

Problem Solving Activity: DON'T EAT THAT FISH!!!

Introduction: In addition to causing environmental problems for the atmosphere, fossil fuels are a serious concern in the marine environment. The removal and transport of petroleum for example, often results in oil spills and the subsequent contamination of many different species in the ocean. Petroleum compounds in general are very mobile compounds which move easily through food webs and up the food pyramid.

There are basically two ways that marine organisms ingest spilled oil: the first is through direct contact with the oil in the water, as when oil passes over the gills of a fish and is absorbed into its tissues. The second way is by ingesting something with oil in it (plankton, shellfish, etc.) Oil starts its way through the food pyramid when it is taken in by primary consumers, tiny animals near the base of the pyramid. Copepods, for example, eat oil droplets that are similar in size to algae. Some of the oil passes through the copepods and is excreted in pellets that sink to the bottom of the ocean. Oil that is not excreted is stored in the body fat of the copepods and is passed along to the organisms that feed on them (whales, larger invertebrates, etc.) In turn, the larger fish ingest oil by feeding on the smaller fish, and so it goes up the food pyramid, with each successive organism ingesting the oil contained in the body fat of the organisms they consume.

Although acute exposures tend to kill more organisms, long term exposures are really much worse. During chronic exposures, oil remains in the water and the sediments, constantly available to marine organisms. Chronic exposures cause problems to the ecosystem for long periods of time by reducing the ability of many fish and invertebrates to reproduce.

Objectives:

- To design a way to solve a problem about a problem in the ocean environment;
- To describe the procedure used for solving the problem by one of the following methods:
 - * Write an expository paragraph describing their procedure;
 - * Illustrate the solution by reproduction of a food pyramid with steps included at each level;
 - * Identify the mathematical processes used to find the solution;
 - * Answer written questions which reflect information acquired during the solution process;
- To work with a partner to solve a problem about the marine environment;

Important Terms: Copepods, food chain, food pyramid, chronic/acute exposure, reproduce, compounds;

Materials: Calculator, plastic counters (optional) copy of **Problem Solving Activity Sheet**, paper and pencil;

Procedure:

1. Read over the **Introduction** and discuss it with the class.
 - Show some examples of food chains and food pyramids.
 - Spend some time explaining the breakdown of energy as you proceed through the pyramid from base to top.
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2. Discuss the **TASK** the students will have and the possible ways they can complete it successfully.
 - Ex: Using beans as oil packets, working solely on the calculator, drawing pictures, etc.
3. Instruct students to take notes on their work sheets of the following data they will need to solve the problem:

Copepods = 384	Fish Fry = 32
Perch = 4	Striped Bass = 1
3. Walk around as students are working give suggestions if needed.
4. Students must hand in a work sheet and an answer sheet with their final answers on it.
5. Students should complete the answers in the **Analysis** section.

Student Activity Sheet: DON'T EAT THAT FISH!

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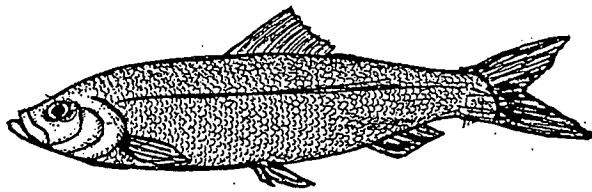
PROCEDURE:

1. Work with your partner(s) to design a way to solve the problem stated on the first page.
2. Describe the method you used for solving the problem.
3. Use your procedure to solve the problem. Write or draw-out the process on another piece of paper to be handed in.
4. Answer the questions in the **Analysis** section.

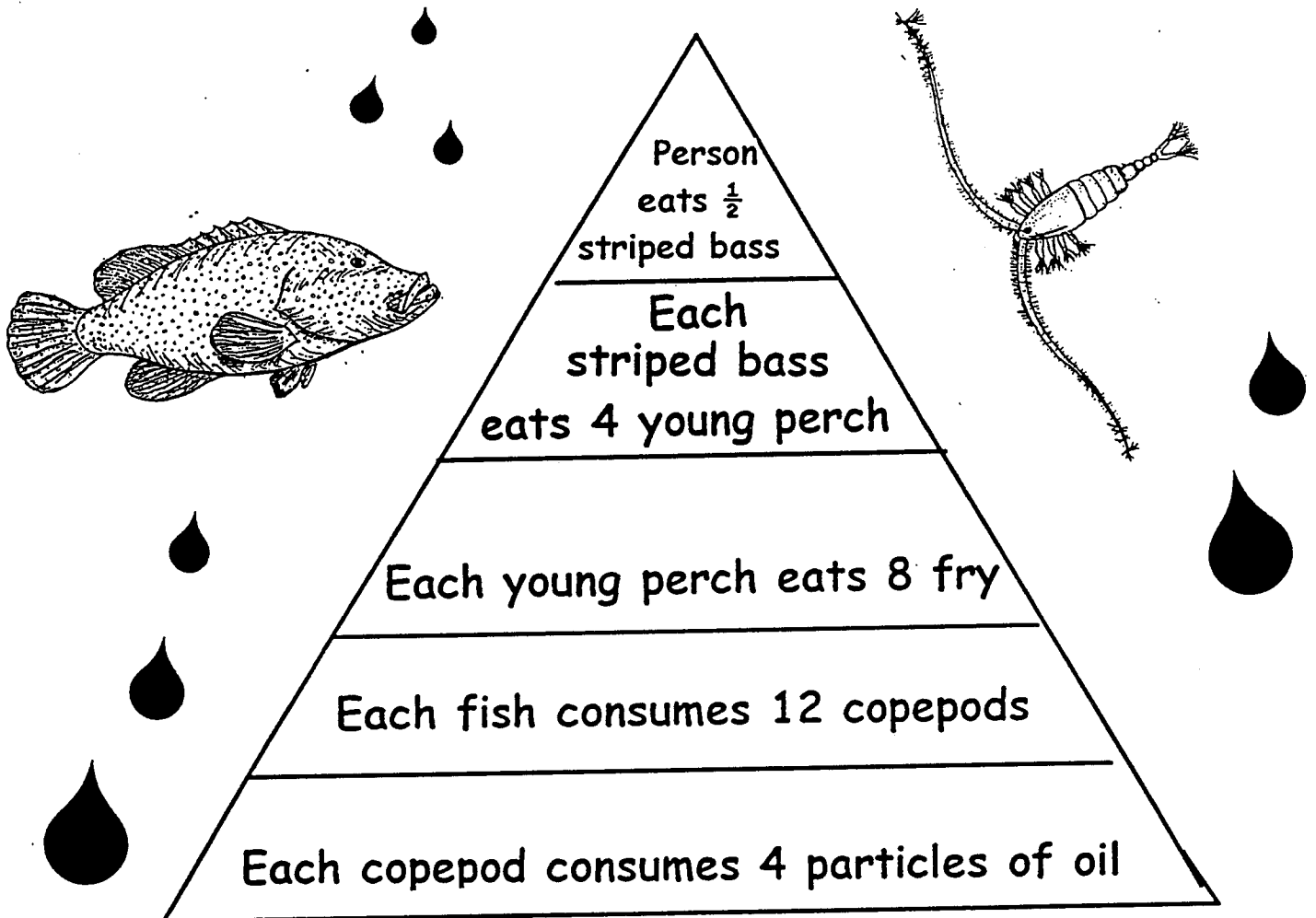
HINT: Only a portion of the oil that is eaten remains in the bottom. Assume that all the organisms in this food pyramid have the ability to digest one-fourth of the oil they consume. The other three-fourths remain in their bodies.

ANALYSIS:

1. Explain why you would or would not eat seafood from near the top of the food pyramid if you knew it had been contaminated by oil?
2. The oil is accumulating in this food pyramid as a result of an acute exposure to an oil spill. How might the situation be different if this pyramid suffered from chronic exposure? Give reasons to support your answer.
3. Even though the number of oil particles available at each level of the pyramid decreases as you go up the pyramid, why is it more deadly to top level consumers than to consumers at the bottom of the pyramid. Explain.;
4. Assume that you live in an area of Alaska that was contaminated by an oil spill about 3 years ago. The oil company responsible had an excellent cleanup program and most of the oil was removed within a relatively short period of time. There is a large population of Bald eagles on one of the off-shore island which was supposedly unaffected by the oil spill. Recently, however, the number of eagles in the area dropped by about 25 percent for no apparent reason. What could be the cause of the sudden drop in the Bald eagle population? Explain the steps you would use to investigate this possibility.
(HINT: Bald eagles are top level consumers that feed on large fish like salmon.)



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PROBLEM: A PERSON HAS EATEN ONE-HALF OF A STRIPPED BASS THAT WAS PART OF AN OIL-CONTAMINATED FOOD PYRAMID. HOW MANY PARTICLES OF OIL HAS THE PERSON CONSUMED?

