CoSEE ALASKA

CENTERS FOR OCEAN SCIENCES EDUCATION EXCELLENCE

PEOPLE, OCEANS AND CLIMATE CHANGE
WWW.COSEEALASKA.NET

Educator Guide

Resources for Teaching about Alaska's Sea & Rivers

Lesson Plans and Units Aligned with
Alaska State Science Standards,
Alaska Standards for Cultural Relevance,
and National Ocean Literacy Principles

AOOS Alaska Ocean Observing System

Alaska SeaLife Center
windows to the sea

UAF University of Alaska Fairbanks

Sea Grant Alaska

Ocean Literacy

Ocean literacy is an understanding of the ocean's influence
And your influence on the ocean.

An ocean-literate person

- Understands the Essential Principles and Fundamental Concepts about the functioning of the ocean,
- Can communicate about the ocean in a meaningful way, and
- Is able to make informed and responsible decisions regarding the ocean and its resources

OCEAN LITERACY ESSENTIAL PRINCIPLES
1 The Earth has one big ocean with many features.
2. The ocean and life in the ocean shape the features of the Earth.
3. The ocean is a major influence on weather and climate.
4. The ocean makes Earth habitable.
5. The ocean supports a great diversity of life and ecosystems.
6. The ocean and humans are inextricably interconnected.
7. The ocean is largely unexplored.

For more information about the Ocean Literacy Essential Principles and Fundamental Concepts
and a K-12 Scope and Sequence for each principle
http://oceanliteracy.wp.coexploration.org/

Organize an Ocean Science Fair at Your School!

The COSEE Alaska Ocean Science Fair has an ocean and watershed theme and a unique emphasis on judging criteria that include scientific merit and cultural relevance and/or place-based learning.

Alaska Native Ways of Knowing

Science Fair Lesson Plan for Grades 3-12

http://www.teachersdomain.org/resource/ean08.sci.ess.earthsys.lpnativeways/

Objectives:

- Learn about the interconnectivity between the air, water, land, fire, and spirit
- Examine the importance of "reading" the land, knowing the local language, learning from Elders, and living in harmony with nature
- Understand that Alaska Native ways of knowing is a systematic method of observing nature and passing on knowledge that is time-tested and successful
- Explain how Western science can complement Alaska Native ways of knowing

Online Media Resources

The Spirit of Subsistence Living Video
Alaska Native Pilots Video
Science Fairs Are Fun
To Show What We Know (AISES science fair)
Alaska Native Profiles
La'ona DeWilde: Environmental Biologist Video
Steve MacLean: Conservationist Video
Dustin Madden: Science Teacher Video
Dolly Garza: A Tlingit and Haida Scientist Interactive
Richard Glenn: Iñupiaq Geologist Interactive
Taqulik Hepa: North Slope Natural Resources Interactive

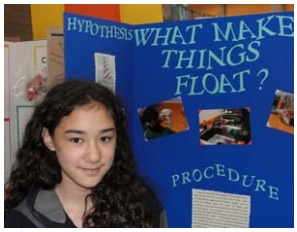
Alaska State Science Standards: Grade Level Expectations:

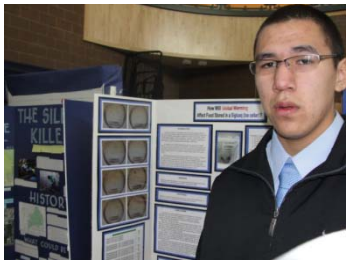
Grades 3-5: SA1.1, SA 2.1, SG1, SG 2.1, SG3, SG 4.1
Grades 6-8: SA1.2, SA 2.1, SG3.1
Grades 9-10: SG3.1, SG 4.1, SA 1.1, SA 1.2, SA 2.1, SE 1, 2, 3

For help organizing a local or regional fair, contact Wilma Osborne (wsbourne2@alaska.edu) for the Inupiat Region and Ray Barnhardt (rjbarnhardt@alaska.edu) for other locations.

Students can enter a project in the Alaska statewide Science and Engineering Fair held in Anchorage (http://www.alaskasciencefair.org/) and the COSEE Alaska "fair within a fair" to be eligible for COSEE Alaska awards and prizes. Winning an award at a local or a regional fair is not a requirement. If a student is not able to travel to Anchorage for the statewide fair, Ray Barnhardt can make arrangements for participation via Skype.

The COSEE Alaska Manual for Science Fairs, Camps, and Projects





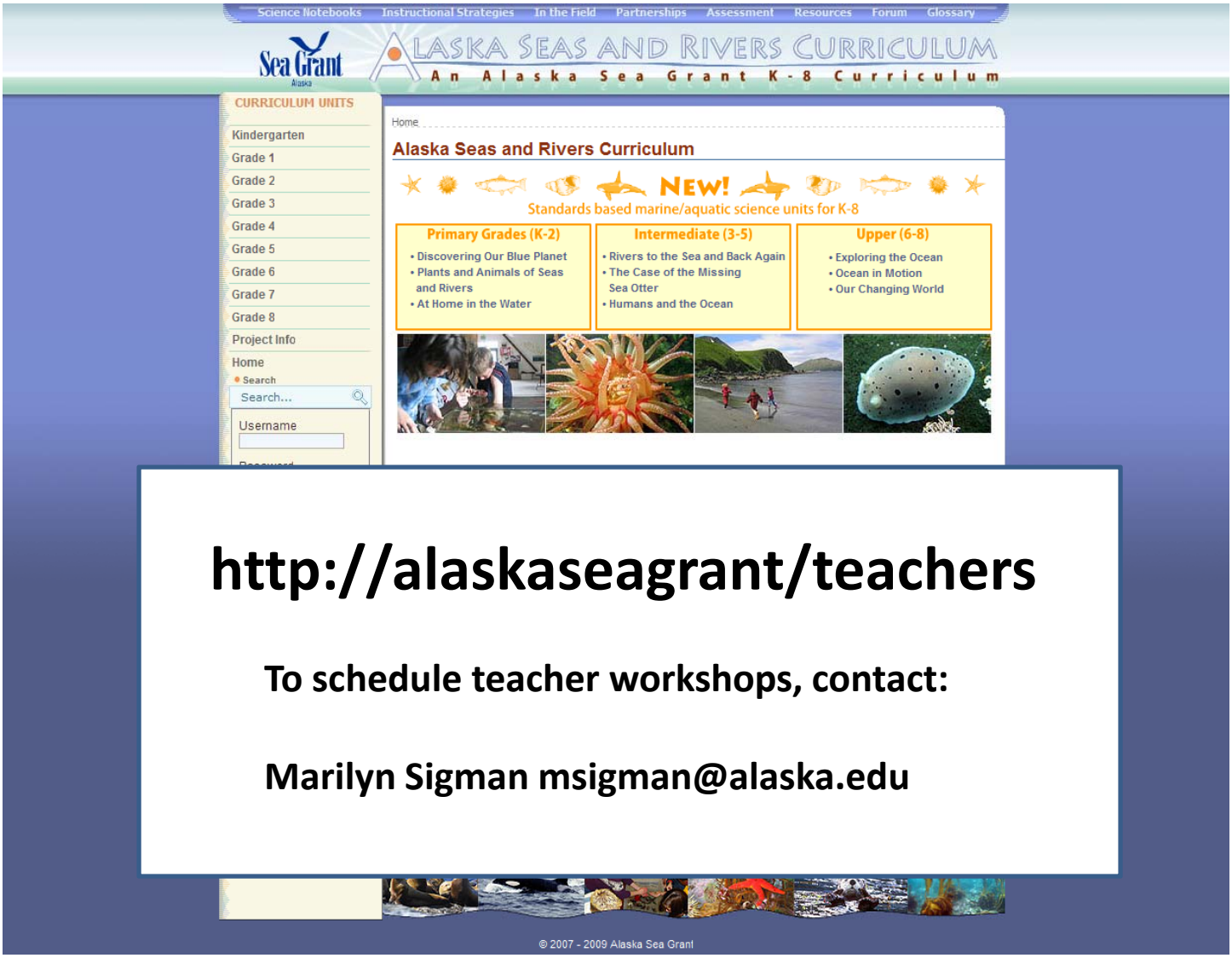
How to put on a science fair or camp
Sample forms and judging rubrics
for scientific merit and cultural/community relevance

More than 200 science fair project ideas
Related to
The ocean, rivers, watersheds,
and climate change

Download available at:
http://www.coseealaska.net/news/index.cfm?FuseAction=ShowNews&NewsID=189

Alaska's Seas and Rivers K-8 Program

These ready-to-use, online units are focused on Alaska's marine and aquatic environments. They were developed by Alaska teachers and are suitable for use by teachers and homeschoolers, as well as interpreters, youth groups, nature tour guides, and anyone seeking fascinating content on marine and aquatic science topics.



http://alaskaseagrant/teachers

To schedule teacher workshops, contact:

Marilyn Sigman msigman@alaska.edu

Kindergarten Unit *Discovering Our Blue Planet*

Essential Question:
What are the characteristics of the living and nonliving things you discover in the water?

Enduring Understandings:
Living and nonliving things in Alaska waters come in a great assortment of colors, shapes, and sizes.
Living things move, grow, and change.

Ocean Literacy Principle Addressed: The ocean supports a great diversity of life and ecosystems.

Investigation	Topic	Focus Questions
1: Backyard Water Discovery	Water – distribution on Earth, local area water, water vs. land	• Where is the water around us? • How is water different from the land? • Where is the water in our neighborhood? • Can we show where the water is around us? • What do we see when we look closely at water?
2: Sea Soup	Living things, observation	• What is in the water around us? • How do you know?
3: Living and Nonliving Things in the Water	Living vs. nonliving, characteristics of organisms	• How do we know living and nonliving things are in the water around us? • What parts of an animal make it special? • What words can you use to describe this aquatic living or nonliving thing? • How can you describe the characteristics of this living or nonliving thing? • How do we know living and nonliving things are in the water around us? • How can we show this to others? • How can we share our learning with others?
4: Field Trip Session	Observation at a field trip site, living vs. nonliving	• What can we find in the water? • What are the characteristics of living and nonliving things? • How can we discover what is in the water?
5: Sharing What We Know	Scientific process, communication of scientific info	• How do we find out information? • How can we, as scientists, naturalists, and biologists share our information? • How do we share our ideas and thinking?

Grade 1 *Plants and Animals of the Seas and Rivers*

Essential Question: What kinds of plants and animals live in or near the water?

Enduring Understandings:
Plants and animals can be sorted into groups based on different characteristics.
People use the plants and animals of the seas and rivers in different ways.

Ocean Literacy Principles Addressed:
The ocean supports a great diversity of life and ecosystems.
The ocean and humans are inextricably linked.

Investigation	Topic	Focus Questions
1: Notice the Plants and Animals	Distribution of plants and animals, observation, technology	• What plants and animals live in the environment around our school? • What plants and animals live in the environment around our school? • How do scientists and subsistence users discover aquatic plants and animals? • What do you notice?
2: Plant and Animal Characteristics	Sorting and classification	• What characteristics of shells can we notice? • How can we group shells by their properties? • What are the unique characteristics of the different groups of marine or freshwater invertebrates? • What characteristics make this animal unique? • What do we know about the characteristics of aquatic plants and animals?
3: Plant and Animal Experts	Life cycles, classification	• How do we show what we know about a plant or animal? • How can we find out more about one plant or animal? • What are the life cycles of local animals? • What different things do marine animals do at high tide and low tide? • How do we identify animals based on their characteristics?
4: Field Trip	Habitat, field trip observations	How can we find the plants and animals in our beach or river environment?
5: What Have We Learned	Communicating science	How do we share information?

Grade 2 *At Home in the Water*

Essential Question: Who Lives Where and Why?

Enduring Understandings:
Living things have certain characteristics that help them survive.
Living things need food, water, oxygen and shelter to survive.
Science is a way to help us answer questions about the world around us.

Ocean Literacy Principle Addressed: The ocean supports a great diversity of life and ecosystems.

Investigation	Topic	Focus Questions
1: Habitats	Habitat, Aquatic Habitat	• What lives where and why? • What lives in the water? • What's in the jar besides water?
2: We Search	Habitat, Aquatic Habitat	• What lives where and why? • What lives in the water?
3: Brine Shrimp, Amazing Survivors!	Habitat, Limiting Factors	• What are brine shrimp? • What conditions do they need to hatch and grow?
4: Field Session	Discovery, Communication, Animals, Local Environment, Observation, Evidence	• How do we find out information? • How can we share information? • What are the animals in our local habitat? • How do we know? • What are the signs/evidence?
5: Communication	Research Skills, Communication	• How do we find information? • How can we, as scientists, naturalists, and biologists share our information?

Kindergarten – Grade 2
Alaska Science Standards & GLEs Addressed

	Kindergarten Investigations						Grade 1 Investigations						Grade 2 Investigations				
	1	2	3	4	5		1	2	3	4	5		1	2	3	4	5
SA 1	X			X	X		X		X	X	X		X		X	X	
SA 1.1															X	X	X
SA 1.2															X	X	X
SA 2	X	X	X	X	X					X							
SA 2.1															X	X	X
SA 2.2															X		
SA 3				X						X							
SA 3.1													x	X	X	X	
SA 3.2															x		
SB 1	X																
SB 2														X		X	X
SB 3																	
SB 3.1													X	X	X		
SC 2		X	X	X			X	X	X	X	X		X				
SC 1.1																	
SC 1.2															X		
SC 2.1																X	
SC2.2														X	X		
SC 3	X	X	X	X						X						X	
SC 3.1																	X
SC 3.2															X		
SD 1													X	X		X	X
SD 1.2													X	X			
SD 2													X				
SD 2.1													X	X	X		
SE 1.1															X		
SG 2							X										
SG 3	X			X			X		X	X							
SG 4							X	X									
SG 4.1													X	X	X		

GRADE *3 Rivers to the Sea & Back Again*

Essential Questions:
How are we connected to wetlands, rivers and the sea?
What is the salmon's life journey through the wetlands, rivers and the sea?
Where does our local water come from and where does it go?

Enduring Understandings:
Watersheds, rivers, wetlands, and the one big ocean of the world are an interconnected system.
Salmon depend on the rivers and the ocean during parts of their life cycle.
Science is a way to answer questions about the world around us.

Ocean Literacy Principles Addressed:
The Earth has one big ocean with many features.
The ocean is a major influence on weather and climate.
The ocean supports a great diversity of life and ecosystems.

Investigation	Topics	Focus Questions
1: Where Does My Water Come From?	Water Cycle, Watershed	• Where does our local water come from and where does it go? • What is a watershed? • Where does your drinking water come from? How do you know?
2: Where Does Our Water Go? 2A: Water Cycle Simulation Activity 2B: Dirty Water/ Clean Water	Water Cycle	• How does water move through the water cycle? • Why don't we run out of water? • Where does the water go after we have used it?
3: A Salmon's Life Journey	Salmon Life Cycle, Salmon Habitat, Watershed	• What is the salmon's life journey through the wetlands, rivers, and the sea? • What are the salmon life cycle stages and where does each take place within the watershed?
4: Fish Finders: Could Salmon Live Here?	Salmon in the Food Web, Limiting Factors, Habitat, Local Environment	• What do salmon need to survive during their various life stages? • How can we find out if salmon could live in a local water body? • How does our local water body fit in the watershed?
5: Make Your Own Watershed	Salmon Life Cycle, Watershed, Habitat	• What are the components of a watershed that can support salmon?

Alaska State Science Standards and Grade Level Expectations:

http://www.eed.state.us/standards/pdf/standards.pdf

GRADE 4 *Case of the Missing Sea Otter*

Essential Question: In what ways are organisms in aquatic environments connected to each other?

Enduring Understandings:
Organisms in aquatic habitats interact with and depend on one another in various ways.
An ecosystem is a community of living things with its physical environment, functioning as a unit.
Science is a way to help us study the many connections in our world.

Ocean Literacy Principles Addressed:
The ocean supports a great diversity of life and ecosystems.
The ocean and humans are inextricably interconnected.

Investigation	Topics	Focus Questions
1: The Missing Sea Otters	Ecosystem, Interrelationships	• What is an ecosystem? • How are things in an ecosystem connected?
2: How Do Scientists Learn about Ecosystems?	Ecosystem Research	• How do scientists learn about ecosystems?
3: Intercon-nections	Food Chain, Food Web, Predator-Prey Relationships, Keystone Species	• How do organisms in an ecosystem depend on and interact with each other? • What happened to the sea otters?
4: Our Nearby Ecosystem	Local Environment, Aquatic Ecosystem	• What are the elements of our local aquatic ecosystem?

GRADE 5 *Humans and the Ocean*

Essential Questions:
How do people interact with the ocean?
What can we do to take care of the ocean?

Enduring Understandings:
Connections between humans and the ocean are important.
Everyone is responsible for caring for the ocean.
Science is a way to help us study the many connections in our world.

Ocean Literacy Principles Addressed:
The Earth has one big ocean with many features.
The ocean supports a great diversity of life and ecosystems.
The ocean and humans are inextricably interconnected.

Investigation	Topics	Focus Questions
1: The Legend of the Bidarki	Ecosystem, Human Uses of the Sea	• How are people who harvest marine life such as bidarkis part of an inter-connected system?
2: Fishing for the Future	Uses of Technology, Fishing, Sustainable Natural Resource Use	• How does technology change our success in fishing? • How can we use resources in ways that are sustainable?
3: Ocean Impacts	Stewardship	• What are some ways that humans can have an impact on marine life in the ocean? • How can we be stewards of the ocean?
4: Human Impact Survey	Human Impacts and Health of Local Marine and Aquatic Environments	• How do human actions change the (name of area or water body)? Are these changes helpful or harmful? • What actions or changes are needed to improve the health of the (name of area or water body)?
5: Friends of the Sea	Stewardship, Action Projects	• How can we be stewards of the ocean?

Grades 3-5 Alaska Science Standards & GLEs Addressed

		Grade 3 Investigations							Grade 4 Investigations					Grade 5 Investigations				
		1	2 A	2 B	3	4	5		1	2	3	4		1	2	3	4	5
SA 1.1		X		X	X	X	X			X	X	X					X	
SA 1.2		X		X	X	X	X			X	X	X					X	
SA 2.1		X		X	X	X	X			X	X	X				X		
SA 3.1			X		X	X	X		X			X		X				
SB 3.1				X		X												
SC 1.1					X	X	X											
SC 2.1					X													
SC 2.2					X	X	X		X									
SC 3.1					X	X	X		X		X	X						
SC 3.2					X				X			X						
SD 1.2		X	X															
SD 2.1		X	X	X	X	X	X											
SE 1.1			X	X										X		X	X	X
SE 2.1										X				X	X	X	X	X
SE 2.2											X			X			X	
SE 3.1															X		X	X
SG 2.1						X				X	X	X						
SG 4.1		X	X	X	X	X	X			X	X	X						

Alaska State Science Standards and Grade Level Expectations:
http://www.eed.state.us/standards/pdf/standards.pdf

Grade 6 *Exploring the Ocean*

Essential Questions:
How can technology help us explore the ocean?
Why do we want to explore the ocean?

Enduring Understandings:
The ocean is largely unexplored.
Humans must use ingenious ways to study the ocean.
Exploration leads to discovery.
Science and technology can be used to detect and solve problems.

Ocean Literacy Principles Addressed:
The Earth has one big ocean with many features.
The ocean makes Earth habitable.
The ocean supports a great diversity of life and ecosystems.
The ocean is largely unexplored.
The ocean and humans are inextricably interconnected.

Investigation	Topics	Focus Questions
1.**The Excitement of Exploration**	Exploration of the Ocean History of Ocean Alaska Ocean Research	• Why do people explore? • Why is the ocean relatively unexplored? • What are some contributions of past and present ocean explorers?
2. **Canyons in the Sea**	Technology Habitats & Ecosystems Current Alaskan Ocean Research; Exploring the Deep Sea Canyons of the Bering Sea	• How do scientists explore the deep sea? • What types of deep sea organisms are found in Alaska's Pribilof and Zhemchug canyons? • What are some of the decisions that scientists must make when deciding how to investigate an unexplored area of the deep ocean?
3. **Mountains in the Sea**	Bathymetry Ocean Science Technology Seamounts	• Why is it important to map the sea floor? • What are some ways that are used to map the sea floor? • How are sea floor features like seamounts formed?
4. **Searching for Sounds in the Sea**	Sound Waves & Sonar Technology Animal Communications Current Alaska Research - Whales	• How does sound travel underwater? • How do scientists record and analyze underwater sounds? • What can scientists learn about whales by listening to their sounds in the sea?
5. **Field Trip - Exploring Our Local Waters**	Scientific Sampling Methods Identifying Organisms Collecting & Analyzing Data	• How can we use scientific methods to explore our local water body or aquatic environment?
6. **Discovering Under-water Wonders of the World**	Environmental Issues Problem-solving Stewardship	• What can you discover about the underwater world?

GRADE 7 *Ocean in Motion*

Essential Questions:
What are the patterns of physical changes in aquatic environments?
How do they affect us?
What are the major weather and ocean circulation systems in Alaska?

Enduring Understandings:
Physical changes in the aquatic environment occur on a daily, seasonal, and long-term basis.
Weather systems and ocean systems have major influences on one another and the dynamics of matter and energy.
Science and technology can be used to detect and solve problems.

Ocean Literacy Principles Addressed:
The earth has one big ocean with many features.
The ocean is a major influence on weather and climate.

Investigation	Topics	Focus Questions
1.Where Did the Rubber Bath Toys Go?	Surface Currents	How did rubber bath toys lost overboard in the Pacific travel to beaches many miles away?
2. Weather and Circulation Systems	Surface Currents Interactions of Atmosphere & Ocean Weather	What causes surface ocean currents?
3. Waves and Tides	Waves Tides	What is a wave in the water?
4.Temperature and Salinity Effects on Deep Ocean Currents	Water Temperature Salinity Density Ocean Circulation	How do the densities of fluids vary, and how does that affect their behavior?
5. Seafloor Topography	Seafloor Features Ocean Currents	How does seafloor topography affect ocean current flow?
6. Debris Detectives Field Trip	Currents Monitoring/Measurement Clean-ups – Beaches & Streams Stewardship	How can we observe and measure movements in a local water body?
7. Global Conveyor Belt	Global Thermohaline Circulation Deep Currents Stewardship	How do all of the pieces of the "ocean motion puzzle" fit together?

GRADE 8 *Our Changing World*

Essential Questions:
How do changes in physical environment affect our ecosystems?
What impacts will a warming climate have on Alaska seas and rivers?

Enduring Understandings:
Climate patterns cause physical changes in the environment.
Physical changes in the environment can change the conditions for life.
Science and technology can be used to detect and solve problems.

Ocean Literacy Principles Addressed:
The Earth has one big ocean with many features.
The ocean supports a great diversity of life and ecosystems.
The ocean and humans are inextricably interconnected.

Investigation	Topics	Focus Questions
1. Ch-Ch-Ch-Changes	Warming Climate Sea Ice Dynamics Sea Ice Research Sea Level	• How is sea ice changing over time? • How do scientists determine and communicate the patterns of change in the extent of Arctic sea ice? • What effect will a warming climate and melting sea ice have on sea level?
2. Impacts of Change in Glacier Ice	Warming Climate Glacial Ice Dynamics Sea Ice Dynamics Sea Level Change Erosion Habitat Impacts & Research	• What changes occur in a landscape when a glacier melts and recedes? • Does melting glacial ice cause a change in sea level? • Will changes in sea ice or glacial ice cause the most change in sea level? • How do melting glaciers affect stream flows, erosion, and habitats for fish and wildlife?
3. Bering Sea Expedition	Warming Climate Physical Habitat Changes Food Web Changes Impacts on People Research & Technology	• How does a warming climate cause physical changes in the Bering Sea that will affect the conditions for life for a variety of species? • How can scientists use technology to detect alterations in food webs? • Why are these changes important to people?
4. Changes in Our Local Environment	Local Environmental Change Local and Traditional Environmental Knowledge Impacts on People	• What changes in our local environment have taken place over the last 50 years? • What are the major changes occurring in our local environment? • How do physical changes affect our local environment?
5. Explaining Impacts of a Warming Climate	Warming Climate Community Impacts	• How can we help others learn about the potential effects of a warming climate on our community, in the Bering Sea and/or in the Arctic?

Grades 6-8 Alaska Science Standards & GLEs Addressed

	Grade 6 Investigation(s)						Grade 7 Investigations							Grade 8 Investigations				
	1	2	3	4	5	6	1	2	3	4	5	6	7	1	2	3	4	5
SA 1.1	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X
SA 1.2		X	X	X	X					X	X	X		X	X		X	
SA 2.1				X							X			X				
SB 2.1															X			
SB 3.1															X			
SC 3.1																X		
SD 2.1			X											X				
SE 2.1		X									X	X						
SE 2.2		X	X					X			X	X		X	X			
SE 3.1			X											X		X		
SF 1.1 – 3.1																	X	
SG 3.1														X				

Alaska State Science Standards and Grade Level Expectations:
http://www.eed.state.us/standards/pdf/standards.pdf

More Teaching Resources are available
about these topics and ocean climate change
at http://www.coseealaska.org.

Join the SEANET listserve to learn about new postings and networking opportunities.
Contact Marilyn Sigman msigman@alaska.edu