

- 1 Some pollutants are not broken down easily and remain in the environment for a long time. These are described as persistent pollutants.

PCBs are a waste material from the manufacturing of electrical insulation. PCBs are one of the most persistent pollutants in the environment.

Between 1947 and 1976, factories dumped large quantities of PCBs into the Hudson River in the USA. Studies measured the concentrations of PCBs in the tissues of organisms in a food chain in the sea near the Hudson River, as shown in Fig. 6.1.

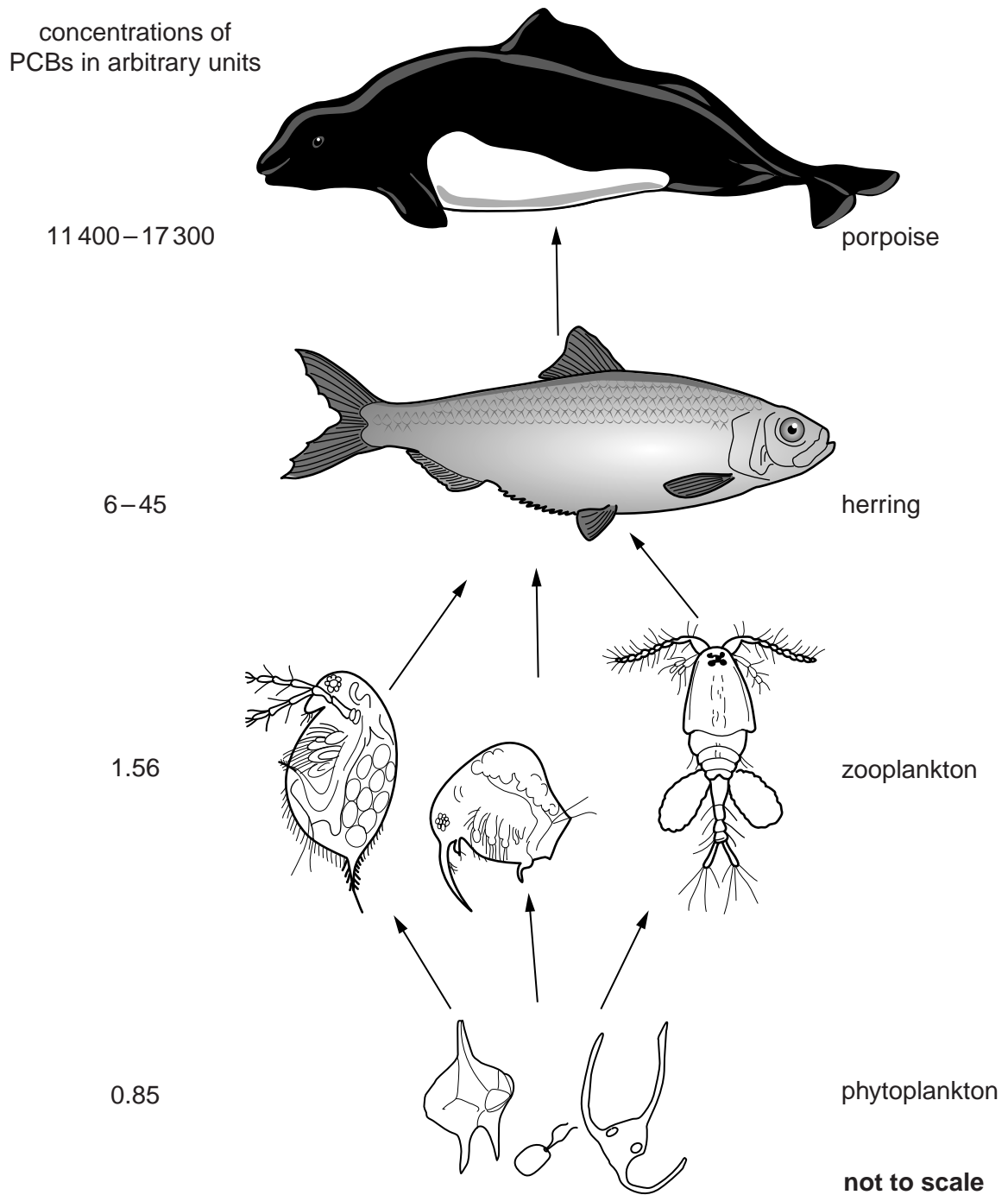


Fig. 6.1

(a) (i) Describe the results shown in Fig. 6.1.

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(ii) Suggest an explanation for the different concentrations of PCBs in the organisms of the food chain.

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- (b) PCBs are toxic to many organisms because they bind to a protein molecule known as AHR.

The Atlantic tomcod, *Microgadus tomcod*, is a fish that lives in the Hudson River and other rivers nearby.

90% of the tomcod population in the Hudson River is resistant to the effects of PCBs. This is because these fish have a different type of AHR compared with other tomcod populations.

- (i) Suggest how this resistance came about.

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- (ii) Scientists predict that the proportion of fish resistant to PCBs will decrease if the concentration of PCBs in the river decreases.

Suggest reasons why the proportion of fish with the altered AHR protein might decrease.

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(c) Describe the problems caused by non-biodegradable plastics in the environment.

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[3]

[Total: 16]

2 Fig. 2.1 shows the flow of energy through a natural ecosystem that is **not** used by humans at any of the trophic levels.

The unit of energy flow is kJ per m² per year.

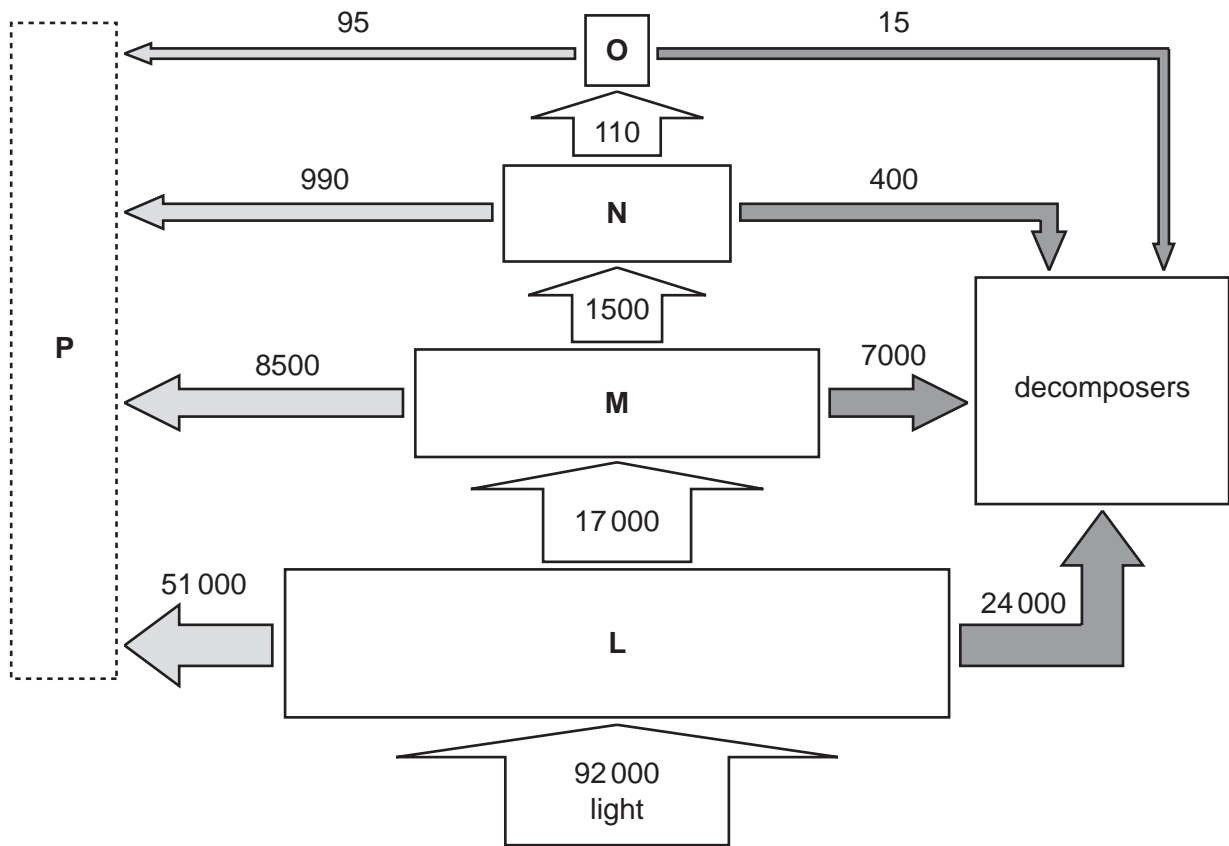


Fig. 2.1

(a) The letters **L** to **O** represent the different trophic levels in the ecosystem.

(i) Name the first and third trophic levels, **L** and **N**.

L

N [2]

(ii) Suggest what is shown by the relative sizes of the boxes, **L** to **O**, in the energy flow diagram in Fig. 2.1.

..... [1]

(iii) There are no predators in the ecosystem feeding on the animals in trophic level **O**.

Suggest **and** explain why there are no predators in the ecosystem feeding on the animals in trophic level **O**.

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(iv) **P** in Fig. 2.1 does **not** represent any organisms.

Explain what **P** represents in the energy flow diagram.

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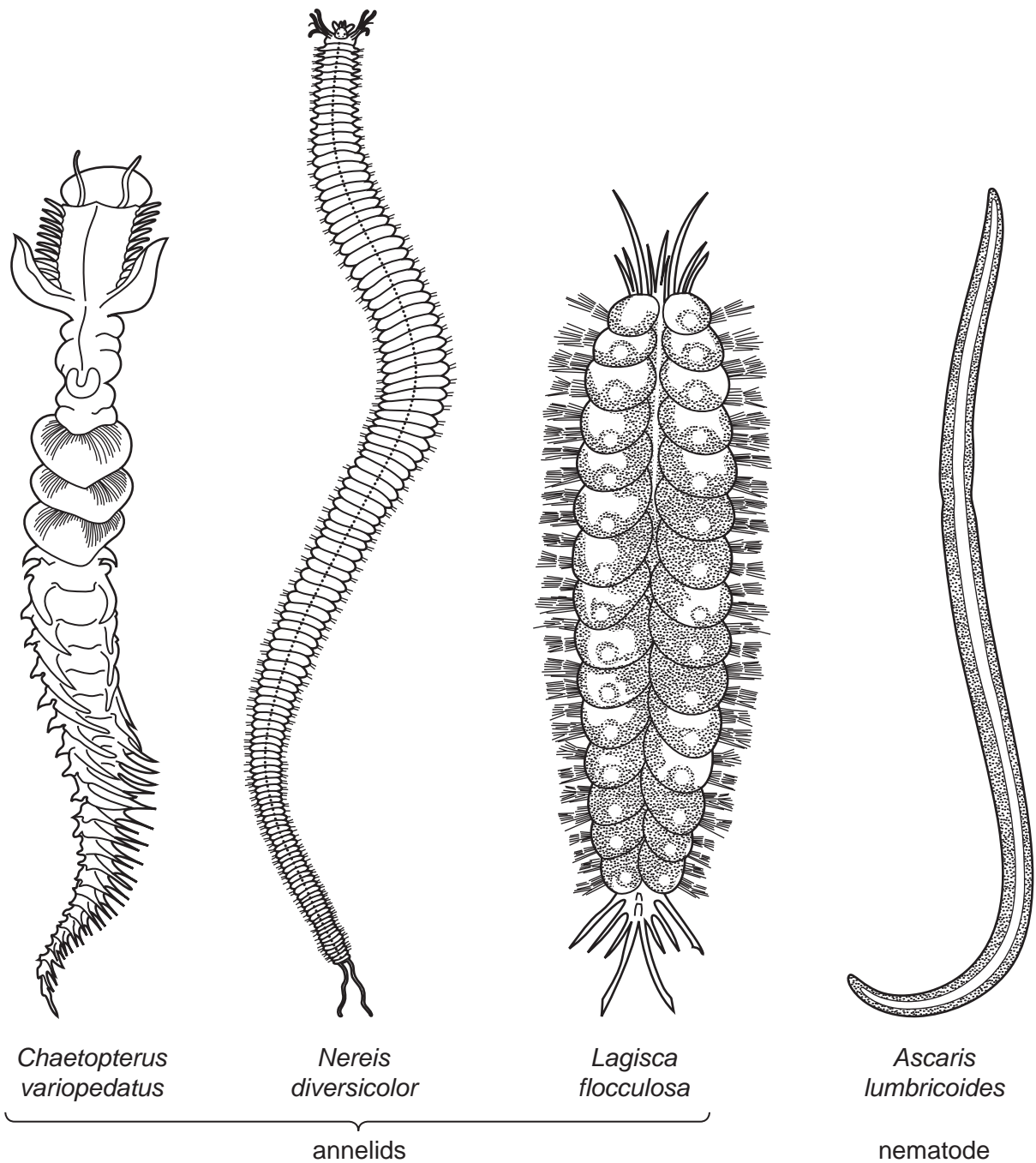
(b) People who live near this ecosystem **would like** to use some of the organisms at trophic level **M** for food.

Suggest **and** explain what might happen to the ecosystem if the people took too many of the organisms at trophic level **M**.

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[Total: 11]

3 Fig. 1.1 shows three annelid species and *Ascaris lumbricoides*, a species of nematode.



not drawn to scale

Fig. 1.1

(a) State **three** features shown by the three annelid species that are **not** shown by the nematode species.

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- 2
- 3

[3]

(b) Organisms are given two names, e.g. *Nereis diversicolor*.

State what is meant by the first name.

..... [1]

(c) *N. diversicolor* is a filter feeder. It filters plankton from sea water.

Annelids like *N. diversicolor* form an important part of the ecosystems of estuaries.

Fish feed on annelids when the sea covers the mud in the estuary.

When the tide is out wading birds are the main predators of annelids.

Birds of prey are the main predators of the wading birds.

(i) Explain the term *ecosystem*.

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(ii) Use the space below to draw a food chain for the estuary ecosystem **when the tide is out**.

[2]

(iii) Describe the advantages of drawing a food web rather than a food chain for an ecosystem.

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(d) The palolo worm is a species of annelid that lives on coral reefs in the Pacific Ocean.

At certain times of the year, all the worms in an area leave their burrows to swim to the surface.

They all release their gametes into the water at the same time.

This is known as mass spawning.

Suggest the advantages of having mass spawning occurring only at certain times of the year and not all year round.

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(e) Meiosis is involved in producing gametes in palolo worms.

Describe how meiosis differs from mitosis **and** explain why meiosis is important for the production of gametes.

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[Total: 18]

4 Many biologists study populations of organisms in their natural habitats.

(a) Define the term *population*.

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(b) A 10-year study was carried out to investigate the relationship between voles and owls. Voles are small mouse-like mammals and owls are carnivorous birds.

The results are shown in Fig. 6.1 and Fig. 6.2.

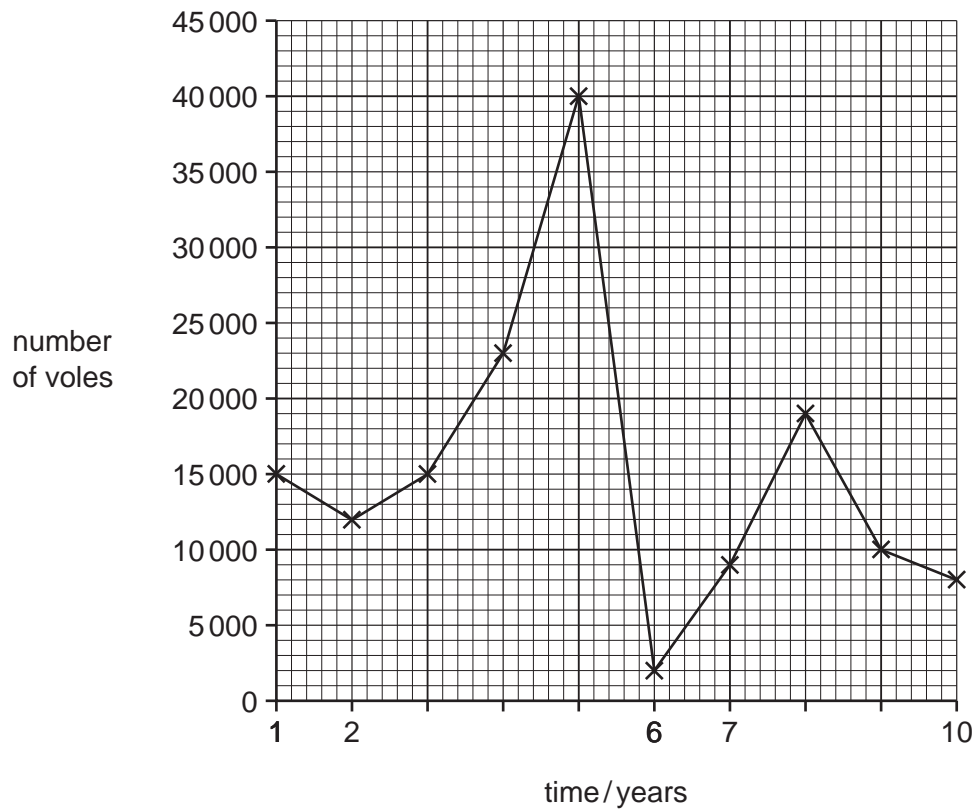


Fig. 6.1

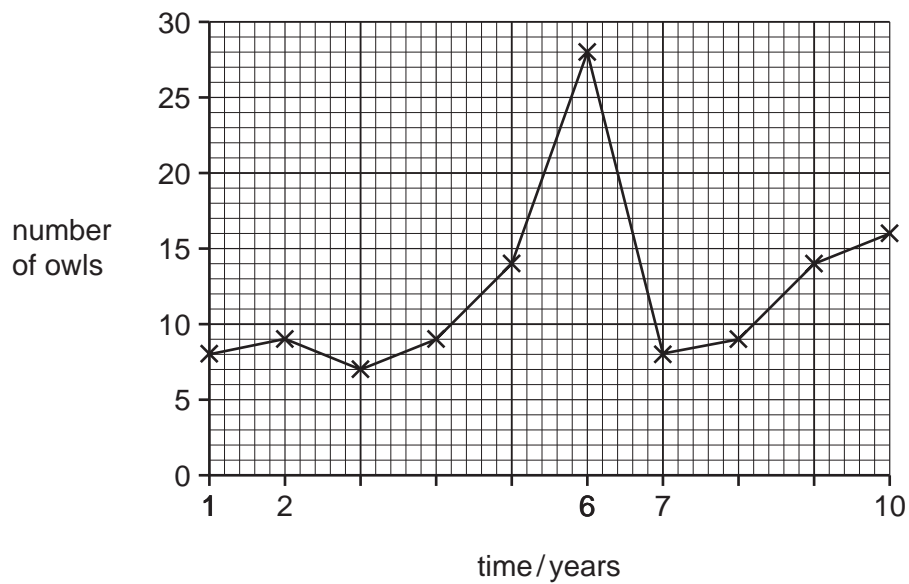


Fig. 6.2

(i) Suggest **three** reasons for the decrease in the population of voles between years 5 and 6.

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..... [3]

(ii) State the evidence from Fig. 6.1 and Fig. 6.2 that supports the idea that voles form a large part of the food eaten by owls.

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[Total: 7]