

MELTDOWN Teacher Guide

Grade Level: 5th-8th

Time needed: 8 one-hour class periods

Nutshell: Students will gain experience using the scientific method while learning about an actual research project studying the building blocks of the Bering Sea food web.

Objectives:

After completing this virtual field trip students will be able to:

- Describe how changes in Arctic sea ice may impact the marine food web.
- Explain the importance of establishing a baseline when conducting scientific research.
- Identify the steps in the scientific method.

Background for teachers:

At the Northern fringe of the Pacific Ocean, along the United States' most remote boundary, lays the Bering Sea. Covering an area more than three times the size of Texas (nearly 900,000 sq. mi.), and supporting some of the most valuable fisheries in the world, the Bering Sea's remote waters have attracted explorers for thousands of years. Now your students can join in the process of discovery as they accompany modern day explorers onto the ice!

In this virtual field trip students will meet Dr. Rolf Gradinger, a Sea Ice Biologist conducting research in the Bering Sea. They follow his research team into the field as they work to answer the question 'What does sea ice mean to the Bering Sea ecosystem?' and 'What would it mean if sea ice were to disappear as a result of climate change?'

Their quest for answers leads the researchers to look under the ice where they'll investigate the role of sea ice algae (tiny marine plants that grow on the bottom surface of sea ice during the spring) in the spring Bering Sea food web.

As your class navigates through this field trip they'll be introduced to process of science, from initial questions, through development of hypotheses, data collection and finally analysis. Watch as an unfamiliar world unfolds, revealing a complex spring food web all stemming from the sea ice algae.

The research of Drs. Rolf Gradinger, Katrin Iken and Bodil Bluhm inspired this virtual field trip. Join us as we explore how climate change may impact one of the world's most productive marine ecosystems, the Bering Sea.



Lesson Outline:

To use this virtual field trip you will need:

- Internet access, video-streaming capabilities
- Access to **Meltdown** the virtual field trip (available on the Education Page of alaskasealife.org)
- Projection system (with audio) to display VFT content or computer lab if preferred.

Or request a copy of all materials on CD by emailing: education@alaskasealife.org

Teachers may choose to have the class navigate through Meltdown as one large group, using a projection system to display content, or have students work independently in a computer lab setting. All activities included in the curriculum supplements work best in a classroom setting with tables arranged into small groups.

Curriculum supplements include complete directions and materials for classroom activities to accompany each section. They are available as pdfs in the right-hand column of the FOR TEACHERS section of the VFT.

Activities are designed to meet AK State & National Content Standards.

Day One & Two:

VFT sections to complete: Introduction and Meet the Scientists (30 minutes)

Focus Questions:

Why is the Bering Sea ecosystem important?

How is the Bering Sea ecosystem changing as a result of changing climate?

Activities:

How Does the Ocean Impact you? (20 minutes)

Plotting Sea Ice Data (45 minutes)

Overview: Students are introduced to this virtual field trip with an introduction to the Bering Sea region. After learning about the important role the Bering Sea plays in our national economy, and in the lives of people across our nation, students learn that the Bering Sea ecosystem is changing as a result of changing global climate. In this section students meet Dr. Rolf Gradinger, a Sea Ice Biologist whose research they'll be following throughout this VFT. In the **How Does the Ocean Impact You?** activity students begin to establish a connection with the Bering Sea, using NOAA's State of the Coast interactive to compare the Bering Sea to their local region. In the second activity, **Plotting Sea Ice Data**, students



use real Arctic ice extent data from the National Snow and Ice Data Center to quantify how the annual minimum ice extent has changed over the recent decades.

AK Science Content Standards Addressed:

5th Grade: SA1.1

6th Grade: SA1.1

7th Grade: SA1.1

8th Grade: SA1.1

Day Three:

VFT section to complete: Background (30 minutes)

Focus Questions:

What physical properties make sea ice different than fresh water ice?

How does sea ice extent change throughout the year?

How do scientists describe different habitats in the ocean?

Activity:

A Closer Look at Sea Ice (30 minutes)

Overview: In the background section students learn about the science of sea ice. They'll look at how its physical properties make it different than fresh water ice before examining how sea ice changes seasonally throughout the year. Next they'll explore the zones of the ocean, learning about what living conditions in the Bering Sea are like from the ice surface to the sea floor. The ***A Closer Look at Sea Ice*** activity included for use with this section helps strengthen students' foundational understanding of the properties of sea ice. In this hands-on lab activity students will observe differences in the structure of melting freshwater and sea ice.

AK Science Content Standards Addressed:

5th Grade: SA1.1

6th Grade: SA1.1, SB3.1

7th Grade: SA1.1, SB1.1

8th Grade: SA1.1, SB1.1

Day Four:

VFT section to complete: Questions (15 minutes)

Focus Questions:

How do scientists come up with a research question?



What techniques are useful when trying to identify an unknown species?

Activities:

Using a Dichotomous Key (30 minutes)

Overview: In this section of Meltdown Dr. Katrin Iken explains what questions spurred the team’s research project studying the Bering Sea food web. Students are introduced to the relative newness of Arctic research, and begin to get a feel for the challenges of planning research in a cold northern climate. In the activity partnered with this section, students practice using dichotomous keys to identify invertebrates. This activity is intended to give students exposure to the types of animals present in the subarctic marine environment. Two versions of the key are included in the curriculum supplement; one for younger students includes images with the key, while the other for more experienced students is text only.

AK Science Content Standards Addressed:

5th Grade: SA1.1, SC2.1

6th Grade: SA1.1, SC2.1

7th Grade: SA1.1

8th Grade: SA1.1, SC2.1

Day Five & Six:

VFT section to complete: The Plan (30 minutes)

Focus Questions:

What challenges must scientists anticipate when conducting research in remote environments?

Activities:

Get to Know an Invert (2 hours)

Overview: In the Plan section of Meltdown students learn about the tools the research team uses to collect data. Students will observe that working on an ice covered ocean comes with unique challenges- researchers must cut through the ice just to access their study area. In the *Get to Know an Invert* activity students take a closer look at the invertebrates researchers are identifying in their samples. Students will conduct research to learn about the life history and classification of their species before completing a creative project to educate class mates.

AK Science Content Standards Addressed:

5th Grade: SA1.1, SA2.1

6th Grade: SA1.1, SA2.1,

7th Grade: SA1.1, SA2.1, SC2.2

8th Grade: SA1.1, SC2.1



Days Seven:

VFT section to complete: Action! (15 minutes)

Focus Questions:

What is it like to work as a research scientist in remote Alaska?

Why is sea ice algae an important part of the Bering Sea food web?

Activities:

Putting it All Together (30 minutes)

Overview: In the Action! section of the virtual field trip students get a chance to imagine life on the USCGC Healy as they take a sneak peek into a day in the life of a scientist. Martin Schuster, one of the research technicians on the sea ice projects describes his experience on the research vessel, highlighting daily duties associated with his position. In the *Putting It All Together* activity, students work in groups discussing what they've learned about marine invertebrates. Together, groups compile their information to build a concept web connecting species to form basic food chains.

AK Science Content Standards Addressed:

5th Grade: SA1.1, SC3.2

6th Grade: SA1.1, SC3.2, SE2.2

7th Grade: SA1.1, SC3.2, SE.2.2

8th Grade: SA1.1, SE.2.2

Days Eight:

VFT sections to complete: Results & Updates (30 minutes)

Focus Questions:

What techniques can scientists use to studying animal diets?

How can understanding the health of one species population help us predict the health of other species in an ecosystem?

Activities:

Building a Food Web Mobile (1.5 hours)

Overview: The Results section of the VFT highlights the methods used by the research team to determine how sea ice algae fit into the spring food web. The video in this section gives students a basic



understanding of the process of stable isotope analysis, explaining that this technique allows scientists to figure out how species are connected when use of other techniques is not possible (example: watching the species eat, looking at stomach contents). In this section students have a chance to see how different species are connected to sea ice algae, including whales, walrus and Polar bears. In the final activity included with this curriculum, students have the opportunity to demonstrate what they've learned, by constructing a food web mobile. Students will visually connect the invertebrate they studied to algae, fish, birds and mammals. Completed mobiles can be hung around the classroom to illustrate the intricacies of a marine food web.

AK Science Content Standards Addressed:

5th Grade: SA1.1, SC3.2

6th Grade: SA1.1, SC3.2, SE2.2

7th Grade: SA1.1, SC3.2, SE.2.2

8th Grade: SA1.1, SC3.1, SE.2.2

Specials Notes to Teachers:

Using Curriculum Supplements

We encourage teachers to read through all Curriculum Supplements before beginning Meltdown with your students. Some projects, like the invertebrate research project, will be completed over the course of several sections.

Videos and PDFs

Many sections of Meltdown include embedded videos and weblinks. All weblinks require internet access. In the CD version of the virtual field trip, all videos will play without internet, unless noted. In the online version of Meltdown, all videos will stream from YouTube. Each video is less than 3 minutes long (exact durations can be found in the description of each video). Video transcripts are available for each video and can be accessed by clicking the 'Video Transcript' button below each clip.

Vocabulary

Important vocabulary terms are included in the VOCABULARY box in the lower right-hand corner of each section. A complete glossary of terms is included as a .pdf in the FOR TEACHERS section.

Age appropriateness

This virtual field trip is designed to meet Alaska state and National science content for students in grades 5-8. We understand that students in grades 5-8 may display a variety of skill sets and reading levels, therefore this grade distinction is designed only as a guideline. The scientific process discussed in this virtual field trip is appropriate for and may be enjoyed by older students as well. Older students may progress through this virtual field trip at a faster rate than that outlined above.

