Pyramids of Biomass

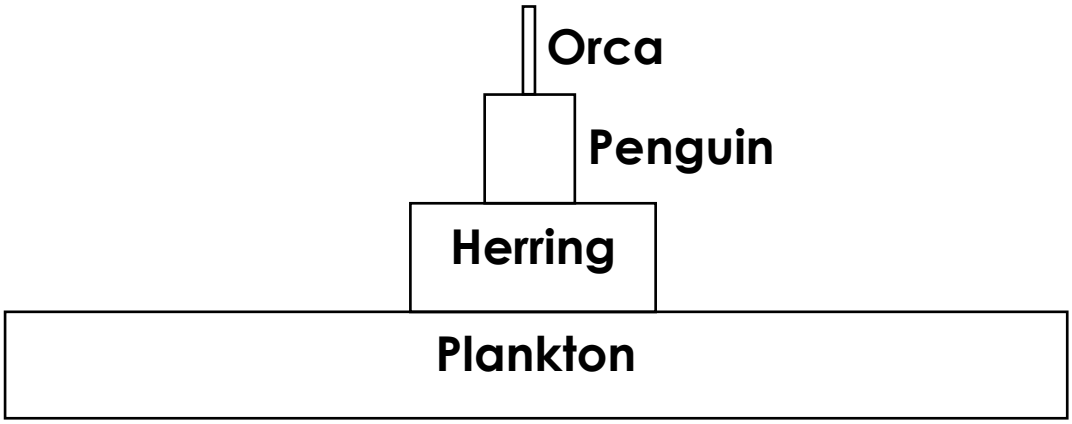
1. State the definition of:
    a. A producer

An organisms that makes its own food (glucose) using sunlight.

    b. A consumer

Organisms that eat other organisms and cannot make their own food.

2. Use the following pyramid of biomass to answer the questions:



a. What is the producer in this food chain?

Plankton

b. State the key words you could use to describe:

i. Herring – **primary consumer, prey, herbivore**

ii. Penguin - **secondary consumer, prey, predator, carnivore**

iii. Orca – **tertiary consumer, apex predator, carnivore**

3. Use the following information to:
    a. Calculate the biomass of each trophic level
    b. Draw a pyramid of biomass to represent the information. Use 1 box = 100 kg.
    c. Calculate the percentage efficiency transfer at each level

30 000 carrots, each with a dry mass of 50 g

80 rabbits, each with a mass of 2 kg

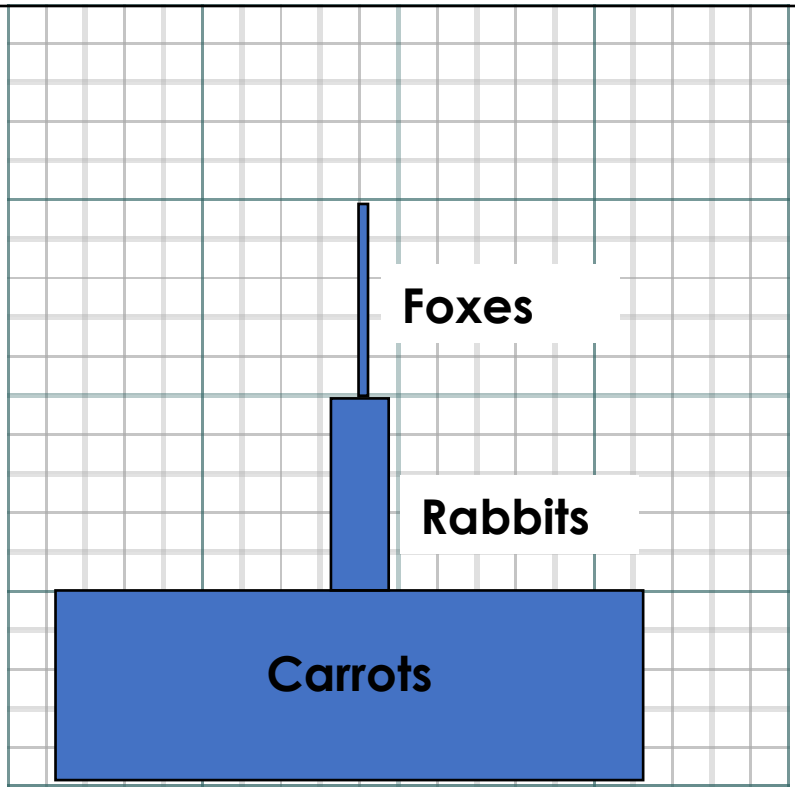
2 foxes, each with a mass of 10 kg.

Calculations of biomass of each trophic level:

Carrots: 30 000 x 0.05 kg = 1500 kg

Rabbits: 80 x 2 kg = 160 kg

Foxes: 2 x 10 kg = 20 kg



Calculations of percentage efficiency transfer at each trophic level:

From carrots to rabbits:

$$\text{Percentage efficiency transfer} = \frac{\text{biomass of higher trophic level}}{\text{biomass of lower trophic level}} \times 100$$

$$= \frac{160\ \text{kg}}{1500\ \text{kg}} \times 100$$

$$= 10.67\ \%$$

From rabbits to foxes:

$$\text{Percentage efficiency transfer} = \frac{\text{biomass of higher trophic level}}{\text{biomass of lower trophic level}} \times 100$$

$$= \frac{20\ \text{kg}}{1600\ \text{kg}} \times 100$$

$$= 12.5\ \%$$

4. Use the following information to:

a. Calculate the biomass of each trophic level
b. Draw a pyramid of biomass to represent the information.
c. Calculate the percentage efficiency transfer at each level

5 sharks, each with a mass of 200 kg

50 seals, each with a mass of 100 kg

2000 flatfish, each with a mass of 20 kg

200 000 kg of plankton

Calculations of biomass of each trophic level:

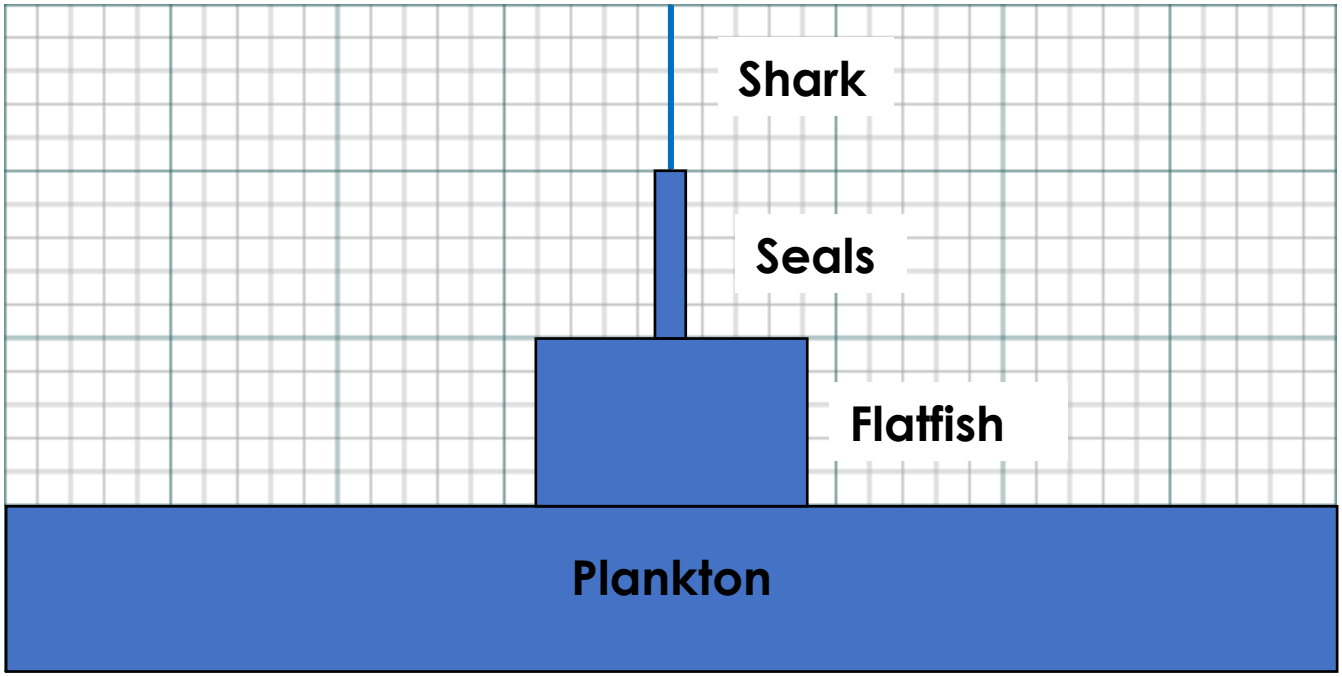
Shark: 5 x 200 kg = 1000 kg

Seals: 50 x 100 kg = 5000 kg

Flatfish: 2000 x 20 kg = 40 000 kg

Plankton: 200 000 kg

1 box = 5000 kg



Calculations of percentage efficiency transfer at each trophic level:

From plankton to flatfish:

Percentage efficiency transfer = $\frac{\text{biomass of higher trophic level}}{\text{biomass of lower trophic level}}$ X 100

= $\frac{40\ 000\ kg}{200\ 000\ kg}$ x 100

= 20 %

From flatfish to seals:

Percentage efficiency transfer = $\frac{\text{biomass of higher trophic level}}{\text{biomass of lower trophic level}}$ X 100

= $\frac{5000\ kg}{40\ 000\ kg}$ x 100

= 12.5 %

From seals to shark:

Percentage efficiency transfer = $\frac{\text{biomass of higher trophic level}}{\text{biomass of lower trophic level}}$ X 100

= $\frac{1000\ kg}{5000\ kg}$ x 100

= 20 %

5. Suggest what life processes would cause the efficiency transfer to not be 100 %.

Biomass is lost through:

- **Respiration (to produce heat to maintain body temperature)**
- **Movement (also uses energy from respiration)**
- **Waste (urine, faeces, sweat etc)**

6. A cow eats 10 kg of grass over the course of a week. Its own mass increases by 0.8 kg and it excretes 5.5 kg in waste (urine, faeces and gas).

    a. Calculate how much biomass was used up in respiration.

Used in respiration = 10 kg – (5.5 kg + 0.8 kg)
= 3.7 kg

    b. Calculate the percentage efficiency transfer (clue – think how much biomass is available to the next trophic level).

Percentage efficiency transfer = biomass (passed to) higher trophic level X 100
biomass (taken in to) lower trophic level
= 0.5 kg x 100
10 kg
= 5 %

7. Explain why there are rarely more than 4 or 5 levels of a food chain.

Only approximately 10 % of biomass is passed on to the next level, so after a few levels this number has become too small to provide any food/energy.