



**Science Unit: *Renewable & Non-renewable Resources***

**Lesson 1: *Exploring Fish Anatomy and Commercial Fishing Gear***

School Year:	2009/20010
Developed for:	Dr. R. E. McKechnie Elementary School, Vancouver School District
Developed by:	Linda Hanson (scientist); Judi Burley and Theresa Lopetrone (teachers)
Grade level:	Presented to grade 4/5; appropriate for grades 1 – 6 with age appropriate modifications
Duration of lesson:	1 hour and 20 minutes
Notes:	Fish specimens can be borrowed from the Beatty Biodiversity Museum at UBC. Scallops and other shellfish can be purchased live at many supermarkets, such as T & T Supermarket.

**Objectives**

1. Discover how commercial fishing methods are influenced by the anatomy and behaviour of fish.
2. Examine fishing gear and fishing practices and discuss their ecological and environmental implications.

**Background Information**

Commercial fishing is the harvesting of fish or shellfish for profit. This can include harvesting wild species or the rearing of aquatic species on aquaculture farms. In British Columbia over 80 species of fish, shellfish and marine plants are harvested as part of the commercial fishery and together aquaculture and commercial fishing generate revenues of >\$700 million annually.

The major gear types utilized in commercial fishing include: hooks and lines, seine nets, gill nets, dredge nets and traps. Some species are also harvested manually (i.e. by divers or by hand). The type of gear used is influenced by the behaviour, anatomy and environment of the species being sought.

**Hooks and lines** range from single rods (i.e. the same as that used by recreational fishers) to huge, automated, multi-line arrangements deployed from large fishing vessels. Hooks and lines are used to catch free swimming species from a range of depths (i.e. in upper, middle and bottom environments). Fish can be attracted to the hooks by bait or in some instances snagged by hooks as they pass by. The hook holds the fish securely until the lines are hauled onboard.

**Seine nets** can also be termed surrounding nets. They are very long nets used to encircle or surround an area or school of fish. This can be done from a boat in open water or from the shore depending on the environment and species being sought. They are most effective on species that aggregate or school and can be used at a variety of depths. One of the potential problems with using seine nets is the high potential for by-catch and catch of undersized individuals. One way to reduce this is to carefully consider both the mesh size of the net and the timing and location of deployment.

**Gill nets** are also known as entangling nets. Gill nets are usually suspended vertically in the water by means of a weighted bottom line and a floating top line. Fish swim into this wall of netting and become entangled – they usually swim into the mesh holes and become trapped by the gills, hence the name gill net. Gill nets can be used at a variety of depths depending on the target species. Careful consideration of the placement and mesh sized of the gillnet helps to ensure a highly selective fishing method. However, incidental catch of non-target species does occur (including turtles, sharks and birds).



**Dredge nets** or dredges consist of a rigid or semi-rigid frame or net. The mouth of the net is framed open and the net is then dragged across the ocean floor to harvest shellfish and molluscs. Dredges can be operated from a boat or from shore. Commercial operations frequently operate several dredges simultaneously. One of the biggest concerns regarding the use of dredges is the damage they can do to the seafloor environment and the impact they can have on non-target bottom living species.

**Traps** come in a variety of forms depending on the target species. The aim of a trap is to have the target species enter the trap voluntarily (usually enticed by bait) but then be unable to escape. The traps are left in place for a suitable length of time and then harvested. Traps are suitable for a variety of species including crabs, prawns, octopus and many species of fish. The fact that caught fish remain alive and unharmed means that non-target species can be released upon harvest. In addition, the mesh size of the trap can help avoid catching undersized individuals.

**Manual harvesting** can refer to divers harvesting target species by hand (i.e. collecting shellfish or catching octopus) or non-aquatic collection (such as digging for clams). Manual harvesting is very specific but also very labour intensive.

### Vocabulary

<u>Commercial Fishing:</u>	Harvesting of fish, shellfish and other seafood for profit. Usually refers to that done on a large scale.
<u>Mesh:</u>	The openings in fishing net.
<u>Seine net:</u>	A net that hangs vertically in the water used to surround an area or group of fish.
<u>Gill net:</u>	A net that is mounted on a frame and sits vertically in the water. Fish of the target size become entangled in the mesh.
<u>Dredge:</u>	A rigid net that is dragged along the ocean bottom.
<u>Non-target species:</u>	Species that are unintentionally harvested by a fisher while harvesting another species.
<u>Handlining:</u>	Catching individual fish by hand using a baited fishing line.

### Materials

- Labelled pictures of the 6 major fishing methods
- examples of each type of fishing gear
- fish specimens for station 1: herring, flatfish, prawn
- Fish specimens with diverse body shapes
- student worksheets
- Pack of small post-its (need 3 Post-its per student)
- seine net samples in 3 mesh sizes (2 of each)
- ocean diagram for station 2 (with fish size correlated to seine net mesh size)
- 2 scallops (for station 3)
- pencils
- 2 mini dredges (created from wire mesh or netting on a frame)
- 2 large plastic tubs or similar to create oceans (Station 3)
- gravel and sand for the ocean floor
- small coloured stones to simulate scallops
- towel (to dry hands at Station 3)

### In the Classroom

#### Introductory Discussion (Capture ideas on chalkboard or flipchart)

1. Has anyone ever gone fishing?
  - How did you catch your fish? (Likely say rod and reel) How long did it take to catch one? (slow) Do you think the fish we buy in the supermarket is caught this way? (Too inefficient)



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- How do you think commercial fishers catch fish? Record suggestions.
  - Let's look at some of the fishing gear used in the commercial fishing industry. (Show examples and discuss usage of each)
    - Hooks and Lines (handlining – i.e. rod and reel, troll boat, long lines)
    - Seine net
    - Gill net
    - Dredge
    - Traps
    - Manual harvest (digging, divers etc.)
  - Why do fishers use so many different methods to catch fish? (record ideas) Not all fish are the same – different anatomy, behaviour, habitat etc.
  - What species of fish are harvested in BC? What about shellfish? (make a list of suggestions) Show pictures and or examples (from fish museum) of as many kinds as possible. Discuss the differences in body shape, behaviour and habitat of two species as examples. Draw a diagram of the ocean showing the areas fish are likely to be found. Have the students suggest the appropriate type of gear. Lead into instructions for Station 1.
2. Briefly describe science experiment/activity.
    - The students will work in small groups (4-5) and move to three stations around the classroom.
  3. The processes of science that the students will focus on for these activities are making predications, making observations, recording their observations and using their observations to come to conclusions.
  4. Briefly describe safety guidelines.
    - Be careful with the preserved specimens. Do not lift the jars as they are heavy and might be dropped by accident.
    - Do not splash water on the desks or other students. Dry your hands when you are finished.
    - Do not touch your mouth or face while doing the activities. Wash your hands using soap at the conclusion of the activities and before eating.

### Science Activity

Activity Title: Three stations: 1) Not all Fish are Created Equal; 2) Which Net to Use? 3) The Effects of Dredging

Purpose of Activity: To learn about different types of fishing gear and discover some of the potential environmental implications associated with different types of fishing gear. Station one will also introduce students to differences in fish anatomy.

Methods and Instructions:

Brief description of how students will work in groups or pairs: Students will work in groups of 4 or 5 and travel to three different stations (Duplicates will be set up of each station).

Station 1: Not all fish are created equal.

1. Students will answer questions about the anatomy and behaviour of different fish species and predict which type of fishing gear is used to catch them.
2. They will record their observations and answers on the attached worksheet. See worksheet for detailed instructions.



## SCIENTIST IN RESIDENCE PROGRAM

3. Fish 1 will be a small pelagic fish such as an anchovy or herring. Fish 2 will be a flat fish such as a halibut, cod or ray. Fish 3 will be a shrimp or prawn.

### Station 2: Which net to use?

1. Students will examine samples of different types and sizes of fishing nets. They will answer questions and predict which net would be best in a given situation.
2. They will record their observations and answers on the attached worksheet. See worksheet for detailed instructions.
3. Nets 1-3 will be samples of seine nets with different mesh sizes. Net one will be the smallest mesh size and net 3 the largest.

### Station 3: The dredge net

1. Students will simulate using a dredge net to harvest scallops to observe the potential environmental impacts of dredging.
2. They will record their observations and answers on the attached worksheet. See worksheet for detailed instructions.
3. The scientist or teacher should briefly demonstrate the correct method of using the dredge to each group of students.
4. Each student should have a chance to try using the dredge.

### Closure Discussion

1. Go over student responses to Station 1. Use the Post-it notes to create a bar graph of student responses.
2. Discuss the pros and cons of the different methods. Ask questions to have students think about catch per unit effort, efficiency etc.
3. Go over student responses to Station 2 questions.
4. Why is mesh size important when using a seine net? Discuss by-catch.
5. Discuss seine net placement and use on schooling versus non-schooling fish.
6. Go over student observations and responses from station 3.
7. What environmental impacts might dredging have? How will dredging affect other organisms that live on or near the ocean floor?

### References

1. <<http://www.al.gov.bc.ca/fisheries/>> Ministry of Agriculture and Lands, British Columbia. Fisheries and Aquaculture. Web site hosted by Government of British Columbia. Accessed February 16, 2010.
2. <<http://www.fao.org/fishery/en>> Food and Agriculture Organization of the United Nations. Fisheries and Aquaculture. Accessed December 28, 2009.

Name: \_\_\_\_\_

### STATION 1: Not All Fish Are Created Equal

Look at the fish labeled #1

Describe its shape: \_\_\_\_\_

Where do you think you would find it in the ocean? (Circle one)

Attached to the ocean floor

Swimming or resting near the ocean floor

Swimming around in the upper or middle ocean

Which of the six main types of fishing gear could you use to catch it? Circle only the ones you would use. You can circle more than one type.

Hooks and Lines (handlining, troll boat, long lines)

Seine net

Hand harvesting (digging, or diving)

Gill net

Dredge

Traps

Which type do you think would be the best? Why?

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Record the gear type on a post-it note labeled #1 for later.

Name: \_\_\_\_\_

Look at the fish labeled #2

Describe its shape: \_\_\_\_\_

Where do you think you would find it in the ocean? (Circle one)

Attached to the ocean floor

Swimming or resting near the ocean floor

Swimming around in the upper or middle ocean

Which of the six main types of fishing gear could you use to catch it? Circle only the ones you would use. You can circle more than one type.

Hooks and Lines (handlining, troll boat, long lines)

Seine net

Hand harvesting (digging, or diving)

Gill net

Dredge

Traps

Which type do you think would be the best? Why?

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Record the gear type on a post-it note labeled #2 for later.

Name: \_\_\_\_\_

Look at the fish labeled #3

Describe its shape: \_\_\_\_\_

Where do you think you would find it in the ocean? (Circle one)

Attached to the ocean floor

Swimming or resting near the ocean floor

Swimming around in the upper or middle ocean

Which of the six main types of fishing gear could you use to catch it? Circle only the ones you would use. You can circle more than one type.

Hooks and Lines (handlining, troll boat, long lines)

Seine net

Hand harvesting (digging, or diving)

Gill net

Dredge

Traps

Which type do you think would be the best? Why?

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Record the gear type on a post-it note labeled #3 for later.

Name: \_\_\_\_\_

### Station 2: Which Net to Use?

Compare the three seine net samples. How are they different?

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Pretend you are a commercial fisher and are fishing in an area that contains anchovy, smelt, perch and salmon.

Which fish could you catch with net #1? (small mesh)

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Which fish could you catch with net #2? (medium mesh)

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Which fish could you catch with net #3? (large mesh)

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Which net would be the best to catch salmon? Why?

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How could you catch only smelt? Any ideas? (hint some fish swim in schools)

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Name: \_\_\_\_\_

### Station 3: Dredging

For this activity you are going to pretend to be a scallop fisher. Scallops are a type of shellfish that live mainly on the ocean floor. One way of harvesting scallops is with a dredge, another way is for divers to collect them by hand.

Each person will take a turn using the dredge. Only make one pass across the ocean floor each.

Describe what happened when you used the dredge? What happened to the ocean floor? The water?

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What problems might dredging cause for the environment? For non-target species? Would divers cause the same problems?

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Why do you think all scallops are not harvested by divers?

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