Lesson Plan

National Park Service
U.S. Department of the Interior

Kenai Fjords National Park, Alaska

Those Fabulous Fjords

OVERVIEW: Students will become fluent in the vocabulary and physical geography of fjords. They will understand where fjords occur and why.

OBJECTIVE: Students will use maps and photographs to learn where the fjords of the world are located and to reach conclusions about fjord formation and other glacial processes.

BACKGROUND: Read the Fjord Estuary Ecosystem section of this manual.

VOCABULARY: Arête, Bay, Calving, Erosion, Estuary, Fjord, Glacier, Hanging Valley, Horn, Ice Age, Salinity, Sediment, U-Shaped Valley, V-Shaped Valley

Grade Level: 6-8

Subject: Fjord biology, geology and geography, glacial processes

Keywords: Fjord, glacier, estuary, ice age, sediment

Duration: 6 sessions of 45-60 minutes

Group Size: Whole class and 8 groups

Setting: Classroom

National Standards: Science A 1, C 4, F 2-4; Geography 1-4, 7,8, 17

MATERIALS

Students will need Internet access.

The following maps are available for loan to teachers who are conducting this lesson (contact the education specialist at Kenai Fjords National Park 907-224-7500). If you would like to obtain your own maps, all of the ones listed are available through the Internet (see the Additional Resources section for places to locate maps).

- Map of Kenai Fjords National Park
- Map of Glacier Bay National Park
- Map of Scandinavia
- Map of Antarctica
- Map of New Zealand Coast
- Map of Chile Coast
- Map of Greenland Coast
- Map of the World

Photographs from the chapter on Fjords may be printed using the online version of this manual http://www.nps.gov/kefj/forteachers/index.htm. Should you have any difficulty contact the park education specialist.

Picture List for the Lesson Plan:

- Picture of a glacier at the head of a fjord.
- Picture of a fjord with no glacier.
- Picture of Aialik Bay from above, showing sediment outflow.
- Picture of waterfalls associated with glacial ice melt, flowing into saltwater
- Aerial picture of Kenai Fjords showing multiple fingers of the sea.
- Picture of a bay and a fjord showing extent, depth, width, and height of each.
- Picture of a hanging valley
- Picture of a V-shaped valley

Day 1

CLASSROOM ACTIVITY: Begin with an icebreaker activity by creating a KWL chart. Have a large piece of paper to write on and document what the students know (K), what they want to know (W), and when they've finished the lesson, what they've learned (L). To help participation ask these questions:

What is a Fjord?
Does anyone know where there is one?
What do you find there?
Can people live there? Animals? What else?

Many other questions can be asked to inspire discussion. Fill in the K and W parts of the chart and let the students know that when they are done with this unit you will all fill in the L part.

When the K and W sections are completed, read as a class, the Fjord Estuary Ecosystems section of this manual. If there is time left in class have students begin defining the vocabulary words, working in small groups to facilitate discussion. Assign unfinished vocabulary as homework.

HOMEWORK ASSIGNMENT: Find definitions for the vocabulary words in this lesson plan.

Day 2

CLASSROOM ACTIVITY: As a class, go through the vocabulary list and have students volunteer their answers.

HOMEWORK ASSIGNMENT: Using your vocabulary sheet and what you now know about fjords, write a story that takes place in a fjord. Be as creative as you like but be sure to use every vocabulary word in the story.

(Note: Let the students know they will have several days to complete this homework assignment. Ideally, if the lesson plan begins on a Monday and you assign this homework on a Tuesday, they would have until the following Monday to complete the assignment.)

Day 3

Begin the class session by breaking students up into small groups. Use the number of maps (6-8 maps, one group per map) to determine the number of groups.

Ask the groups to look at their maps for a few minutes and find the fjords on each of the maps. Have students look for the word 'fjord,' and after they get a feel for what a fjord is see if they can point them out from map to map.

Pass out the Finding Fjords Worksheet and have students complete the map portion of the assignment in class. Give the groups about 5 minutes with each map and then have all the groups move at once to the next map table.

After the groups have completed the map section of the worksheet bring the group together and go through the questions. Have groups share their answers and discuss any topics that are unclear.

This discussion should focus on the location of fjords (found in northern and southern hemispheres, found in coastal regions, found in mountainous regions, not found near equator), the features of fjords (long narrow inlets, often have islands associated with them, deep water compared to nearby bays) the climate in fjord locations can also be brought up (areas of heavy precipitation, areas that don't have extremely hot summers.)

Day 4

During the next class period have the same groups spend their time examining the available photographs (the pictures are found in the Teachers Manual and can be downloaded from http://www.nps.gov/kefj/forteachers/index.htm. Give the student groups about 5-8 minutes with each photograph. Ask them to use what they've learned about fjords so far to answer questions about the pictures.

Day 5

Spend the following day reviewing the photograph section of the worksheet. Remind students that their fjord stories are due on the next classroom day. If there is still time at the end of this day, allow them time to work on the stories.

Day 6

Collect the fjord story assignment. Review the KWL chart and determine what students have learned. Ask for volunteers to read their story to the class.

FINDING FJORDS WORKSHEET

Examine the maps in the classroom and answer the following questions.

Map Questions:

1) In what parts of the world are fjords located?

2) Is there any part of the world where fjords are not found?

3) Look at the physical features found on the maps. What water or land features are always part of the fjords?

4) By looking at the maps, can you come up with a more exact definition of a fjord?

Photograph Questions:

1) Describe what you see in the picture and how this may have affected the surrounding landscape.

2) Is this a fjord? Why or why not?

3) What is odd about the water in this picture? How do you think this happened?

4) Describe what is happening in this picture. How might this affect the land? The water?

5) What is this a picture of? Can you describe how this area was formed?

6) Describe how fjords (picture #6A) and bays (picture #6B) are different. Are there any ways in which they are similar?

7) What would you call this? (Hint: look at the vocabulary words) How was it formed? When was it formed? What letter is it shaped like?

8) Describe the difference in shape and surroundings from Picture #7.

ASSESSMENT: Review student's answers on their Finding Fjords Worksheet to create assessment. Students should have ample time to complete the work both in class with their groups and to correct the work at home between classes. Look for these points to be made:

Map Questions:

- Fjords are found in both hemispheres but tend to be near the poles.
- Fjords are not found near the equator.
- Oceans and mountains are always associated with fjords, long fingers of the sea reaching into the land. Sometimes there are still glaciers in fjords.
- A fjord is a place where there once was a glacier, when the glacier melted the sea took its place.

Photograph Questions:

- There is a glacier at the edge of the ocean. The rock around it is steep. The glacier may have had an affect on the rock. There are not many plants in the picture near the glacier.
- This could be a fjord but the glacier is gone.
- The water is oddly colored, looks like the regular ocean water on one side but its very grey/brown on the other. A river brought the dirty water into the bay.
- Waterfalls are running down a mountain side from a glacier. The water could erode the rock. The water from the ice is fresh water and it's flowing into the ocean water, which is salty.
- It's a picture of a fjord. The areas of water were once valleys carved out by glaciers. Now the glaciers are gone.
- A fjord has to be carved by a glacier. For this reason, it is deeper than a bay that is not a fjord. But a fjord can be called a bay, and a bay can't be called a fjord unless a glacier created it. Bays and fjords are similar because they are both surrounded by land on 3 sides.
- This is a 'hanging valley' carved by ice when the surrounding ice was this far up the mountain. It is also a U-shaped valley
- This is a V-shaped valley or river valley.

Grade vocabulary homework and the fjord story homework.

PARK CONNECTIONS: At the end of this activity after students have handed in their worksheets, ask the class if they can imagine why a national park might have been created here. Pass around the map of Kenai Fjords National Park to help with ideas. Try to generate some of these reasons:

- There aren't many fjords in the world and in the Kenai Fjords National Park we have great examples of them.
- Kenai Fjords National Park can teach us a lot about the past. The fjords were created by the glaciers expanding during the Ice Age.
- Kenai Fjords National Park has an icefield which is the largest icefield found completely within the U.S. boundary.
- Fjords are unique environments and home to many species of animals. By protecting Kenai Fjords National Park we protect the homes of these animals.
- Natural places provide us with laboratories to study the process of nature. Kenai Fjords National park is one of these great laboratories.

USGS photograph by Bruce Molnia

Picture 1: McCarty Glacier at the head of McCarty Fjord.

Picture 2: Thumb Cove.

USGS photograph by Bruce Molnia

USGS photograph by Bruce Molnia

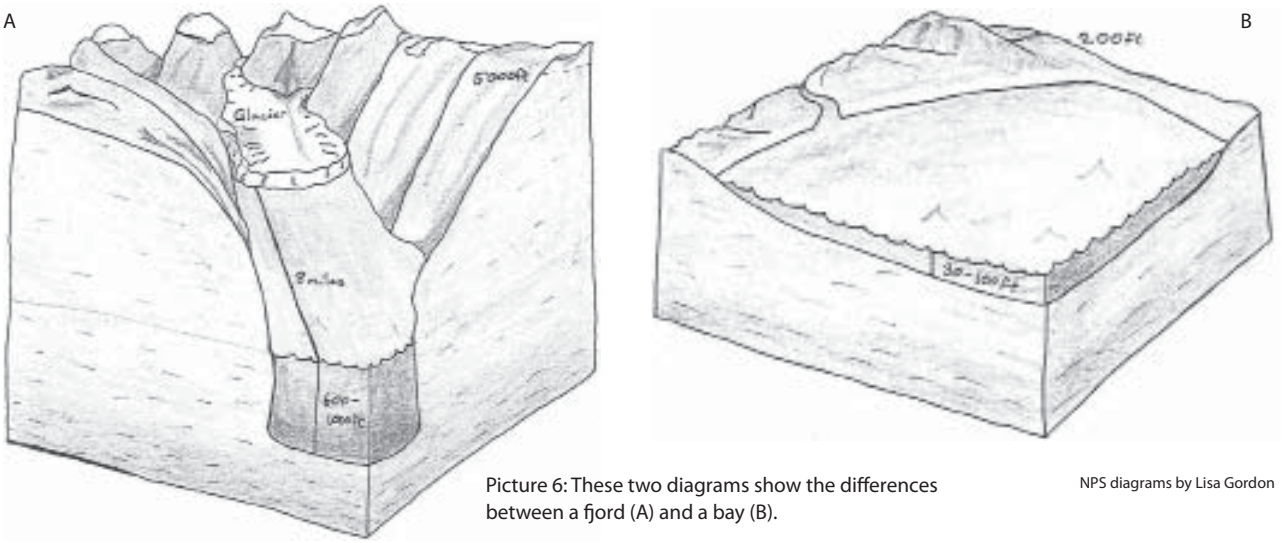
Picture 3: Aialik Glacier from above showing water discolored from sediment.

NPS photograph by CJ Rea

Picture 4: Melting glacial ice creates many waterfalls.

NPS photograph

Picture 5: This aerial image shows the Kenai Fjords coastline.



Picture 6: These two diagrams show the differences between a fjord (A) and a bay (B).

NPS diagrams by Lisa Gordon

Picture 7: Hanging valleys show where a glacier in the mountains abutted a larger glacier. As all of the ice melted, the larger glaciers became the fjords.

NPS photograph by CJ Rea

Picture 8: A river carved this V-shaped valley behind the town of Seward.

NPS photograph by CJ Rea