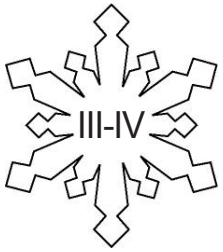
Observing Sea Ice

Levels



Grades 5-8

Overview:

Students use the Student Network for Observing Weather to list and define the different types of sea ice, and then identify the types of sea ice in Alaskan art. Completion of the "Identifying Sea Ice" lesson is recommended before beginning this lesson. "Identifying Sea Ice" can be accessed from the ACMP website.

Objectives:

The student will:

- use the Student Network for Observing Weather to list each type of sea ice; and
- identify types of sea ice in images of Alaskan art.

GLEs Addressed:

Science

- [5] SA1.2 The student demonstrates an understanding of the processes of science by using quantitative and qualitative observations to create inferences and predictions.
- [5] SB3.1 The student demonstrates an understanding of the interactions between matter and energy and the effects of these interactions on systems by identifying physical and chemical changes based on observable characteristics (e.g., tearing paper vs. burning paper).

Whole Picture:

The water in all the world's oceans is constantly in motion. Ocean currents carry water around the globe, intermingling Atlantic and Pacific, Indian and Mediterranean, and all the great bodies of water. This circulation drives the "Great Ocean Conveyer," also known as the thermohaline circulation, which is powered by heat ("thermo"), and saltiness ("haline," which is similar to a name for table salt, "halite.") The Great Ocean Conveyer works like a giant conveyer belt, carrying tremendous amounts of cold, salty water from the North Atlantic to the Northern Pacific. That water is replaced by fresher, warmer water. The Great Ocean Conveyer is important because it affects the weather all over the world; cold waters offshore of an area like Europe will cool the continent, for example. Scientists have found that melting glaciers are introducing more fresh water into the world's oceans, which might slow down the global thermohaline circulation.

Materials:

- Computer with Internet access
- OVERHEAD: "Sea Ice Images"
- Canadian Ice Service. (2005). *Manual of Standard Procedures for Observing and Reporting Ice Conditions*. Ottawa, Ontario: Canadian Ice Service – Environment Canada.
- STUDENT WORKSHEET: "Observing Sea Ice"

Activity Procedure:

1. Distribute the STUDENT WORKSHEET: "Observing Sea Ice" and lead students through Part I of the worksheet by doing the following:

   a. Direct students to the Student Network for Observing Weather on the ACMP website at http://www.arcticclimatemodeling.org/son/index.html.

b. Instruct students to click on “ENTER Data.”

c. Instruct students to click on “Guest.”

d. Instruct students to click and hold on the red arrow facing North in the Sea Ice section of the page until “None: no sea ice” is displayed.

e. Explain that students should press and hold to scroll through each type of sea ice and list each type of sea ice on their worksheets under Part I in the “Type of Ice” column.

f. Once students have completed the first column, they should use chapter one of the *Manual of Standard Procedures for Observing and Reporting Ice Conditions* to define each stage (or type) of sea ice development and write the definition in the middle column of the worksheet.

g. Finally, students should complete the last column by listing one thing for each type of sea ice that will help the student to identify it later.

2. Once students have completed Part I of their worksheets, display the OVERHEAD: “Sea Ice Images” and direct students to Part II of their worksheets. For each image displayed, discuss what type of ice is depicted and how to determine the type of ice. Instruct students to identify the type of ice on their worksheets.

Critical Thinking Activity: ***Activity Response Method:*** Ask students to write a paragraph describing their response to the activity. They can begin their response with “I was surprised to learn…” or “I learned that…” or “I wonder if…”

Extension Idea: Allow students to create ice art, in groups or individually. Fill shallow baking trays (9 inches x 9 inches or smaller) with colored water in various colors and freeze overnight. Remove ice and place in gallon-size re-sealable plastic bags. Keep in freezer or coolers until class. Provide each student or group of students with an empty shallow baking tray (the trays used to freeze the ice can be reused). Ask students to label their trays with their name. Divide the class into groups and provide each group with a different color of ice, or place all ice in a central location. Direct students to break the ice into different size shapes and pieces. Instruct students to make an ice painting in their tray by placing different size, shapes, and colors of ice in their tray. The thickness of the ice should prevent it from melting right away, but students must work quickly. When done, fill the trays of ice with very cold water and freeze. When completely frozen, take photographs of ice art to share. (Art A1, A3)

Answers:

Part I

1. a. New ice
   b. Recently formed ice which includes frazil ice, grease ice, slush and shuga. These types of ice are composed of ice crystals which are only weakly frozen together (if at all) and have a definite form only while they are afloat.
   c. Fine plates of ice, spongy white ice lumps, matte appearance on water

2. a. Nilas; Ice rind
   b. Nilas is a thin elastic crust of ice, easily bending on waves and swell under pressure, growing in a pattern of interlocking “fingers.” Ice Rind is a brittle, shiny crust of ice formed on a quiet surface by direct freezing or from grease ice, usually in water of low salinity.
   c. Matte surface, finger rafting, rectangular pieces

3. a. Young ice
   b. Ice in the transition stage between nilas and first-year ice, 10-30 centimeters in thickness.
   c. Rafts, ridges

4. a. Grey ice
   b. Young ice that is 10-15 centimeters thick; less elastic than nilas and breaks on swell,

usually rafts under pressure
c. Rafts under pressure

5. a. Grey-white ice
   b. Young ice that is 15-30 centimeters thick; more likely to ridge than raft under pressure.
   c. Ridges under pressure
6. a. First-year ice
   b. Sea ice of not more than one winter's growth, developing from young ice; 30 centimeters or greater.
   c. Can be rough
7. a. Thin first-year ice
   b. First-year ice that is 30-50 centimeters thick.
   c. NA
8. a. Thin First-year ice, first stage
   b. First-year ice that is 50-70 centimeters thick.
   c. NA
9. a. Thin first-year ice, second stage
   b. First-year ice that is 50-70 centimeters thick.
   c. NA
10. a. Medium first-year ice
    b. First-year ice that is 70-120 centimeters thick.
    c. NA
11. a. Thick first-year ice
    b. First-year ice that is more than 120 centimeters thick.
    c. NA
12. a. Old ice
    b. Sea ice which has survived at least one summer's melt.
    c. Topographic features generally are smoother than first-year ice.
13. a. Second-year ice
    b. Old ice which has survived only one summer's melt.
    c. Thicker than first year ice, it stands higher out of the water. Summer melting produces a regular pattern of numerous small puddles, usually greenish bluish in color.
14. a. Multi-year ice.
    b. Old ice which has survived at least two summer's melt.
    c. Hummocks are smoother than on second-year ice and the ice is almost salt-free. When bare, the ice is usually blue in color. The melt pattern consists of large, interconnecting puddles and a well developed drainage system.

Part II
1. Thick first-year ice
2. Ice Rind
3. Multi-year ice
4. Nilas
5. Second-year ice
6. New ice, pancake ice
7. First-year ice

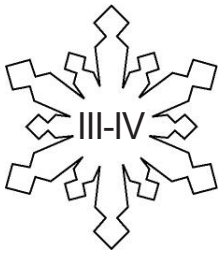
Rubric

Class Participation. Use this rubric to assess students' performance, as best fits the class, and/or allow students to assess their own performance.

Performance Measure	Self	Teacher
1. I listened carefully to the instructor and directions.		
2. I followed established rules and procedures for class behavior.		
3. I contributed relevant and thoughtful information to the class discussions.		
4. I respected the opinions of others.		
5. I provided ideas for the group to consider.		
6. I was alert and on-task.		

Name:_____

Levels



Observing Sea Ice

Student Worksheet (page 1 of 4)

Directions:

STEP 1. Go to the Student Network for Observing Weather on the ACMP website at: http://www.arcticclimatemodeling.org/son/index.html.

STEP 2. Click on “ENTER DATA.”

STEP 3. Click on “GUEST.”

STEP 4. Click and hold down the red arrow facing north in the Sea Ice section of the page until “None: no sea ice” is displayed.

STEP 5. Scroll through the different types of sea ice shown. In the chart below and on the following page, list each type of sea ice in the column labeled: “Type of Ice.”

STEP 6. Use the *Manual of Standard Procedures for Observing and Reporting Ice Conditions* to find a definition for each type of sea ice. Write the definition in the column labeled: “Definition.”

STEP 7. Complete the last column in the chart by listing one feature for each type of sea ice that will help identify it.

Part I

Type of Ice (A)	Definition (B)	Identifiable Feature (C)
1.	_____ _____	
2.	_____ _____	
3.	_____ _____	

Name:_____

Observing Sea Ice

Student Worksheet (page 2 of 4)

Part I (continued)

Type of Ice (A)	Definition (B)	Identifiable Feature (C)
4.	_____ _____	
5.	_____ _____	
6.	_____ _____	
7.	_____ _____	

Name:_____

Observing Sea Ice

Student Worksheet (page 3 of 4)

Part I (continued)

Type of Ice (A)	Definition (B)	Identifiable Feature (C)
8.	_____ _____	
9.	_____ _____	
10.	_____ _____	
11.	_____ _____	

Name:_____

Observing Sea Ice

Student Worksheet (page 4 of 4)

Part I (continued)

Type of Ice (A)	Definition (B)	Identifiable Feature (C)
12.	_____ _____	
13.	_____ _____	
14.	_____ _____	

Part II

Directions: Identify and list the type of sea ice shown in each image listed below. The instructor will show the images.

1. [Polar bear on the ice] _____
2. "Breakup" _____
3. "Ice Hummocks in Bering Sea" _____
4. "Nome city looking north" _____
5. "Freighting goods over the ice from S.S. Corwin, June 2, [19]07, 4 miles from shore, Nome Alaska" _____
6. "Pancake ice in the Bering Sea" _____
7. "Winter sea ice terrain of the Beaufort Sea" _____
8. "Pressure ridge on Alaska North Slope" _____

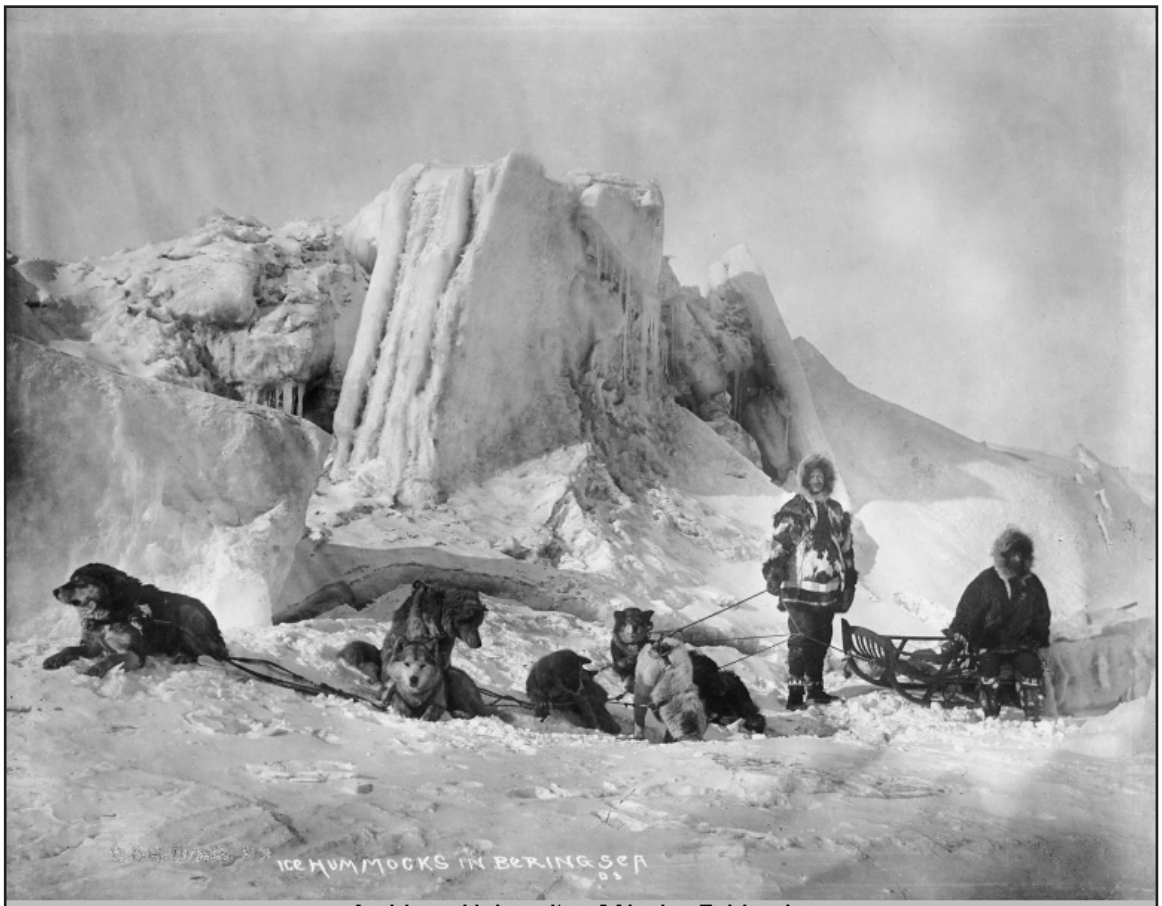
Sea Ice Images
Overhead (page 1 of 5)

1. [Polar bear on ice] http://forces.si.edu/arctic/04_00_05.html

2. “Breakup” from Alaska’s Digital Archives #UAF-1964-74-127

Sea Ice Images
Overhead (page 2 of 5)

3. “Ice Hummocks in Bering Sea” from Alaska’s Digital Archives #UAF-1989-0166-48 Print



Archives, University of Alaska, Fairbanks

Sea Ice Images
Overhead (page 3 of 5)

4. “Nome city looking north” from Alaska’s Digital Archives #AMRC--b01-41-367”

Sea Ice Images
Overhead (page 4 of 5)

5. “Freighting goods over the ice from S.S. Corwin, June 2, [19]07, 4 miles from shore, Nome Alaska”

Anchorage Museum of History & Art. Library & Archives.

Sea Ice Images
Overhead (page 5 of 5)

6. “Pancake ice in the Bering Sea” from NOAA Photo Library, photo by Commander Richard Behn, NOAA Corps

7. “Winter sea ice terrain of the Beaufort Sea” from NOAA Photo Library, photo by Rear Admiral Harley D. Nygren, NOAA Corps (ret.)

8. “Pressure ridge on Alaska North Slope” from NOAA Photo Library, photo by Rear Admiral Harley D. Nygren, NOAA Corps (ret.)