Boom and Bust
SMILE Winter Teachers' Workshop
February 3-4, 2006

Boom and Bust

Adapted from the NOAA Ocean Explorer activity of the same name the original can be accessed at http://oceanexplorer.noaa.gov
Orange Roughy (*Hoplosththus atlanticus*) fact information from the Monterey Bay Aquarium Seafood Watch Program
http://www.mbayaq.org/cr/SeafoodWatch/web/sfw_factsheet.aspx?fid=54

Background:

Most deep-water fish are not considered worth eating by humans. The flesh of deep-water fish is usually low in protein and has higher water content than fish that live in shallower waters. Orange Roughy (*Hoplosththus atlanticus*) is a deep-water fish that is an exception. In the 1980's fishermen discovered large populations of orange roughy, and found the flesh of orange roughy is firm and tasty with a high content of protein and lipids. Not only are orange roughy good to eat, they were found in large groups around seamounts (under sea mountains) around Australia and New Zealand, making them easy to catch. Orange roughy has become popular in North American seafood markets. Scientists who have studied orange roughy think that they can survive in such large populations around seamounts because seamounts change the local circulation pattern, which concentrates nutrients and food organisms (refer to the stream table activity).

According to research, fish populations that live in large groups are very susceptible to over-harvesting that can cause "boom and bust" cycles in the population. In "boom and bust" cycles fish are abundant when they are first discovered and then quickly decline to very low levels.

In order to preserve species like orange roughy fisheries managers need to be able to recognize the signs of over fishing before the fish population goes into rapid decline.

Procedure:

This activity pairs nicely with the activity on how underwater seamounts alter currents.

Give out copies of "Orange Roughy Landings Data" and graph paper.

Discuss with club members different ways to analyze the data.

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Have club members graph the first two columns of the data. Put total landings on the y-axis and year on the x-axis. On the same graph add in the number of full-time fishing boats. You might want to use two different y-axes.

What does this graph show about orange roughy landings? Assuming there was no natural disaster, over fishing is the only possible cause of this dramatic result.

These raw data graphs show the increase and decline of orange roughy landings, but the goal is to stop over fishing before the fish population crashes. Another variable needs to be examined.

One way to predict a crash in a fish population is to determine the catch per unit effort (CPUE). CPUE is a way to determine how much work (measured by number of fishing vessels) is needed to catch fish (measured in tons caught). By looking at the weight of fish caught instead of the number of fish caught fisheries managers can correct for the phenomenon that as the population gets smaller in number more and more little fish are caught. Discuss why this would be a good thing to measure.

CPUE = tons of fish caught / number of boats fishing

Plot CPUE either on the original graph or on a new graph.

What does this graph indicate? Does this give a better indication of early signs of over fishing? Check out the CPUE and number of tons of fish caught from 1985 and 1994.

If you were fisheries managers working in the orange roughy industry in the 1980's what steps would you have taken to try to prevent the population crash in the late 1990's?

<u>Common fisheries management tools</u>

- setting a minimum size limit (to allow fish to grow large enough to reproduce)
- restricting fishing to certain seasons (to allow fish to successfully spawn and reproduce)
- limiting the number of fishing boats (limited entry)
- setting aside areas where fishing boats are not allowed (protected area, or sanctuary)
- complete closure of the fishery (banning fishing for a period of time)

What are other possible reasons for fish populations to rapidly decline? Habitat destruction is another major cause for fish populations to crash.

Over fishing is a problem in lots of different fisheries, but it is especially dangerous for fish like the orange roughy that all come together for reproduction. Often these fish are targeted when they are all together to spawn which can wipe out two generations at once.