

Laaqudaġ: The Northern Fur Seal

GRADES 7-12 PART III: LESSONS 7-8

2018



Artwork by
Thomas Stream

Northern fur seal

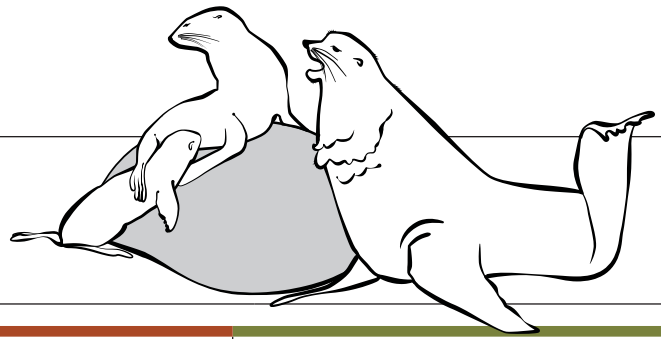
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Thomas Stream 2018

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

LESSON ONE

What is a fur seal?



Subject Area(s): Life Science

Grade Levels: 7-12

Presentation – 10 minutes

Labs – variable

Lesson Topics: Review characteristics of mammals, marine mammals, and pinnipeds.

Learning Objectives: Students will:

- review the characteristics of mammals, marine mammals, and pinnipeds.

Focus Questions

- What is a mammal?
- What is a marine mammal?
- What is a pinniped?

Key words: mammal, pinniped, true seal, eared seal, walrus, phocid, otariid, odobenid, northern fur seal, harbor seal, sea lion, pelage

LABS		STANDARDS		
		Science	Minutes	Grades
Lab 1.1	Review Mammals, Marine Mammals, and Pinnipeds (worksheets)	SC2	30	7-12

Targeted Alaska Grade Level Expectations (GLEs)

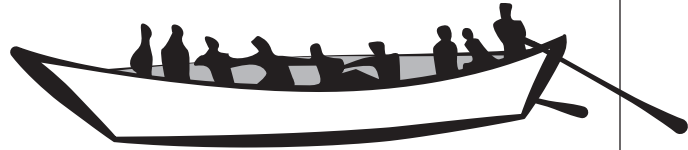
Science

Concepts of Life Science

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: 7-12

Presentation – 15 minutes

Labs – variable

Lesson Topics:	Geography, Unangam culture and history, Unangan relationship to northern fur seals	Focus Questions	- Where are the Aleutian and Pribilof Islands? - Who are the Unangan? - How have historical events affected Unangam history?
Learning Objectives:	Students will: - investigate the geography of the Aleutian and Pribilof Islands - interpret the Unangam culture through film and literature	Key words:	Unangan (noun), Unangam (adjective), Aleutian Islands, Pribilof Islands, culture, history, internment

LABS		ALASKA STANDARDS		Minutes	Grades
		Science	History		
Lab 2.1	Where are the Aleutian Islands and the Pribilof Islands? (mapping)	SF1-3	PPE1	50	7–12
Lab 2.2	Who Are the Unangan? (read and discuss)		IGCP2	50	7–12
Lab 2.3	<i>People of the Seal</i> (watch and discuss)		ICGP2,9, CC1-4	2x50	7-12
Lab 2.4	<i>Aleut Story</i> (watch and discuss)		ICGP2,5,9, CC1-4	3x50	7-12
Lab 2.5	<i>Aleutian Sparrow, The White Seal, Libby</i> (read and discuss)		ICGP2,5,9, CC1-4	30-50	7-12

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.

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).

ICGP 5 explaining the impacts of military actions relative to Native communities (e.g., Naval bombardment of Angoon, Aleut internment, military expeditions.)

ICGP 9 exploring the federal government's influence on settlements in Alaska (e.g., Matanuska Colony, Anchorage, Adak, Tok, Hyدابurg) by establishment of post offices, military facilities, schools, courts, and railroads.

Continuity and Change (CC)

The student demonstrates an understanding of the chronology of Alaska history by:

CC 1 using texts/sources to recognize and explain the interrelationships among Alaska, national, and international events and developments (e.g., international interest, trade, commerce).

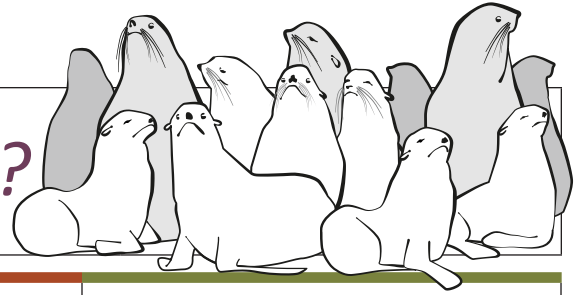
CC 2 describing how policies and practices of non-natives (e.g., missionaries, miners, Alaska Commercial Company merchants) influenced Alaska Natives.

CC 3 describing how the roles and responsibilities in Alaska Native societies have been continuously influenced by changes in technology, economic practices, and social interactions.

CC 4 giving correct and incorrect examples to explain subsistence as a way of life.

LESSON THREE

What is a fur seal rookery?



Subject Area(s): Life science, genetics, reading

Grade Levels: 7-12

Presentation – 15 minutes

Labs – variable

Lesson Topics: Fur seal rookery structure, location, and seasonal changes

Focus Questions

- What is a fur seal rookery?
- What information can scientist gather from a rookery?
- How does the structure of the fur seal population change on the rookery?

Learning Objectives: Students will:

- describe the seasonal structure of a fur seal rookery
- investigate fecundity
- examine genetic relationships
- summarize their knowledge with art

Key words: rookery, haulout, fecundity, paternity, maternity, seasonal, age class, genetics

LABS		ALASKA STANDARDS		
		Science	Minutes	Grades
Lab 3.1	What is a Rookery? (review, worksheet, discussion)	SC2	30	7–12
Lab 3.2	Fecundity: The Next Generation (worksheet)	SC2	50	7-12
Lab 3.3	Rookery Timeline (hands-on, spreadsheet)	SC2	50	7–12
Lab 3.4	Paternity and Maternity on the Rookery (worksheet)	SC2	50	7–12
Lab 3.5	Create a Rookery – Rubber Stamp Making (hands-on, art)	SC2	2x50	7-12

Targeted Alaska Grade Level Expectations (GLEs)

Science

Concepts of Life Science

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

Math

CC Counting and Cardinality

MD Measurement and Data

LESSON FOUR

What do fur seals eat?

Subject Area(s): Life science

Grade Levels: 7-12

Presentation – 15 minutes

Labs – variable

Lesson Topics:	Food chain, food web, scat analysis, food habits/diet	Focus Questions	• How do scientists study the fur seal's diet? • What is learned from studying food habits? • Why do scientists study food habits?
Learning Objectives:	Student will: • create a Bering Sea food web • analyze scat contents • graph and analyze scat contents	Key words:	diet, prey, ecosystem, scat, food habits, forage, food web, frequency of occurrence

LABS		ALASKA STANDARDS					
		Math 7	Math 8	MATH 9-12	Science	Minutes	Grades
Lab 4.1	Bering Sea Food Web (hands on)				SC2,3	30	7-12
Lab 4.2	Microworlds: What do Marine Mammals Eat? (video)				SC2,3	30	7-12
Lab 4.3*	Scat Detective (hands on)	7.SP1-4	8.SP1	S-ID, S-IC	SA1,2, SC 2,3 SE1,2, SG2	50	7-8
Lab 4.4*	Scat Detective and Frequency of Occurrence (hands on)	7.SP1-4	8.SP1	S-ID, S-IC	SA1,2, SC 2,3 SE1,2, SG2	50	9-12
Lab 4.5*	Advanced Scat Detective (graphing and data analysis)	7.SP1-4	8.SP1	S-ID, S-IC	SA1,2, SC 2,3 SE1,2, SG2	50	9-12

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.

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.

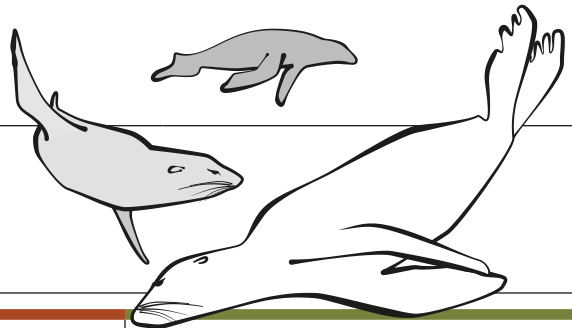
*Labs 4.3, 4.4, and 4.5 involve investigating the diets of northern fur seals through scat analysis.

*Lab 4.3 is the most basic and involves plotting the frequency of items found in scats prepared by the instructor.

*Lab 4.4 takes the process one step further by calculating the Frequency of Occurrence of prey items found in scats created by the instructor. The data provided for this lab are very similar to real data collected in the field.

*Lab 4.5 uses a set of actual data collected from the Pribilof Islands for the students to manipulate, graph, and analyze.

LESSON FIVE

How do fur seals dive?

Subject Area(s): Life science

Grade Levels: 7-12

Presentation – 15 minutes

Labs – variable

Lesson Topics:	Fur seal diving and adaptations to cold environments.	Focus Questions	• How are pinnipeds adapted to cold water? • Why do fur seals dive? • What can be learned from studying diving behavior?
Learning Objectives:	Students will: • investigate adaptations of seals to water • collect and summarize data • interpret fur seal dive data	Key words:	blubber, body shape, forage, adaptation, counter-current heat exchange, thermoregulation

LABS		ALASKA STANDARDS					
		Math 7	Math 8	Math 9-12	Science	Minutes	Grades
Lab 5.1	How do Marine Mammals Stay Warm? Blubber vs. Air (hands-on)	7.SP.1-4	8.SP.1-4		SA1,2 SC1,2	30	7–12
Lab 5.2	Thermoregulation: Counter Current Heat Exchange (hands-on)	7.SP.1-4	8.SP.1-4		SA1,2 SC1,2 SG2	50	9-12
Lab 5.3	Waiting to Inhale! (hands-on)	7.SP.1-4	8.SP.1-4		SA1,2 SC1,2 SG2	50	7–12
Lab 5.4	Interpreting Fur Seal Dive Data (data analysis)	7.SP.1-4	8.SP.1-4	S-IC.	SA1,2 SC1,2 SG2	50	9-12

Targeted Alaska Grade Level Expectations (GLEs)

Math

MD Measurement and Data

SP Statistics and Probability

Statistics: IC.1

Science

Science as Inquiry and Process

SA1; SA2

Concepts of Life Science

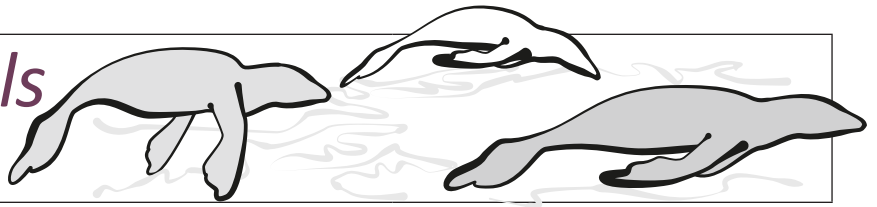
SC2

History and Nature of Science

SG2

LESSON SIX

Where do fur seals go in the winter?



Subject Area(s): Life science, geography, reading

Grade Levels: 7-12

Presentation – 15 minutes

Labs – 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

Lab		ALASKA STANDARDS		
		Science	Minutes	Grades
Lab 6.1	Where are Fur Seal Rookeries? (mapping)	SA3; SC2,3; SF1,2,3	30	7-12
Lab 6.2	<i>Fur Seal Migrations</i> (video, discussion)	SA3; SC2; SF1,2,3	30	7–12
Lab 6.3	Fur Seal Migrations (mapping)	SA3; SC2,3; SF1,2,3; SG1,3,4	50	7–12

Targeted Alaska Grade Level Expectations (GLEs)

Science

Science as Inquiry and Process

SA3

Concepts of Life Science

SC2; SC3

Cultural, Social, Personal Perspectives, and Science

SF1; SF2; SF3

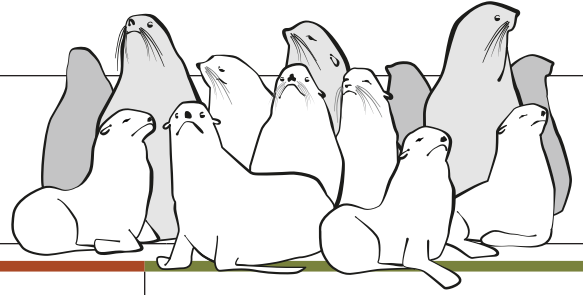
History

History and Nature of Science

SG1; SG3; SG4

LESSON SEVEN

Populations, Harvest, and Management



Subject Area(s): Life science

Grade Levels: 7-12

Presentation – 20 minutes

Labs – variable

Lab Topics: Population estimation, harvest management, and historical timelines

Learning Objectives: Students will:

- estimate populations
- interpret historical events
- analyze harvest and population data.

Focus Questions

- How do scientists estimate fur seal populations?
- What are the relationships between Pribilof Island historical events, fur seal population changes, and world history?

Key words:

population estimation, population, harvest, population biology, population management, stakeholder, rate of decline

LESSONS		ALASKA STANDARDS						
		Math 7	Math 8	Math 7-12	Science	History	Minutes	Grades
Lab 7.1	Estimating a Population (math)	7.RP.1-3 7.SP1-2	8.SP.1	S-ID,S-IC A-CED.2	SA3,SE1,2 SF1,SG1-4		50	7-12
Lab 7.2	Mark-Recapture: How many pups? (math)	7.RP.1-3 7.SP1-2	8.SP.1	S-ID,S-IC A-CED.2			50	7-12
Lab 7.3	Analyze Pup Population Data: 1961-2016 (math)	7.RP.1-3 7.SP1-2	8.SP.1	A-CED.2 S-ID,S-IC			50	9-12
Lab 7.4	Compare Historical Timelines (history, writing, discussion)					PPE2,5,7 IGCP2,5,8,8 CC1-4,7	50	7-12
Lab 7.5	Interpret Historical Images (history, writing, discussion)					PPE2,5,7 IGCP2,5,8,8 CC1-4,7	50	7-12
Lab 7.6	Analyze Fur Seal Harvest Data: 1817-2016 (math)	7.RP.1-3 7.SP1-2	8.SP.1	A-CED.2 S-ID,S-IC	SA3,SE1,2 SF1,SG1-4		20	9-12

Targeted Alaska Grade Level Expectations (GLEs)

Math

RP Ratios and Proportional Relationships

SP Statistics and Probability

A-CED Algebra-Creating Equations that Describe

S-IC Statistics-Inferences and Conclusions

S-ID Statistics-Interpreting Data

Science

Science as Inquiry and Process
SA3

Science and Technology
SE1; SE2

Cultural, Social, Personal Perspectives, and Science
SF1

History and Nature of Science
SG1; SG2; SG3; SG4

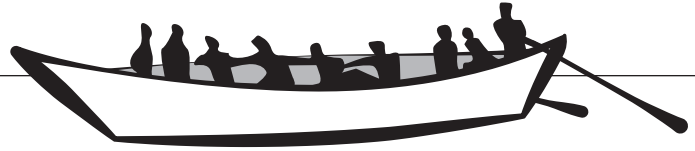
History

People, Places, and Environment
PPE2,5,7

Consumption, Production, Distribution
CC1-4,7

Individual, Citizenship, Governance, Power
IGCP2,5,8,8

LESSON EIGHT

Marine Mammal Protection Act

Subject Area(s): Life science,
history, cultural

Grade Levels: 7-12

Presentation – 20 minutes

Labs – variable

Lab Topics:	Marine Mammal Protection Act Subsistence hunting Treaty rights	Focus Questions	• What is the Marine Mammal Protection Act? • What were the unintended consequences of the MMPA? • How were the Makah and the Pribilof Islanders affected by the MMPA?
Learning Objectives:	Students will: • summarize the Marine Mammal Protection Act • compare and contrast the rights of Native American tribes in states other than Alaska and Alaska Natives.	Key words:	Marine Mammal Protection Act, permit, waiver, treaty, subsistence

LABS		ALASKA STANDARDS		Minutes	Grades
		Science	History		
Lab 8.1	Marine Mammal Protection Act Summary (research, writing, interpretation)		CC1-4,7	50	9–12
Lab 8.2	MMPA: Unintended Consequences of a law (research, writing, interpretation)		CC1-4,7	50	9–12
Lab 8.3	MMPA Case Study: Gray Whales (research, writing, interpretation)		CC1-4,7	50	9–12
Lab 8.4	MMPA Case Study: Northern Fur Seals (research, writing, interpretation)		CC1-4,7	50	9–12
Lab 8.5	MMPA Comparative Analysis: Makah and Pribilof Islanders (research, writing, interpretation)		CC1-4,7	50	9–12

Targeted Alaska Grade Level Expectations (GLEs)**American History****Individual, Citizenship, Governance, Power Continuity and Change (CC)**

The student demonstrates an understanding of the chronology of Alaska history by:

CC 1; CC 2; CC 3; CC 4; CC 7

Laaqudax^ the Northern Fur Seal for grades 7-12 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, and the NMFS Alaska Regional Office. The curriculum was developed by Lisa Hiruki-Raring (NMFS), Pam Goddard (Thalassa), 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). Curriculum and activities for Aleut Story (Lab 2.4) are used with permission by Marla Williams. 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 Fisheries (Alaska Regional Office and Alaska Fisheries Science Center), the Central Bering Sea Fishermen's Association, and the National Marine Sanctuaries Foundation.

Please send comments or inquiries to:

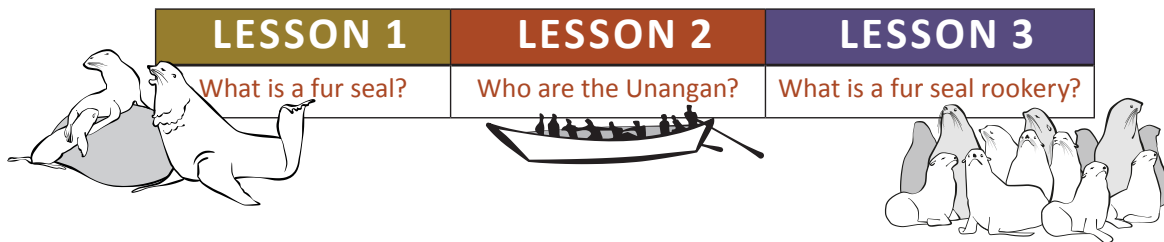
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Introduction

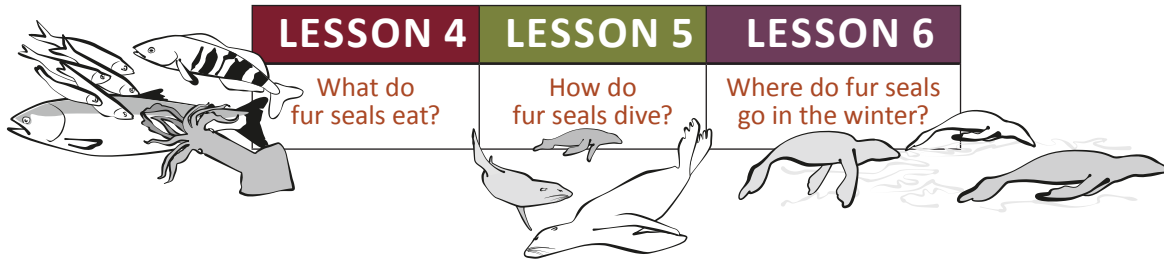
Northern fur seals have played an important economic and biological role in the history of Alaska and the United States that is often overlooked. Historically, Alaska was home to over 90% of the world's population of northern fur seals with the majority found on the Pribilof Islands in the Bering Sea. 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 dollar purchase price.

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 term **Unangan** when appropriate.

Part I: Marine Mammal Review



Part II: More In-Depth Biological Information



Part III: Population Estimation, Management, and Policy

LESSON 7	LESSON 8
Populations, Harvest, Management	Marine Mammal Protection Act

Goal

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 7-12. 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.

Parts I, II, and III of this curriculum accomplish the following objectives:

- Review the story of the annual cycle of northern fur seals,
- Review the core concepts in fur seal biology,
- Review the relationship between northern fur seals and Unangan culture,
- Introduce methods behind population estimation,
- Understand the reasons for and consequences of the Marine Mammal Protection Act,
- Develop awareness of the science and research techniques used to study northern fur seals.

CURRICULUM FRAMEWORK

The curriculum is divided into Part I (Lessons 1-3), Part II (Lessons 4-6), and Part III (Lessons 7-8), each with a PowerPoint presentation and accompanying activities for different grade levels. A complementary curriculum is available for grades K-6. The labs are designed to reinforce and expand the lesson themes, and to provide hands-on opportunities for students to investigate and integrate the information they have learned.

Part I Lessons

1 What is a fur seal?

2 Who are the Unangan?

3 What is a fur seal rookery?

Part II Lessons

4 What do fur seals eat?

5 How do fur seals dive?

6 Where do fur seals go in the winter?

Part III Lessons

7 Populations, Harvest, and Management

8 Marine Mammal Protection Act

Lessons 1, 2, and 3 provide the foundation for the curriculum. It is strongly suggested that teachers at least review the information in these lessons before proceeding. Lesson 4-6 can be taught in any order. Lessons 7 and 8 are the most advanced. They introduce population dynamics, management techniques, and the Marine Mammal Protection Act. Lessons 7 and 8 can be taught independently of the other lessons but some background information is recommended. Labs are structured to take one class period of 45-55 minutes. Some shorter labs take half a class period (30) minutes.

See Appendix III for a complete curriculum overview and Appendix IV for lesson overviews from Parts II and III.

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 lab; 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

HOW MUCH TIME DO I NEED?

Each lesson can be completed in 40-60 minutes if at least one lab is selected. Labs range from 10-50 minutes with most being 50 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:

- Teach what you have learned to someone else (family, another class).
- Create a school display.
- Create an all-school mural using the stamps created in Lab 3.4. This is a great opportunity for older students to work with younger students or earn community service hours.
- Write a song, skit or a play about a northern fur seal rookery or migration and act it out for students at your school.
- Make an educational video about something you learned.
- Record an elder telling a story. Ask for permission to share it with your class or school.
- Hold a debate on the Marine Mammal Protection Act.
- Visit the Pribilof Islands for summer camp.
- Write a letter to your Congressional representative.

Northern Fur Seal Curriculum Overview Part III

Lesson	Topic	Components	Grade Level	Time
<i>Labs vary by grade level allowing educators to select age appropriate activities for their class.</i>				
	Part III Pre- and Post-assessment		7-12	15 min
7	Populations, Harvest, Management	PowerPoint Overview (13 slides) Lab 7.1: Estimating a Population (math) Lab 7.2: Mark-Recapture: How Many Pups? (math) Lab 7.3: Analyzing Pup Population Data: 1961-2016 (math) Lab 7.4: Compare Historical Timelines (history, writing, discussion) Lab 7.5: Interpret Historical Images (history, writing, discussion) Lab 7.6: Analyzing Fur Seal Harvest Data: 1817-2016 (math)	7-12 7-12 9-12 7-12 7-12 9-12	50 min 50 min 50 min 50 min 50 min 50 min
8	Marine Mammal Protection Act	PowerPoint Overview (19 slides) Lab 8.1 Marine Mammal Protection Act Summary (research, writing, interpretation) Lab 8.2 MMPA: Unintended Consequences of a Law (research, writing, interpretation) Lab 8.3 MMPA Case Study: Gray Whales (research, writing, interpretation) Lab 8.4 MMPA Case Study: Northern Fur Seals (research, writing, interpretation) Lab 8.5 MMPA Comparative Analysis: Makah/Pribilof Islanders (research, writing, interpretation)	9-12 9-12 9-12 9-12 9-12	50 min 50 min 50 min 50 min 50 min

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.

breeding philopatry or breeding-site fidelity returning to the same location to breed, year after year.

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

chromosome A threadlike strands found in the nucleus of most living cells consisting of a single DNA molecule bonded to proteins and that carries genetic information in the form of genes.

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.

countercurrent heat exchange A process that occurs in nature preventing large amounts of heat from being lost to the environment by causing the transfer of heat from warm blood to cool blood reentering the core of the body.

DNA (deoxyribonucleic acid) is the material present in all living organisms that carries all the information about how a living thing will look and function.

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.

Eskimo A name commonly used in Alaska to refer to Inuit and Yupik people.

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

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

fecundity Fecundity is derived from the word fecund which means 'fruitful'. In biology, fecundity refers to fertility or the rate of reproduction of an individual or population.

fissiped Carnivores with toes that are separated from each other. Fissiped is Latin for "split-foot." Weasels (sea otters, mink, badgers), bears (polar, brown, black), dogs and cats are fissipeds.

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.

gene Genes are made of DNA and are the basic physical unit of heredity.

APPENDIX I

GLOSSARY

harbor seal A true seal with 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.

Laaqudaġ Unangam word for northern fur seal.

Laaqudaaġ 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.

locus the location of a gene on a chromosome.

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.

Marine Mammal Protection Act of 1972 An Act to protect marine mammals and their environment, passed by Congress and signed by President Richard Nixon in 1972. Animals protected under this Act include whales, dolphins, seals, sea lions, and walruses.

MMPA: Depletion a population below its optimum sustainable population.

MMAP: Harassment causing a marine mammal to change its behavior in any way.

MMPA: Moratorium a complete ban on taking or importing marine mammal/marine mammal products.

MMPA: Optimum Sustainable Population (OSP) the number of animals that will maintain a healthy population in their ecosystem.

MMPA: Population stock a group of marine mammals of the same species that interbreed.

MMAP: Take the "hunt, harass, capture, or kill" a marine mammal or attempt to do so.

MMPA: Secretary the Secretary of Commerce of the Secretary of the Interior, or both.

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.

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

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 7 years or older.

northern fur seal: breeding male An adult male who defends a territory on the rookery containing females. Usually 9 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.

APPENDIX I

GLOSSARY

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.

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.

thermoregulate regulate temperature, especially one’s own body temperature

toothed whale A whale with teeth, instead of baleen. Also called odontocete.

topography The physical or natural features of an area.

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).

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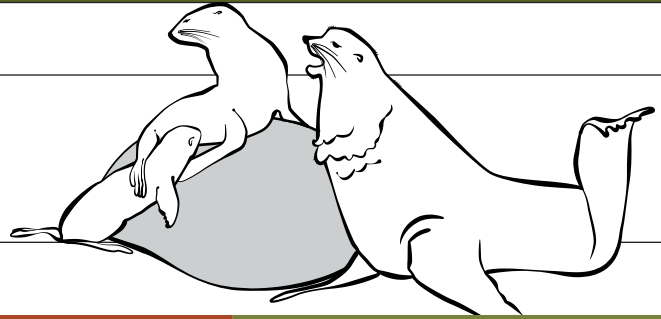
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APPENDIX III		CURRICULUM OVERVIEW		
Lesson	Topic	Components	Grade Level	Time
<i>Labs vary by grade level allowing educators to select age appropriate activities for their class.</i>				
	Curriculum Pre and Post Assessment		7-12	15 min
1	What is a fur seal?	PowerPoint Overview (7 slides) Lab 1.1: Review: Mammals, Marine Mammals, and Pinniped	7-12	30 min
2	Who are the Unangan?	PowerPoint Overview (10 slides) Lab 2.1: Where are the Aleutian and Pribilof Islands? (mapping) Lab 2.2: Who are the Unangan? (read and discuss) Lab 2.3: <i>People of the Seal</i> (watch and discuss) Lab 2.4: <i>Aleut Story</i> (watch and discuss) Lab 2.5: <i>Aleutian Sparrow, The White Seal, and Libby</i> (read and discuss)	7-12 7-12 7-12 7-12 7-12	50 min 50 min 2x50 min 3x50 min 30-50 min
3	What is a fur seal rookery?	PowerPoint Overview (13 slides) Lab 3.1: What is a Rookery? (review, assess, worksheet, discussion) Lab 3.2: Fecundity: The Next Generation (hands-on) Lab 3.2: Rookery Timeline (hands-on) Lab 3.4: Paternity and Maternity on the Rookery (hands-on) Lab 3.5: Create a Rookery – Rubber Stamp Making (hands on, art)	7-12 7-12 7-12 9-12 7-12	50 min 50 min 50 min 50 min 2x50 min
4	What do fur seals eat?	PowerPoint Overview (8 slides) Lab 4.1: Bering Sea Food Web (hands on) Lab 4.2: Microworlds: What do Marine Mammals Eat? (video) Lab 4.3: Scat Detective (hands on) Lab 4.4: Scat Detective and Frequency of Occurrence (hands on) Lab 4.5: Advanced Scat Detective (graphing and data analysis)	7-12 7-12 7-8 9-12 9-12	50 min 30 min 50 min 50 min 50 min
5	How do fur seals dive?	PowerPoint Overview (10 slides) Lab 5.1: Blubber vs. Air (hands-on) Lab 5.2: Thermoregulation: Countercurrent Heat Exchange (hands-on) Lab 5.3: Waiting to Inhale! (hands-on) Lab 5.4: Interpreting Fur Seal Dive Data (data analysis)	7-12 9-12 7-12 9-12	30 min 50 min 50 min 50 min
6	Where do fur seals go in the winter?	PowerPoint Overview (10 slides) Lab 6.1: Where are Fur Seal Rookeries? (mapping) Lab 6.2: <i>Fur Seal Migrations</i> (video) Lab 6.3: Fur Seal Migrations (mapping)	7-12 7-12 7-12	30 min 30 min 50 min
7	Populations, Harvest, Managements	PowerPoint Overview (13 slides) Lab 7.1: Estimating a Population (math) Lab 7.2: Mark-Recapture: How Many Pups? (math) Lab 7.3: Analyzing Pup Population Data: 1961-2016 (math) Lab 7.4: Compare Historical Timelines (history, writing, discussion) Lab 7.5: Interpret Historical Images (history, writing, discussion) Lab 7.6: Analyzing Fur Seal Harvest Data: 1817-2016 (math)	7-12 7-12 9-12 7-12 7-12 9-12	50 min 50 min 50 min 50 min 50 min 50 min
8	Marine Mammal Protection Act	PowerPoint Overview (22 slides) Lab 8.1 Marine Mammal Protection Act Summary (research, writing, interpretation) Lab 8.2 MMPA: Unintended Consequences of a Law (research, writing, interpretation) Lab 8.3 MMPA Case Study: Gray Whales (research, writing, interpretation) Lab 8.4 MMPA Case Study: Northern Fur Seals (research, writing, interpretation) Lab 8.5 MMPA Comparative Analysis: Makah/Pribilof Islanders (research, writing, interpretation)	9-12 9-12 9-12 9-12 9-12	50 min 50 min 50 min 50 min 50 min

APPENDIX IV

LESSON OVERVIEWS

LESSON ONE

What is a fur seal?**Subject Area(s):** Life Science**Grade Levels:** 7-12

Presentation – 10 minutes

Labs – variable

Lesson Topics:

Review characteristics of mammals, marine mammals, and pinnipeds.

Learning Objectives:

Students will:

- review the characteristics of mammals, marine mammals, and pinnipeds.

Focus Questions

- What is a mammal?
- What is a marine mammal?
- What is a pinniped?

Key words:

mammal, pinniped, true seal, eared seal, walrus, phocid, otariid, odobenid, northern fur seal, harbor seal, sea lion, pelage

LABS

ALASKA STANDARDS

		Science	Minutes	Grades
Lab 1.1	Review Mammals, Marine Mammals, and Pinnipeds (worksheets)	SC2	30	7-12

Targeted Alaska Grade Level Expectations (GLEs)**Science****Concepts of Life Science**

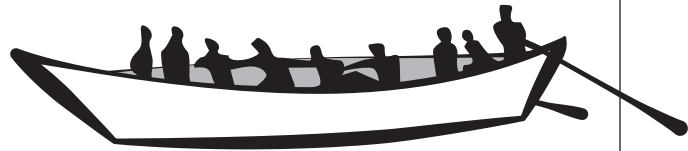
SC2 Students develop an understanding of the structure, function, behavior, development, life cycles, and diversity of living organisms.

APPENDIX IV

LESSON OVERVIEWS

LESSON TWO

Who Are The Unangan?



Subject Area(s): Life science,
history, cultural

Grade Levels: 7-12

Presentation – 15 minutes

Labs – variable

Lesson Topics:	Geography, Unangam culture and history, Unangan relationship to northern fur seals	Focus Questions	• Where are the Aleutian and Pribilof Islands? • Who are the Unangan? • How have historical events affected Unangam history?
Learning Objectives:	Students will: • investigate the geography of the Aleutian and Pribilof Islands • interpret the Unangam culture through film and literature	Key words:	Unangan (noun), Unangam (adjective), Aleutian Islands, Pribilof Islands, culture, history, internment

LABS		ALASKA STANDARDS		Minutes	Grades
		Science	History		
Lab 2.1	Where are the Aleutian Islands and the Pribilof Islands? (mapping)	SF1-3	PPE1	50	7–12
Lab 2.2	Who Are the Unangan? (read and discuss)		IGCP2	50	7–12
Lab 2.3	<i>People of the Seal</i> (watch and discuss)		ICGP2,9, CC1-4	2x50	7-12
Lab 2.4	<i>Aleut Story</i> (watch and discuss)		ICGP2,5,9, CC1-4	3x50	7-12
Lab 2.5	<i>Aleutian Sparrow, The White Seal, Libby</i> (read and discuss)		ICGP2,5,9, CC1-4	30-50	7-12

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.

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).

ICGP 5 explaining the impacts of military actions relative to Native communities (e.g., Naval bombardment of Angoon, Aleut internment, military expeditions.)

ICGP 9 exploring the federal government's influence on settlements in Alaska (e.g., Matanuska Colony, Anchorage, Adak, Tok, Hydaburg) by establishment of post offices, military facilities, schools, courts, and railroads.

Continuity and Change (CC)

The student demonstrates an understanding of the chronology of Alaska history by:

CC 1 using texts/sources to recognize and explain the interrelationships among Alaska, national, and international events and developments (e.g., international interest, trade, commerce).

CC 2 describing how policies and practices of non-natives (e.g., missionaries, miners, Alaska Commercial Company merchants) influenced Alaska Natives.

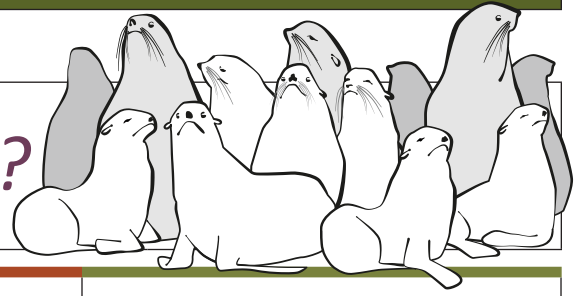
CC 3 describing how the roles and responsibilities in Alaska Native societies have been continuously influenced by changes in technology, economic practices, and social interactions.

CC 4 giving correct and incorrect examples to explain subsistence as a way of life.

APPENDIX IV

LESSON OVERVIEWS

LESSON THREE

What is a fur seal rookery?

Subject Area(s): Life science,
genetics, reading

Grade Levels: 7-12

Presentation – 15 minutes

Labs – variable

Lesson Topics: Fur seal rookery structure, location, and seasonal changes

Focus Questions

- What is a fur seal rookery?
- What information can scientist gather from a rookery?
- How does the structure of the fur seal population change on the rookery?

Learning Objectives: Students will:

- describe the seasonal structure of a fur seal rookery
- investigate fecundity
- examine genetic relationships
- summarize their knowledge with art

Key words: rookery, haulout, fecundity, paternity, maternity, seasonal, age class, genetics

LABS		ALASKA STANDARDS		
		Science	Minutes	Grades
Lab 3.1	What is a Rookery? (review, worksheet, discussion)	SC2	30	7–12
Lab 3.2	Fecundity: The Next Generation (worksheet, hands-on)	SC2	50	7-12
Lab 3.3	Rookery Timeline (hands-on)	SC2	50	7–12
Lab 3.4	Paternity and Maternity on the Rookery (worksheet)	SC2	50	9–12
Lab 3.5	Create a Rookery – Rubber Stamp Making (hands-on, art)	SC2	2x50	7-12

Targeted Alaska Grade Level Expectations (GLEs)

Science

Concepts of Life Science

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

APPENDIX IV

LESSON OVERVIEWS

LESSON FOUR

What do fur seals eat?

Subject Area(s): Life science

Grade Levels: 7-12

Presentation – 15 minutes

Labs – variable

Lesson Topics:	Food chain, food web, scat analysis, food habits/diet	Focus Questions	• How do scientists study the fur seal's diet? • What is learned from studying food habits? • Why do scientists study food habits?
Learning Objectives:	Student will: • create a Bering Sea food web • analyze scat contents • graph and analyze scat contents	Key words:	diet, prey, ecosystem, scat, food habits, forage, food web, frequency of occurrence

LABS		ALASKA STANDARDS					
		Math 7	Math 8	MATH 9-12	Science	Minutes	Grades
Lab 4.1	Bering Sea Food Web (hands on)				SC2,3	30	7-12
Lab 4.2	Microworlds: What do Marine Mammals Eat? (video)				SC2,3	30	7-12
Lab 4.3*	Scat Detective (hands on)	7.SP1-4	8.SP1	S-ID, S-IC	SA1,2, SC 2,3 SE1,2, SG2	50	7-8
Lab 4.4*	Scat Detective and Frequency of Occurrence (hands on)	7.SP1-4	8.SP1	S-ID, S-IC	SA1,2, SC 2,3 SE1,2, SG2	50	9-12
Lab 4.5*	Advanced Scat Detective (graphing and data analysis)	7.SP1-4	8.SP1	S-ID, S-IC	SA1,2, SC 2,3 SE1,2, SG2	50	9-12

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.

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.

*Labs 4.3, 4.4, and 4.5 involve investigating the diets of northern fur seals through scat analysis.

*Lab 4.3 is the most basic and involves plotting the frequency of items found in scats prepared by the instructor.

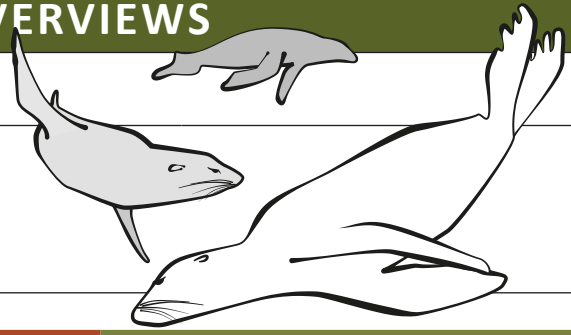
*Lab 4.4 takes the process one step further by calculating the Frequency of Occurrence of prey items found in scats created by the instructor. The data provided for this lab are very similar to real data collected in the field.

*Lab 4.5 uses a set of actual data collected from the Pribilof Islands for the students to manipulate, graph, and analyze.

APPENDIX IV

LESSON OVERVIEWS

LESSON FIVE

How do fur seals dive?

Subject Area(s): Life science

Grade Levels: 7-12

Presentation – 15 minutes
Labs– variable

Lab Topics: Fur seal diving and adaptations to cold environments.

Learning Objectives: Students will:

- investigate adaptations of seals to water
- collect and summarize data
- interpret fur seal dive data

Focus Questions

- How are pinnipeds adapted to the cold water?
- Why do fur seals dive?
- What can be learned from studying diving behavior?

Key words: blubber, body shape, forage, adaptation, counter-current heat exchange, thermoregulation

LABS		ALASKA STANDARDS					
		Math 7	Math 8	Math 9-12	Science	Minutes	Grades
Lab 5.1	How do Marine Mammals Stay Warm? Blubber vs. Air (hands-on)	7.SP.1-4	8.SP.1-4		SA1,2 SC1,2	30	7–12
Lab 5.2	Thermoregulation: Counter Current Heat Exchange (hands-on)	7.SP.1-4	8.SP.1-4		SA1,2 SC1,2 SG2	50	9-12
Lab 5.3	Waiting to Inhale! (hands-on)	7.SP.1-4	8.SP.1-4		SA1,2 SC1,2 SG2	50	7–12
Lab 5.4	Interpreting fur seal dive data (data analysis)	7.SP.1-4	8.SP.1-4	S-IC.	SA1,2 SC1,2 SG2	50	9-12

Targeted Alaska Grade Level Expectations (GLEs)

Math

MD Measurement and Data
SP Statistics and Probability

Statistics: IC.1

Science

Science as Inquiry and Process
SA1; SA2

Concepts of Life Science
SC2

History and Nature of Science
SG2

APPENDIX IV

LESSON OVERVIEWS

LESSON SIX



Where do fur seals go in the winter?

Subject Area(s): Life science, geography, reading

Grade Levels: 7-12

Presentation – 15 minutes
Labs– variable

Lab 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

LABS		ALASKA STANDARDS		
		Science	Minutes	Grades
Lab 6.1	Where are Fur Seal Rookeries? (mapping)	SA3; SC2,3; SF1,2,3	30	7-12
Lab 6.2	<i>Fur Seal Migrations</i> (video, discussion)	SA3; SC2; SF1,2,3	30	7–12
Lab 6.3	Fur Seal Migrations (mapping).	SA3; SC2,3; SF1,2,3; SG1,3,4.	50	7–12

Targeted Alaska Grade Level Expectations (GLEs)

Science

Science as Inquiry and Process

SA3

Concepts of Life Science

SC2; SC3

Cultural, Social, Personal Perspectives, and Science

SF1; SF2; SF3

History

History and Nature of Science

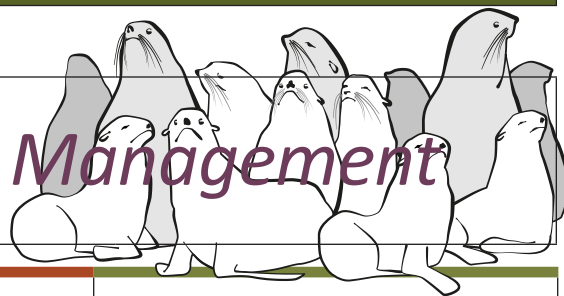
SG1; SG3; SG4

APPENDIX IV

LESSON OVERVIEWS

LESSON SEVEN

Populations, Harvest, and Management



Subject Area(s): Life science

Grade Levels: 7-12

Presentation – 20 minutes

Labs – variable

Lab Topics:	Population estimation, harvest, and management, historical timelines	Focus Questions	- How do scientists estimate fur seal populations? - What are the relationships between Pribilof Island historical events, fur seal population, and world history?
Learning Objectives:	Students will: - estimate populations - interpret historical events - analyze harvest and population data.	Key words:	population estimation, population, harvest, stakeholder, rate of decline

LABS		ALASKA STANDARDS						
		Math 7	Math 8	Math 7-12	Science	History	Minutes	Grades
Lab 7.1	Estimating a Population (math)	7.RP.1-3 7.SP1-2	8.SP.1	S-ID,S-IC A-CED.2	SA3,SE1,2 SF1,SG1-4		50	7-12
Lab 7.2	Mark-Recapture: How many pups? (math)	7.RP.1-3 7.SP1-2	8.SP.1	S-ID,S-IC A-CED.2			50	7-12
Lab 7.3	Analyze Pup Population Data: 1961-2016 (math)	7.RP.1-3 7.SP1-2	8.SP.1	A-CED.2 S-ID,S-IC			50	9-12
Lab 7.4	Compare Historical Timelines (history, writing, discussion)					PPE2,5,7 IGCP2,5,8,8 CC1-4,7	50	7-12
Lab 7.5	Interpret Historical Images (history, writing, discussion)					PPE2,5,7 IGCP2,5,8,8 CC1-4,7	50	7-12
Lab 7.6	Analyze Fur Seal Harvest Data: 1817-2016 (math)	7.RP.1-3 7.SP1-2	8.SP.1	A-CED.2 S-ID,S-IC	SA3,SE1,2 SF1,SG1-4		20	9-12

Targeted Alaska Grade Level Expectations (GLEs)

Math

RP Ratios and Proportional Relationships

SP Statistics and Probability

A-CED Algebra-Creating Equations that Describe

S-IC Statistics-Inferences and Conclusions

S-ID Statistics-Interpreting Data

Science

Science as Inquiry and Process
SA3

Science and Technology
SE1; SE2

Cultural, Social, Personal Perspectives, and Science
SF1

History and Nature of Science
SG1; SG2; SG3; SG4

History

People, Places, and Environment
PPE2,5,7

Consumption, Production, Distribution

CC1-4,7

Individual, Citizenship, Governance, Power

IGCP2,5,8,8

APPENDIX IV

LESSON OVERVIEWS

LESSON EIGHT



Marine Mammal Protection Act

Subject Area(s): Life science,
history, cultural

Grade Levels: 7-12

Presentation – 20 minutes
Labs – variable

Lab Topics:	Marine Mammal Protection Act, subsistence hunting, treaty rights	Focus Questions	• What is the Marine Mammal Protection Act? • What were the unintended consequences of the MMPA? • How were the Makah and the Pribilof Islanders affected by the MMPA?
Learning Objectives:	Students will: • summarize the Marine Mammal Protection Act • compare and contrast the rights of Native American tribes in states other than Alaska and Alaska Natives.	Key words:	Marine Mammal Protection Act, permit, waiver, treaty, subsistence

LABS		ALASKA STANDARDS		Minutes	Grades
		Science	History		
Lab 8.1	Marine Mammal Protection Act, Summary (research, writing, interpretation)		CC1-4,7	50	9–12
Lab 8.2	MMPA: Unintended Consequences (research, writing, interpretation)		CC1-4,7	50	9–12
Lab 8.3	MMPA Case Study: Gray Whales (research, writing, interpretation)		CC1-4,7	50	9–12
Lab 8.4	MMPA Case Study Northern Fur Seals (research, writing, interpretation)		CC1-4,7	50	9–12
Lab 8.5	MMPA Comparative Analysis: Makah and Pribilof Islanders (research, writing, interpretation)		CC1-4,7	50	9–12

Targeted Alaska Grade Level Expectations (GLEs)

American History

Individual, Citizenship, Governance, Power Continuity and Change (CC)

The student demonstrates an understanding of the chronology of Alaska history by:

CC 1; CC 2; CC 3; CC 4; CC 7

APPENDIX V**CURRICULUM PRE/POST ASSESSMENTS**

Lesson	Student Name: _____ Date: _____
1	Name four characteristics of a mammal. List up to four mammals.
1	How is a marine mammal different from a mammal? List up to four marine mammals. (Hint: A penguin is not a marine mammal.)
3	What is a rookery? Name two animals that use rookeries.
4	Describe an ocean food web. Where do northern fur seals fit into the ocean food web?
5	What is blubber? Why do some animals need it?
6	Where are northern fur seal rookeries? Where do northern fur seals go when they are at sea?
7	How do scientists estimate the population of northern fur seals?
2	Who are the Unangan?
8	What is the Marine Mammal Protection Act?

APPENDIX V TEACHER KEY: CURRICULUM PRE/POST-ASSESSMENT

Lesson	Student Name: _____ Date: _____
1	Name four characteristics of a mammal. List up to four mammals. hair or fur gives birth to live young mouse, dog, cat, mammary glands/nurses young warm blooded/endothermic human, seal, whale
1	How is a marine mammal different from a mammal? List up to four marine mammals. (Hint: A penguin is not a marine mammal.) A marine mammal lives in or depend on the ocean. fur seal, harbor seal, walrus, sea lion, elephant seal, orca, blue whale, humpback whale, manatee... (many more)
3	What is a rookery? Name two animals that use rookeries. A rookery is a colony of breeding animals. A specific area where animals gather each year to mate and raise their young. Answers will vary. E.g., northern fur seal, Steller sea lions, Puffins, Kittiwakes, and many other birds
4	Describe an ocean food web. Where do northern fur seals fit into the ocean food web? Sun - Phytoplankton - Zooplankton - Forage Fish - Fish - Marine Mammals - Humans
5	What is blubber? Why do some animals need it? Blubber is a thick layer of fat underneath the skin of marine mammals. Blubber provides insulation from the cold and is a source of energy when food supplies are low.
6	Where are northern fur seal rookeries? Where do northern fur seals go when they are at sea? > 80% of northern fur seals come to land in the Bering Sea (Pribilof Islands, Commander Islands, Bogoslof Island) a small number come to land on San Miguel Island At sea they travel south from the Bering Sea to the coast of the U.S. and then back north to the Bering Sea again.
7	How do scientists estimate the population of northern fur seals? Mark recapture
2	Who are the Unangan? The people who live in the Aleutian, Pribilof, and Commander Islands.
8	What is the Marine Mammal Protection Act? A law that protects marine mammals from being killed or harassed.