

# Teacher's Guide For: *Fishing Responsibly*

Fishers have choices. They can choose:

- where they fish
- the type of gear they use (gill nets, trawling, net mesh size, etc)
- the depth at which they fish
- how long they trawl or set their nets
- when they fish (season)

Many of these options are controlled by laws and regulations, but there are still many decisions to be made within the regulations.

## ***The Basics:***

The older term, *fisherman*, has been replaced with the modern term, *fisher*. It is not just men involved in sport and commercial fishing. A trawl is the gear (the net, net doors, wire, etc) that fishers use to capture the fish. Many different types of nets are used. A gill net is “set” with floats and passively catches fish that swim into it. The head of the fish pokes through the mesh and the fish is caught behind its gills. The fish cannot swim forward or backward, is trapped, and usually dies before the net is retrieved by the fisher. This makes it likely that fish that are not wanted will be killed. The net is therefore, non-selective gear and can catch species that are not wanted, called by-catch. This means that fish that you are not allowed to catch or do not want to catch are removed from the ecosystem and wasted.

Trawling is actively dragging a net through the water to catch fish or shrimp. Trawling is done at specific depths based on the type of fish that are sought. For example, the fisher may decide to bottom trawl for deep species or surface trawl for more shallow-living species. The fisher must understand the ecology of the species they want in order to catch more of that species and reduce the by-catch. Sometimes by-catch species can be released unharmed when they are brought to the ship. However, sometimes fish are killed by this process, too. For example, if bottom trawling brings fish from a great depth too rapidly to the surface, this can kill the fish. This is the same reason human divers must be careful to surface slowly, avoiding problems like nitrogen bubbles and the “bends”.

The following integrated math-science problems teach the student about using mathematical calculations to optimize the fisher’s catch while minimizing costly and destructive by-catch. Use these problems as a basis to discuss environmental concerns and economic concerns that have a bearing on decision making.

The problems used to challenge the students use species of fish and hypothetical situations that are based on fishery management techniques. The numbers used are appropriate for the math skills of the students and do not reflect market values or economic outcomes.

### **Solutions to: *The Cod Fishing Problem (Level 1 Difficulty)***

1. 7 hours
2. 7000 cod
3. \$5600
4. \$14,000
5. \$4375
6. \$4025

**Solutions to: *The Mackerel Fishing Problem (Level 2 Difficulty)***

Bill makes a profit of \$1,125. He does this by selling the mackerel for \$9817.50 and pays a total of \$2,992.50 in fines for the shad and \$5,700 in crew and ship expenses.

**Solutions to: *The Haddock Fishing Problem (Level 3 Difficulty)***

Bill and his crew should go to Port B in another state.

Selling the catch at Port A produces \$9750, since they cannot sell the lobsters. Selling the catch at Port B generates \$8250 for the Haddock and \$2250 for the lobster (total of \$10,500) minus the additional fuel cost of \$260 results in a total of \$10,240.