

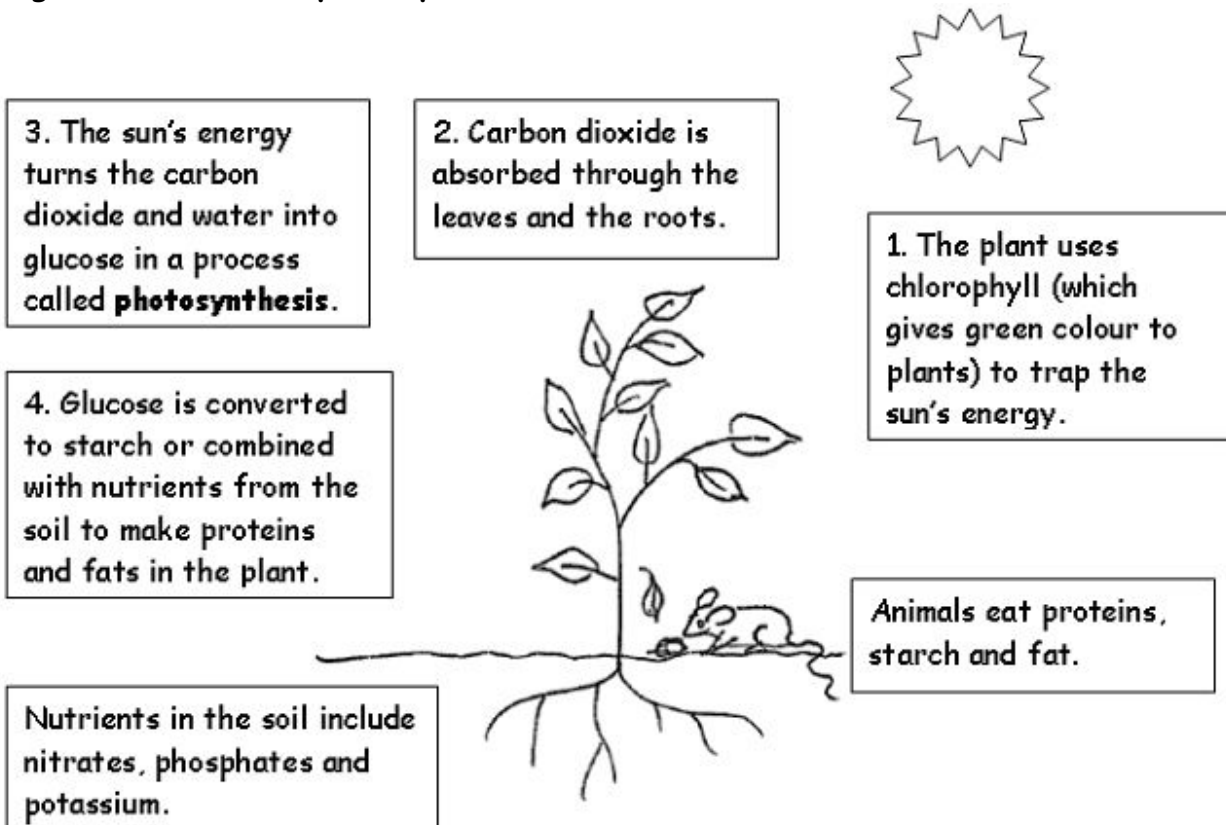
SHINGLE BEACH ECOSYSTEMS, FOOD CHAINS AND FOOD WEBS

The community of plants and animals in any habitat interact with the non-living environment, such as the soil and the atmosphere. The combination of the community of plants and animals and the non-living physical environment is known as the **ECOSYSTEM**. On shingle, the ecosystem is very fragile because of the harsh conditions. The plants in the community are eaten by insects or mammals such as rabbits. In turn these could be eaten by other insects, birds or mammals. There is a transfer of nutrients and energy between one organism and another in the community, forming a food chain or food web.

1. THE SHINGLE BEACH FOOD CHAIN

The plants, such as Sea-kale, are known as **PRODUCERS**. They are the first organisms in the food chain, and produce energy-rich food substances such as starch, fats and proteins, needed by organisms higher up the chain, which cannot produce their own food.

Diagram to show how plants produce food



Animals get their energy from other organisms. Animals, such as snails or rabbits, that eat the producers (the plants) are **PRIMARY CONSUMERS**. They are called **HERBIVORES** because they only eat plants. **SECONDARY CONSUMERS** feed off primary consumers. These are meat-eaters or **CARNIVORES**. Some food chains also have **TERTIARY CONSUMERS**, which are also **CARNIVORES**, sometimes known as **TOP PREDATORS**.

The arrows linking the organisms in a food chain always point in the direction that the food energy goes (not who eats what).

The different layers or links in the food chain are known as **TROPHIC LEVELS** (T1, T2 etc.):

T4	Carnivore	Tertiary consumer	_____
	↑	↑	
T3	Carnivore	Secondary consumer	_____
	↑	↑	
T2	Herbivore	Primary consumer	_____
	↑	↑	
T1	Plants	Producer	_____

a) Fit the following four organisms into the correct trophic levels in the spaces at the right of the food chain diagram:

Bird, Fox, Sea Spurge, caterpillar.

b) Colour the producer level green, the primary consumer level yellow, the secondary consumer level red and the tertiary consumer level purple.



Spurge
Hawkmoth
caterpillar on
Sea Spurge



2. FOOD WEBS

In any ecosystem each organism usually feeds on a variety of foods, and instead of one simple food chain, there are several different food chains that connect each organism. For instance, the Sea Pea could be eaten by other consumers besides caterpillars, such as snails, rabbits or weevils. These consumers in turn could each be eaten by several different secondary consumers. Thus a complicated **FOOD WEB** is produced from all the different food chains woven together in the ecosystem.

a) Sort the organisms in the box below into the correct trophic levels by colouring them in using the same colours that you used earlier.

FURTHER FACTS ABOUT SHINGLE PLANTS AND ANIMALS

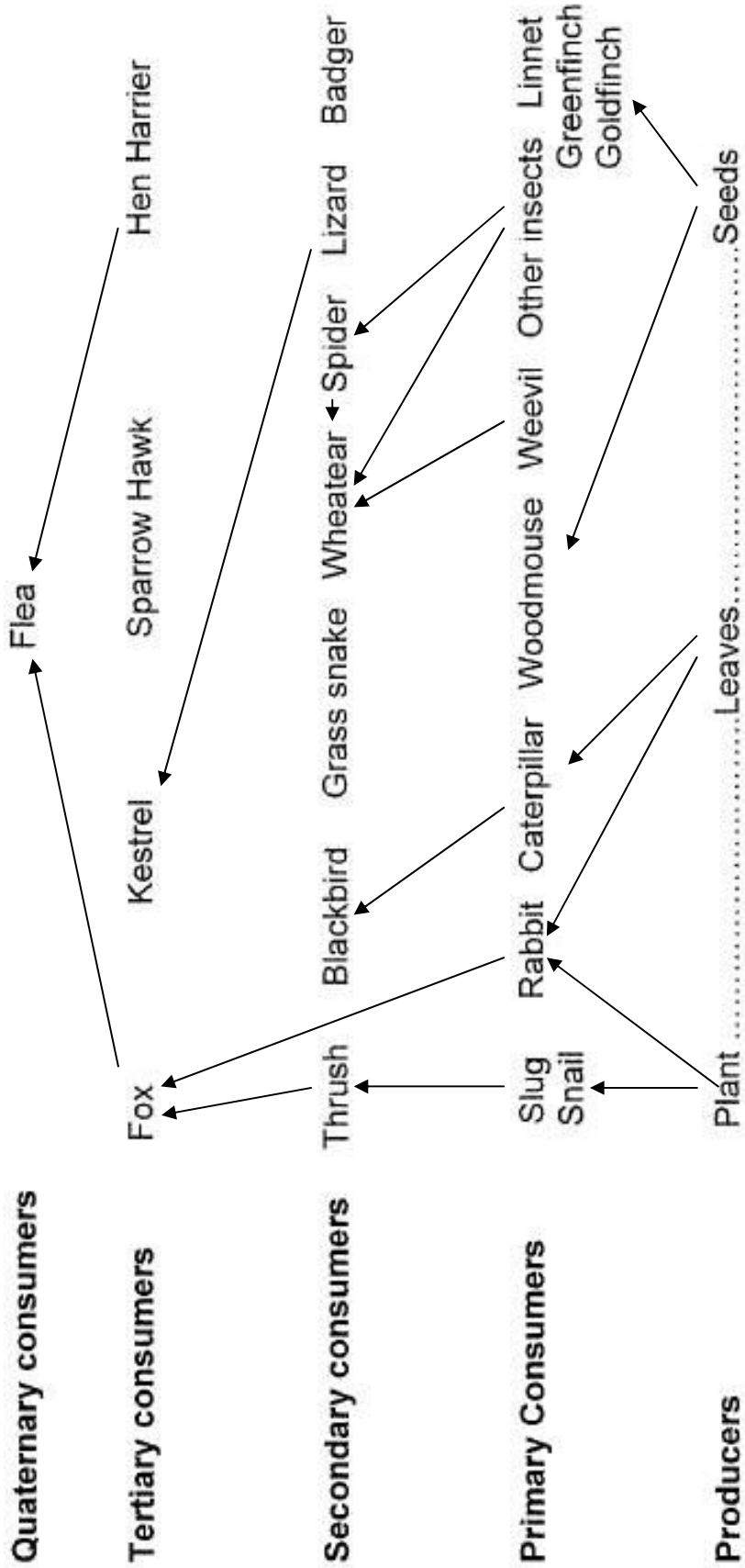
- Green plants such as Sea-kale and Sea Pea photosynthesise and use nutrients from the soil to grow.
- Weevils eat plants such as Sea Pea.
- Snails eat plants such as Sea-kale.
- Caterpillars eat plants.
- Rabbits eat plants.
- Linnets, Goldfinches and Greenfinches eat seeds.
- Spiders eat other insects.
- Thrushes eat snails and caterpillars. They sometimes fly to shingle beaches to feed, though they breed elsewhere, often in nearby bushes.
- Blackbirds and Starlings also fly in to eat caterpillars.
- Wheatears eat insects and spiders from the ground, and occasionally catch flies in the air.
- Ringed Plovers eat crustaceans like sand hoppers.
- Grass Snakes and lizards eat insects, slugs and snails.
- Little Terns, Common Terns, and Oystercatchers breed on shingle and eat invertebrates and fish.
- Badgers eat fruits, seeds and insects.
- Foxes, Hen Harriers, Kestrels and Sparrowhawks eat birds and Rabbits.
- Fleas live on the blood of birds and mammals, such as Rabbits and Foxes.

You can find further information on the wildlife of the shingle beaches of East Sussex and Kent from:

- <http://www.wildRye.info>
- <http://www.RXwildlife.org.uk>



SHINGLE FOOD WEB (much simplified)



WORKSHEET 19: Shingle beach ecosystems - food chains & webs



b) On the food web provided, fill in extra links for (1) Blackbird, (2) spider, (3) Grass Snake, (4) lizard, (5) Linnet, (6) Sparrowhawk, and (7) Hen Harrier.

c) Terns feed out at sea, but breed on the shingle and are part of the food web. Try to fit them into the diagram.

d) Badgers feed on seeds and fruits as well as insects. Add the link lines on the diagram. How does the badger's feeding pattern differ from that of the other animals shown?

e) What is the name for this type of feeder?

f) Do you think fleas deserve their place right at the top of the food web?

Sitticus inexpectus - a jumping spider



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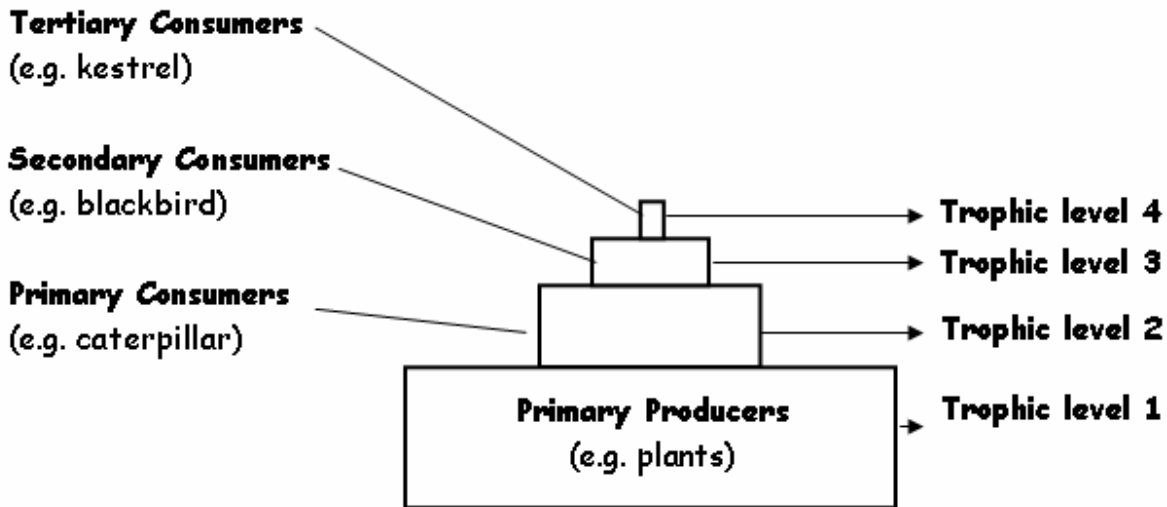
3. BIOMASS AND PYRAMID OF NUMBERS

Look at the diagram below. You will notice that there is a large mass of plant material, compared to the mass of animal tissue in the layers or trophic levels above. This is because only a small amount (about 2%) of the energy of the plant producers goes into the growth of the animals, the primary consumers, in the trophic level above. The rest of the energy is used in the animals' respiration, movement, digestion and excretion. Some animals use about 60% of their energy just to keep warm. Hunting for food also takes up large amounts of energy, further restricting the mass of animal material in the top trophic levels.

The mass of animal or plant material is called the **BIOMASS**. If the amount in each trophic level is calculated and then drawn as a horizontal bar graph the result is a pyramid with a very large base, representing the biomass of the shingle plants, then a rapid decrease upwards to a very small amount in the top trophic level.

A PYRAMID OF NUMBERS

Diagram showing the relationship of biomass to trophic levels



a) Why do food chains usually only have four (and at the most five) trophic levels?



4. **DECOMPOSERS** are bacteria and fungi that break down dead material (leaves, faeces etc.) from the plants and animals in the food web. Conditions in the shingle ecosystem are quite difficult for such organisms, so breakdown is slow. However, the end result is a return of nutrients to the soil, often in the form of humus, which helps new plants to grow (see diagram below).

- a) Put arrow marks on the recycling diagram to show the direction of flow of nutrients.
- b) One flow line is missing on the diagram. Draw it in, with its arrow mark.
- c) Add decomposers below the base of your shingle food web. Draw three links to other trophic levels.
- d) Explain why the decomposers are the recyclers:

