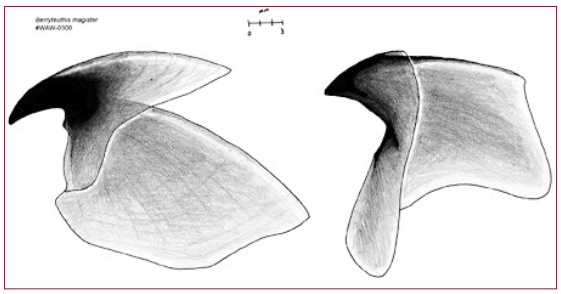
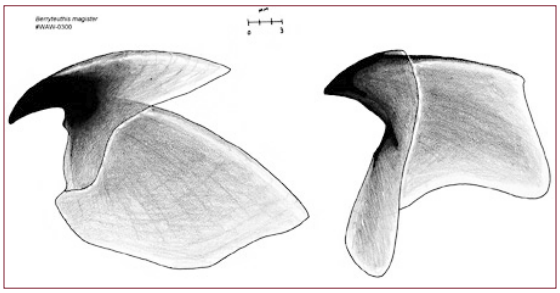
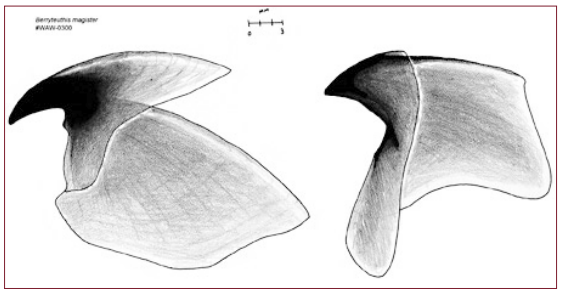
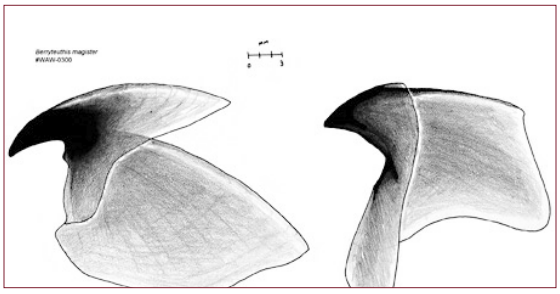
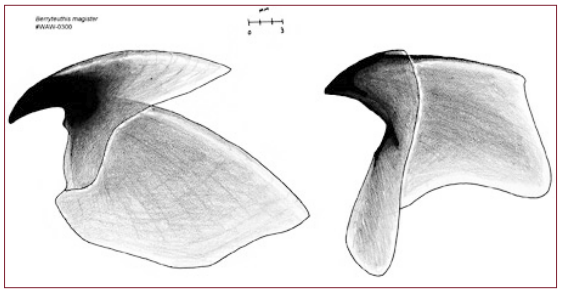
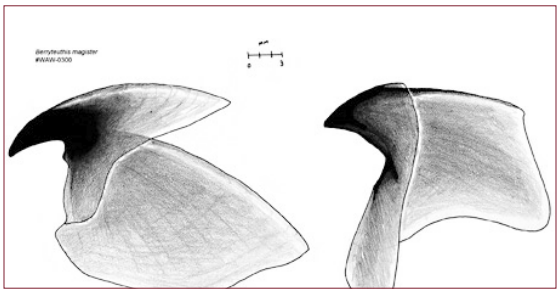
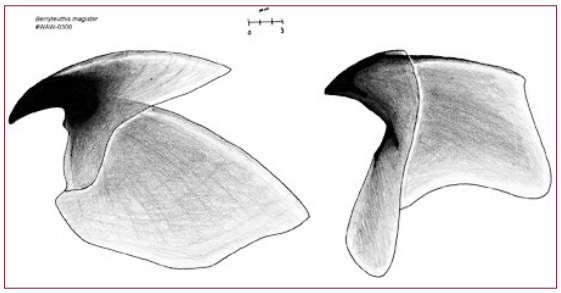


Pacific sand lance, *Ammodytes hexapterus*



APPENDIX II SCAT DETECTIVE IMAGES

squid, *Berryteuthis magister*

APPENDIX II SCAT DETECTIVE IMAGES

walleye pollock *Theragra chalcogramma*

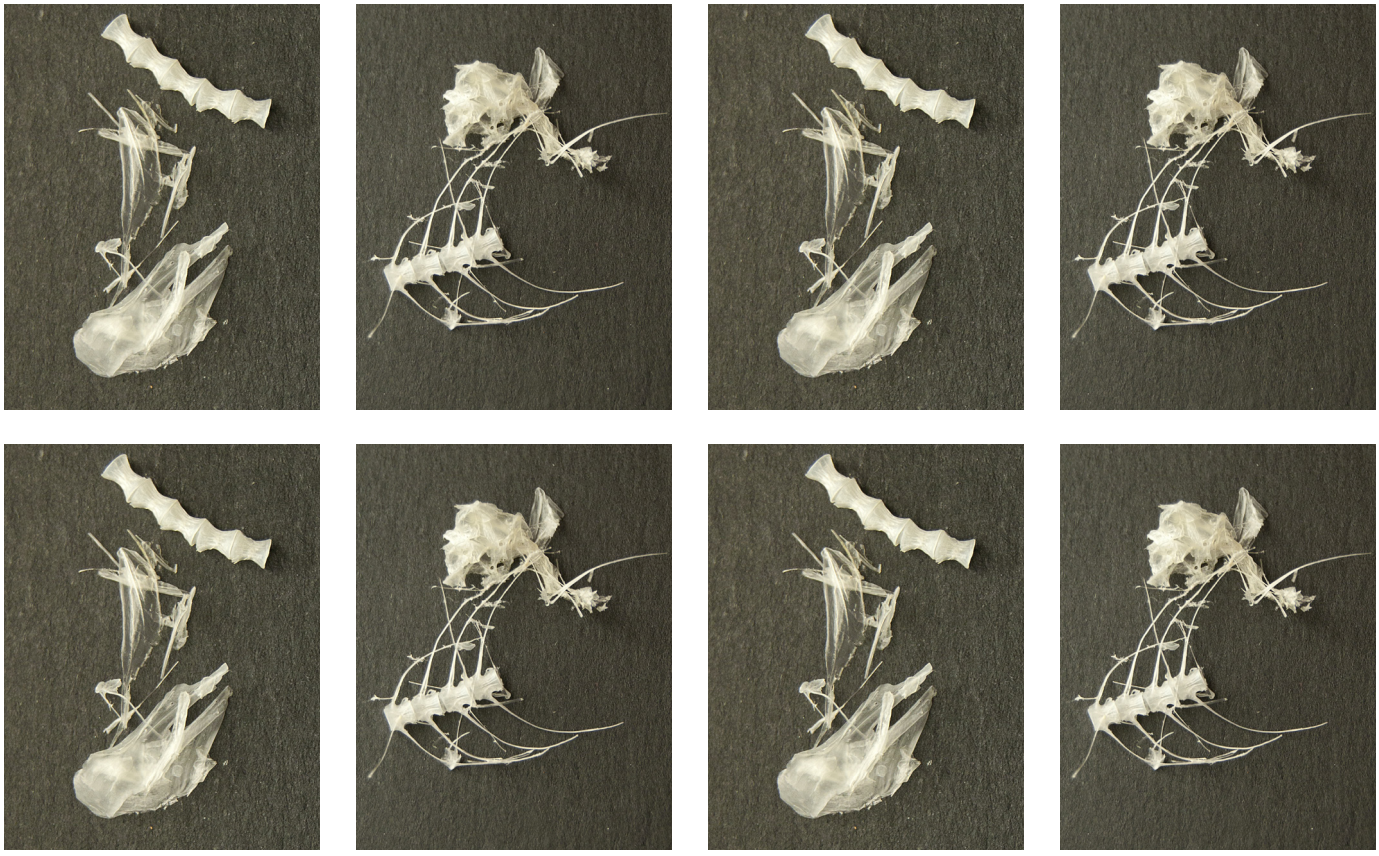


APPENDIX II SCAT DETECTIVE IMAGES

Pacific cod, *Gadus macrocephalus*



Northern Smoothtongue, *Leuroglossus schmidti*



APPENDIX II SCAT DETECTIVE IMAGES

Pacific herring, *Clupea pallasii*



Pacific sand lance, Ammodytes hexapterus



APPENDIX II SCAT DETECTIVE IMAGES

coho salmon *Oncorhynchus kisutch*



Atka mackerel, *Pleurogramma monopterygius*



APPENDIX III PHOTO CREDITS

Lesson 4 Activity 4.3: Scat detective

Bag-stomach game

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Bone Image Source

Pam Goddard, Thalassa Education

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