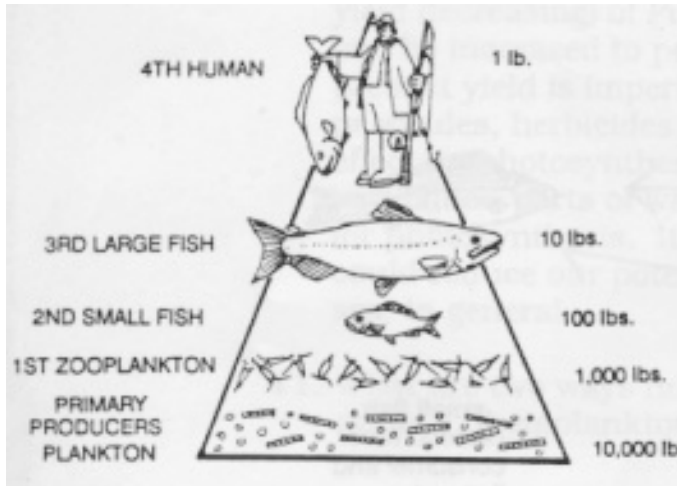


Food pyramid worksheet

On your own paper, answer the underlined questions. (Hint: you will need to read the whole thing to answer these five questions.)

1. Before you start, make a guess: “I think it takes about ... pounds of phytoplankton to make one pound of fourth order consumer.”

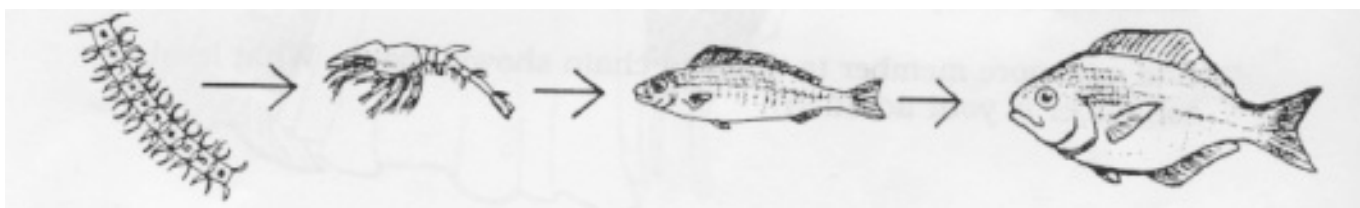


We have a clue. We've seen that processes like respiration (breathing) and natural mortality (death) cause the loss of 90 percent of the energy at each step in the food chain. Let's see how much phytoplankton it would take to produce one pound of our salmon: it takes 10 pounds of medium fish which need to eat 100 pounds of small fish which needed to eat 1,000 pounds of zooplankton which needed to eat 10,000 pounds of phytoplankton!

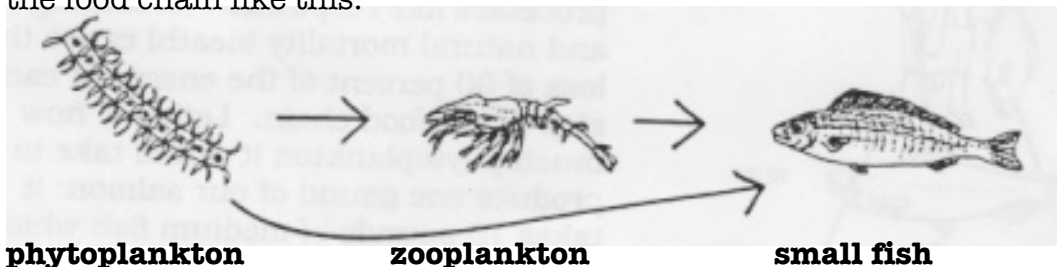
Sometimes it is helpful for us to know whether the consumer we are talking about was the one who ate the producer, or one who is another

consumer. To accomplish this, we call a consumer who eats green plants and algae a **first order consumer**. A consumer who eats a first order consumer is called a **second order consumer** and so on. At each energy transfer, (for example, a second order consumer eating a first order consumer) about 80 to 90% of the energy is “lost”; only 10 to 20% of the energy is available to the higher order consumer. (In reality, you can't *lose* energy, just like you can't *lose* matter. The energy can, however, be *transferred* to another system...like a decomposer or something...and therefore is *lost* from the energy pyramid system we are looking at. Matter, on the other hand, will always stay in our Earth's system.) Because of this energy loss, food chains are seldom over four or five links long.

2. In the food chain shown below, what would we call a medium sized fish that ate the small fish?



“Aha” I hear you say, “What about the Pacific Herring that eats both zooplankton and phytoplankton?” Okay, you've got me. When the herring eats the phytoplankton it is a first order consumer and when it eats the zooplankton it is a second order consumer. We can draw the food chain like this:



phytoplankton

zooplankton

small fish

(producer)

(1st order consumer)

(2nd order consumer **and** 1st order consumer)

Wow! To produce one pound of our Coho salmon, we had to start with 10,000 pounds or 5 tons of phytoplankton. Without phytoplankton, we would have no fish to eat.

3. An example of a large, fourth order consumer fish, is the Albacore tuna. Caught off the Straits of Juan de Fuca, tuna comes to our supermarkets usually packed in 6.5 ounce cans. There are 24 of these cans in a case. How many pounds of phytoplankton were required to produce each case of tuna?

(Hint: there are 16 ounces in a pound)

Many people regard Puget Sound and the ocean as unlimited sources of food that we have not yet begun to tap. From the above discussion it should be obvious that the total production of marine food animals depends upon the annual rate of production of phytoplankton. We must also consider the fact that marine food for human consumption must be both economical to harvest and edible. The amount of marine food available to humans also depends upon the consumer level of the food organisms we choose to eat.

4. To maximize the amount of marine food available to people, what level consumer should we harvest?

What is the maximum sustainable yield (the production which can be sustained year after year without the yield decreasing) of Puget Sound? There isn't a simple answer to that question. Even the present yield is imperiled by overfishing, and by pollution from pesticides, herbicides, and oil. Many types of pollution have a negative effect on the photosynthesis of algae. It is conceivable that over fishing and pollution could reduce our potential harvest from Puget Sound and the sea in general.

5. What are two ways humans would be affected by the death of the ocean's phytoplankton?

The importance of phytoplankton to the economy of Puget Sound and the world cannot be underestimated. The health of these minute organisms has a direct impact on human welfare. Plankton, so seemingly insignificant, in reality, are the basis for all fish life in Puget Sound.

