

Human influences on ecosystems revision notes

Humans change ecosystems when they grow food, build, extract resources and release waste. This topic looks at how farming raises food production and what it costs, why habitats are destroyed, how pollution damages water, land and air, and how conservation tries to protect species and resources for the future.

For Cambridge IGCSE Biology 0610 (and 0970, which has the same content). **Supplement** is Extended content, only examined on Papers 2 and 4.

1 Food supply **Spec 20.1**

How humans have increased food production **Spec 20.1.1**

The human population keeps growing, so more food is needed. Farmers have increased food production in five main ways.

Ways of increasing food production		
Method	What it does	How it increases production
Agricultural machinery	Tractors, ploughs and combine harvesters do the work of many people	Larger areas of land can be farmed and jobs are done faster and more efficiently
Chemical fertilisers	Add nitrates and other mineral ions to the soil	Replace ions removed by crops, so plants grow bigger and yields improve
Insecticides	Chemicals that kill insect pests	Fewer crops are eaten or damaged, so quality and yield improve
Herbicides	Chemicals that kill weeds	Reduce competition with weeds for light, water and ions
Selective breeding	Choosing parents with the best features to breed from	Crop plants and livestock with higher production, such as more grain or more milk

Selective breeding takes many generations. Each time, the best offspring are chosen and bred together, so the useful feature becomes more common.

Exam tip: Give the reason as well as the method. 'Herbicides kill weeds so there is less competition for light and water' earns more than 'herbicides kill weeds'.

Monocultures and intensive livestock production **Spec 20.1.2, 20.1.3**

Large-scale monocultures

A **monoculture** is the growing of a single crop plant on a large area of land. Often the same crop is grown on the land every year.

Large-scale monocultures of crop plants

Advantages

Machinery can plant, spray and harvest the whole field in the same way, which is efficient

Large amounts of food produced at lower cost per tonne

All the plants need the same conditions, so watering, fertiliser and pesticide use can be planned for the whole field

The crop variety best suited to the local soil and climate can be grown, giving a high yield

Disadvantages

Only one crop species is grown, so **biodiversity** is low and hedges and wild habitats may be removed

A pest or disease that attacks the crop can spread quickly through the whole field

If the same crop is grown every year, the same ions are removed from the soil, so large amounts of fertiliser are needed

Heavy use of fertilisers and pesticides can pollute nearby water, and pests can become resistant to pesticides

Intensive livestock production

In **intensive livestock production**, large numbers of animals are kept in small spaces, often indoors, with controlled temperature and feed so that they grow quickly.

Intensive livestock production

Advantages

A lot of meat, milk or eggs is produced from a small area of land

Less energy is lost as heat because the animals move little and are kept warm

Food is produced at a lower cost, so prices for consumers are lower

Animals grow quickly and reach market size sooner

Disadvantages

Animals have little space and may suffer stress, which raises animal welfare concerns

Disease spreads easily when animals are crowded, so antibiotics may be overused and resistant bacteria can develop

Large amounts of waste are produced, which can pollute water

Large amounts of feed must be grown elsewhere and brought in

Exam tip: If asked for an advantage and a disadvantage, make sure the two points are different and each is about the method named in the question.

Quick check

1. Name five ways humans have increased food production.
2. What is a monoculture?
3. Give one disadvantage of a monoculture.
4. Give one advantage of intensive livestock production.

2 Habitat destruction Spec 20.2

Biodiversity and habitat destruction Spec 20.2.1, 20.2.2, 20.2.3

Biodiversity

The number of different species that live in an area.

A habitat is destroyed when it is changed so much that the organisms living there can no longer survive. This reduces **biodiversity**.

Reasons for habitat destruction

- **Increased area for housing, crop plant production and livestock production:** forests, grassland and wetlands are cleared to build homes and to grow food for a growing population.
- **Extraction of natural resources:** mining, quarrying and drilling remove soil and rock and destroy the habitat above.
- **Freshwater and marine pollution:** pollutants such as sewage, fertiliser and plastics make water unsuitable for the organisms that live in it.

Damage to food webs

Humans can also have a negative impact on habitats by altering **food webs and food chains**. Removing one species affects others. For example, if a predator is hunted out, its prey may increase in number and eat too much of the producers. If a producer is cleared, the animals that feed on it lose their food and may die or move away.

Exam tip: Biodiversity is about the number of different species, not the number of individual organisms.

Deforestation Spec 20.2.4

Deforestation is the removal of forests on a large scale. Forests are cleared for timber, for farmland (crops and cattle), for housing and for roads and mining.

Undesirable effects of deforestation

Effect	Explanation
Reduced biodiversity	Trees provide food and shelter, so many species lose their habitat and food source
Extinction	If a species lives only in that forest and cannot move elsewhere, the whole species can die out
Loss of soil	Tree roots hold soil together; without them rain washes the soil away (soil erosion)
Flooding	Tree roots absorb water and leaves intercept rain; without trees more water runs straight into rivers
Increase of carbon dioxide in the atmosphere	Fewer trees take in CO ₂ for photosynthesis , and burning or decay of the felled trees releases CO ₂

Common mistake: Do not say trees 'make' oxygen as the main problem. The mark is for fewer trees removing less CO₂ from the air by photosynthesis, plus CO₂ released when wood is burned or decays.

Quick check

- 1 . Define biodiversity.
- 2 . Give three reasons for habitat destruction.
- 3 . How does deforestation lead to flooding?
- 4 . How does deforestation increase carbon dioxide in the air?

3 Pollution Spec 20.3

Sewage, fertiliser and eutrophication Spec 20.3.1, 20.3.4

Untreated sewage and excess fertiliser both contain nitrates and other ions. If they get into rivers and lakes, they harm aquatic ecosystems.

- **Untreated sewage** also contains microorganisms that cause disease and organic matter that decomposers break down using oxygen.
- **Excess fertiliser** is washed (leached) from fields by rain into streams and rivers.
- The extra ions cause water plants and algae to grow quickly. When they die, decomposers break them down and use up oxygen in the water, so fish and other aquatic organisms die.

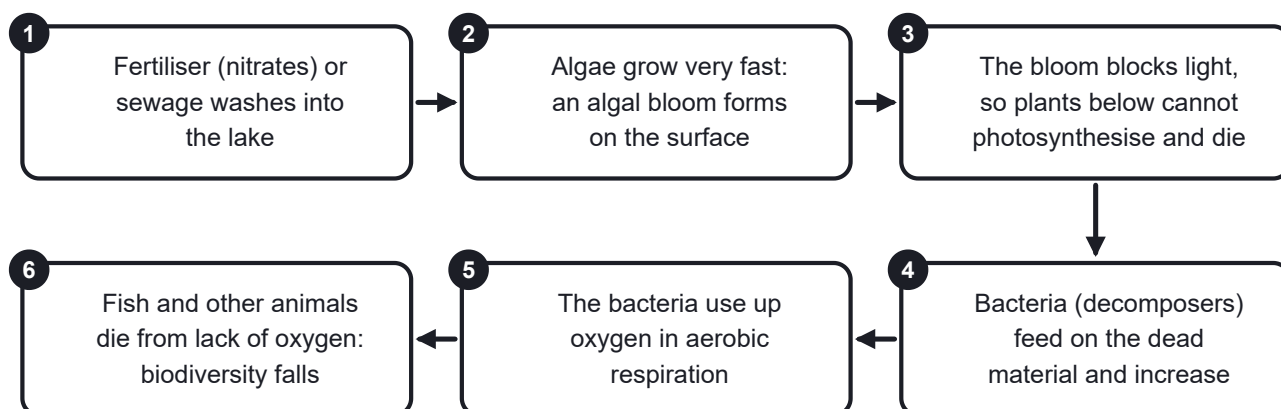
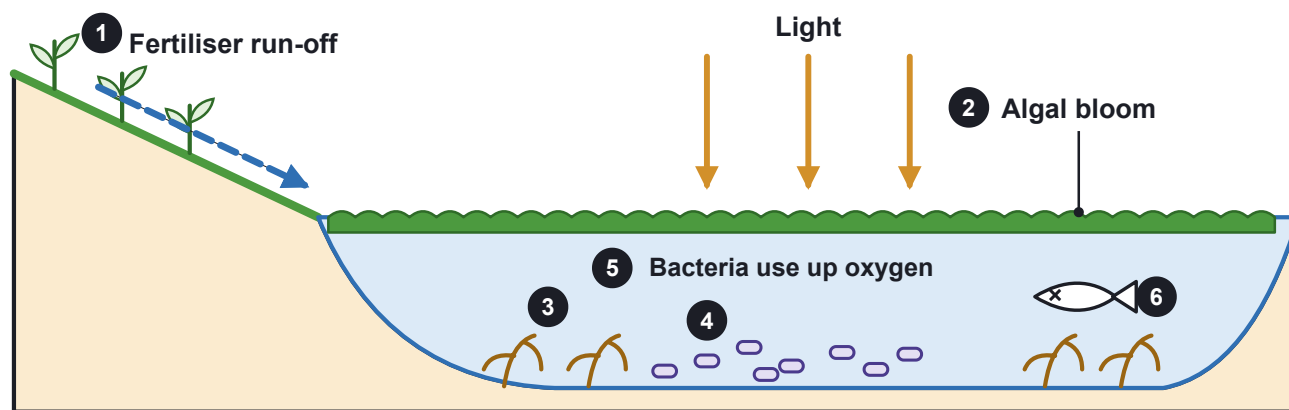
Supplement

Eutrophication

Supplement

1. Nitrate and other ions increase in availability in the water.
2. Producers (algae and water plants) grow faster, forming an algal bloom that blocks light.
3. Producers deeper in the water cannot photosynthesise and die; there is increased decomposition after their death.
4. Decomposers (bacteria) increase in number and carry out increased aerobic respiration.
5. The decomposers use up oxygen, so there is a reduction in dissolved oxygen.
6. Organisms that require dissolved oxygen, such as fish and insect larvae, die.

Supplement



Eutrophication: from fertiliser run-off to the death of fish.

Supplement

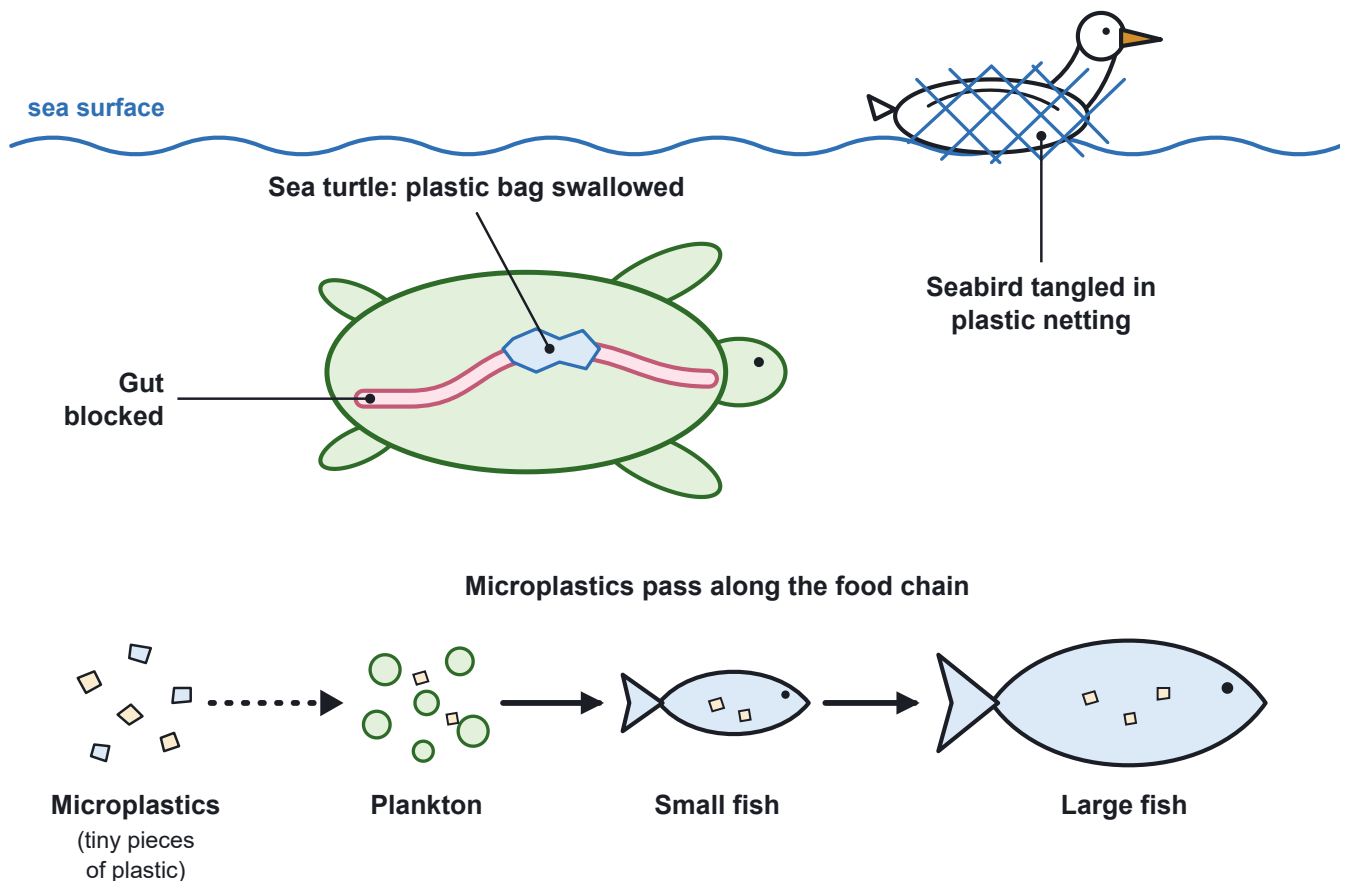
Exam tip: Do not say the algae 'use up the oxygen'. It is the decomposers' aerobic respiration, after the producers die, that lowers dissolved oxygen.

Non-biodegradable plastics Spec 20.3.2

Plastics are **non-biodegradable**: microorganisms cannot break them down, so they stay in the environment for a very long time. Plastics are widely used for packaging and are often thrown away carelessly.

Effects of non-biodegradable plastics

Ecosystem	Effects
Aquatic (rivers, seas)	Animals such as turtles, seabirds and fish swallow plastic, which can block their digestive system so they starve; animals become tangled in plastic and drown or cannot move; plastic breaks into tiny pieces that enter food chains
Terrestrial (land)	Plastic waste in landfill takes up space and does not rot; animals eat plastic or become trapped in it; plastic can build up in soil and may release harmful chemicals; plastic waste can block drains and watercourses



Plastic **blocks the gut**, **entangles** animals and enters **food chains** as microplastics.

Exam tip: Always link the plastic to a specific harm: 'blocks the gut' or 'entangles the animal', not just 'it harms animals'.

Methane, carbon dioxide and climate change Spec 20.3.3

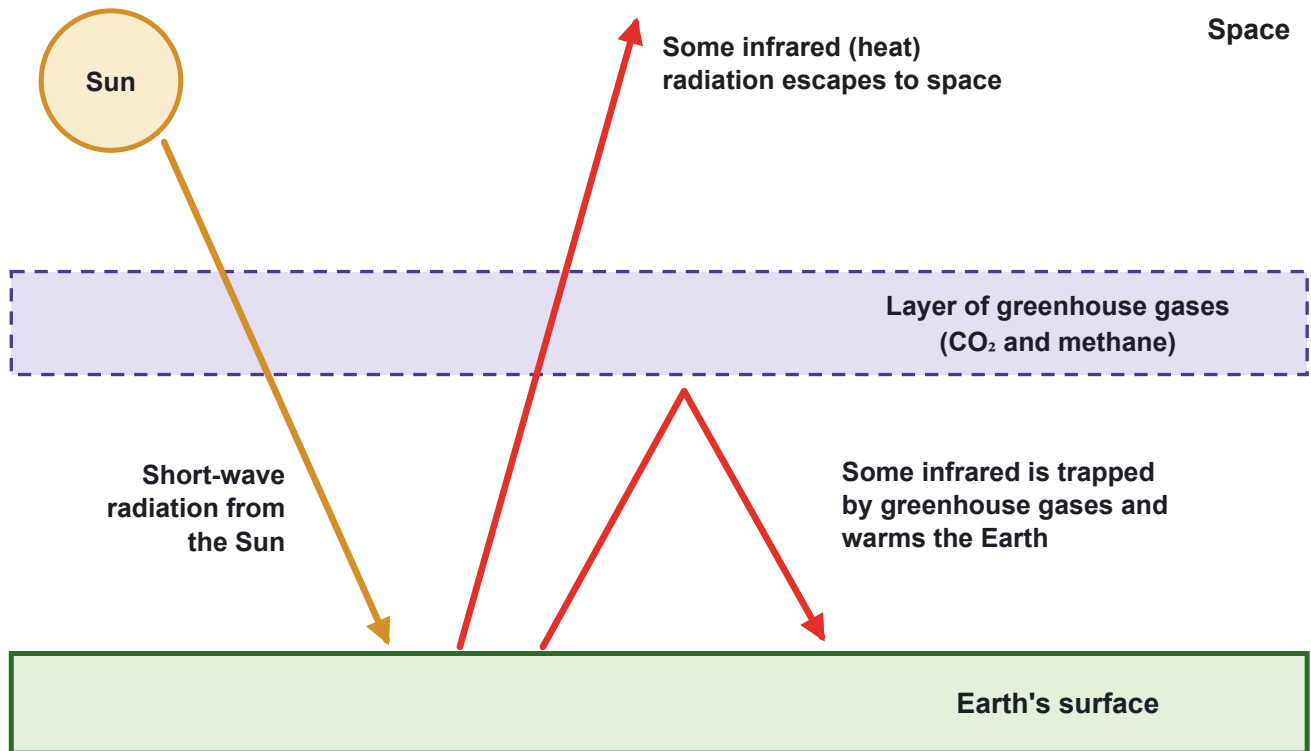
Sources of methane and carbon dioxide

Gas	Sources
Carbon dioxide	Burning fossil fuels (in vehicles, power stations and homes); burning forests; respiration of decomposers when trees decay
Methane	Cattle and other livestock (from digestion); rice paddy fields; decomposition of waste in landfill sites

The enhanced greenhouse effect

- Short-wave radiation from the Sun passes through the atmosphere and warms the Earth's surface.
- The Earth re-radiates this energy as infrared (heat) radiation.
- Greenhouse gases** such as carbon dioxide and methane trap some of this infrared radiation in the atmosphere, which keeps the Earth warm. This is the natural greenhouse effect.
- Human activities have increased the concentrations of carbon dioxide and methane, so more heat is trapped. This is the **enhanced greenhouse effect**.

The average temperature of the Earth rises (global warming). This leads to **climate change**. Effects include melting ice caps and rising sea level, changes to rainfall and weather, and loss of habitats, so some species may become endangered or extinct.



Greenhouse gases such as carbon dioxide and methane trap infrared radiation. More of these gases traps more heat.

Common mistake: The greenhouse effect is not caused by a hole in the ozone layer. These are separate issues.

Quick check

1. Why does excess fertiliser harm rivers and lakes?
2. Why do non-biodegradable plastics last so long?
3. Name two sources of methane.
4. What is the enhanced greenhouse effect?

4 Conservation Spec 20.4

Sustainable resources: forests and fish stocks Spec 20.4.1, 20.4.2, 20.4.5, 20.4.6

Sustainable resource A resource which is produced as rapidly as it is removed from the environment so that it does not run out.

Some resources can be conserved and **managed sustainably**. Two examples are **forests** and **fish stocks**.

Supplement

Conserving forests

Supplement

Conserving forests

Method	How it helps
Education	People learn why forests matter, so they use wood carefully and support protection
Protected areas	Laws stop trees being felled in national parks and reserves, so habitats and species are kept
Quotas	Limits on how many trees can be cut, so wood is removed no faster than it grows back
Replanting	New trees are planted to replace those felled, so forest cover is maintained

Supplement

Conserving fish stocks

Supplement

Conserving fish stocks

Method	How it helps
Education	Fishers and consumers learn about overfishing and choose sustainable fish
Closed seasons	Fishing is banned during the breeding season, so fish can reproduce
Protected areas	Fishing is banned in some areas so populations can recover
Controlled net types and mesh size	Larger mesh lets young fish escape, so they can grow and breed; nets that catch other species by accident are banned
Quotas	Limits on the mass or number of fish that can be caught, so they are not removed faster than they reproduce
Monitoring	Fish populations are counted regularly so that quotas can be adjusted

Supplement

Exam tip: Say how each method helps: 'larger mesh size lets young fish escape so they can breed later', not just 'larger mesh size'.

Endangered species and how to conserve them Spec 20.4.3, 20.4.4, 20.4.8

An **endangered** species is at risk of dying out. A species is **extinct** when no individuals are left alive anywhere.

Why organisms become endangered or extinct

Causes of endangerment and extinction	
Cause	Explanation
Climate change	Habitats change too quickly for species to adapt or move
Habitat destruction	Loss of food, shelter and breeding sites
Hunting	Animals are killed for meat, fur, horns or tusks faster than they reproduce
Overharvesting	Plants or animals are collected or caught faster than they can be replaced
Pollution	Poisons or waste make habitats unsuitable or kill organisms
Introduced species	A non-native species may compete with, prey on or spread disease to native species

How endangered species can be conserved

- **Monitoring and protecting species and habitats:** populations are counted, and reserves and laws protect the animals and their habitats.
- **Education:** people are taught why species matter, so they support conservation.
- **Captive breeding programmes:** animals are bred in zoos and reserves, and young may be released into the wild.
- **Seed banks:** seeds of rare plants are stored at low temperature so that plants can be grown later if the wild population dies out.

Supplement

Artificial insemination and IVF in captive breeding

Supplement

- **Artificial insemination (AI):** sperm is collected from a male and placed into the female by a technician. It allows breeding between animals in different zoos without moving them, and helps animals that will not mate naturally.
- **In vitro fertilisation (IVF):** eggs are fertilised by sperm outside the body in a laboratory. The embryos are placed into the female, or into a surrogate female, to develop. This produces more offspring than natural mating.
- With both methods, conservationists can choose parents that are not closely related, which helps to keep genetic variation in the captive population.

Common mistake: Captive breeding programmes alone do not save a species. The habitat must also be protected so that the animals can be released.

Reasons for conservation programmes Spec 20.4.7, 20.4.9 Supplement

Reasons for conservation programmes

- **Maintaining or increasing biodiversity,** so that there are many species in an area.
- **Reducing extinction,** because extinction is permanent.
- **Protecting vulnerable ecosystems,** such as rainforests and coral reefs, which are easily damaged.

- **Maintaining ecosystem functions:** nutrient cycling and resource provision, including food, drugs, fuel and genes.

Nutrient cycling relies on decomposers and a variety of organisms. Resource provision means ecosystems supply food, medicines (drugs from plants), fuel such as wood, and genes in wild species that may be useful for breeding crop plants and livestock or for genetic engineering.

Risks of reduced population size

When the population of a species decreases, genetic variation is reduced because there are fewer different alleles in the population. This brings risks:

- Fewer individuals have alleles that give resistance to a new disease, so the disease can kill most or all of the population.
- If the environment changes, there may be no individuals with features suited to the new conditions, so the species is less able to adapt and survive.
- Related individuals are more likely to breed together, which can increase inherited disorders.

Exam tip: Link the small population to the loss of variation, then to what happens when the environment changes or disease arrives. Genetic drift is not required.

Quick check

1. Define a sustainable resource.
2. Give four reasons why species become endangered or extinct.
3. What is a seed bank?
4. **Supplement** Why does a small population have a greater risk of dying out?
5. **Supplement** Why does a larger mesh size help conserve fish stocks?

Quick check answers

Food supply

1. Machinery, chemical fertilisers, insecticides, herbicides and selective breeding.
2. The growing of a single crop plant on a large area of land.
3. A pest or disease can spread quickly through the crop (or low biodiversity).
4. Lots of food is produced from a small area, at a lower cost.

Habitat destruction

1. The number of different species that live in an area.
2. Housing, crop and livestock production; extraction of natural resources; freshwater and marine pollution.
3. Fewer roots and leaves to absorb water, so more water runs into rivers.
4. Fewer trees photosynthesise, and burning or decay of trees releases CO₂.

Pollution

1. Nitrates cause rapid growth of algae and water plants, which can lead to eutrophication and the death of other organisms.
2. Microorganisms cannot break them down.
3. Cattle (livestock); rice paddy fields; landfill sites.
4. Extra heat trapped in the atmosphere because human activity has raised carbon dioxide and methane levels.

Conservation

1. One which is produced as rapidly as it is removed from the environment so that it does not run out.
2. Any four of: climate change, habitat destruction, hunting, overharvesting, pollution, introduced species.
3. A store of seeds from rare plants, kept so that the plants can be grown again if wild populations are lost.
4. Less genetic variation, so fewer individuals may survive disease or environmental change.
5. Young fish escape and can grow and breed.