4.3 Aquatic food production systems

Name: _____ Class: _____ Date: _____ **Total: 21 marks**

KEY WORDS fishery • tragedy of the commons • maximum sustainable yield • quota • bycatch • aquaculture

Objective

Build the skills to answer exam questions on **aquatic food production** : fisheries, **maximum sustainable yield** , overfishing and its management, and **aquaculture** .

You must be able to:

- explain how fish stocks are overexploited, using the idea of the commons
- use the maximum sustainable yield model
- evaluate ways to manage fisheries
- evaluate the environmental impacts of aquaculture

1 Key knowledge and worked examples

■ Fisheries and aquaculture

The open sea is a **commons**: no one owns it, so each fishing boat gains from catching more while the cost of a shrinking stock is shared by all – the **tragedy of the commons**. Bigger boats, sonar and huge nets have made overfishing easy.

Maximum sustainable yield (MSY): the largest catch that can be taken year after year without reducing the stock. A fish population grows fastest at about **half its carrying capacity**, so the MSY is taken there. Fishing above MSY makes the stock and the catch fall.

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Collapse: the Grand Banks cod off Newfoundland collapsed by the early 1990s after years of overfishing; Canada banned cod fishing in 1992, and the stock has recovered only slowly.

management	how it works
quotas	a maximum catch per year, based on stock surveys
minimum mesh size	young fish escape and can breed
closed seasons and areas, MPAs	protect spawning and nursery grounds
bans on gear	e.g. bottom trawling that destroys the seabed
eco-labels	consumers can choose sustainable fish

Bycatch is unwanted species (dolphins, turtles, young fish) caught by accident.

Aquaculture (fish farming) now gives about half of the fish people eat. Impacts: mangroves cleared for shrimp ponds; waste and uneaten food cause eutrophication; disease and parasites spread to wild fish; escaped fish compete with wild ones; feed made from wild fish.

Answer shapes: link each management method to what it protects (adults, young, breeding grounds, habitat).

2 Practice

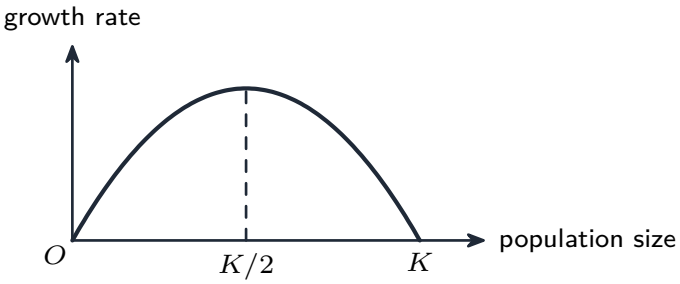
2.1 Explain why the open ocean fishery is called a "commons". [2]



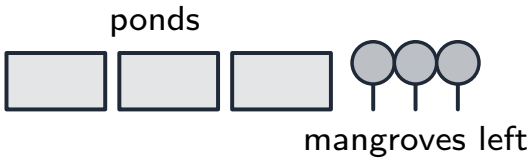
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2.2 Use the MSY graph. (i) State the population size at which MSY is taken. (ii) Explain why catching more than the MSY each year causes the catch to fall later. [3]



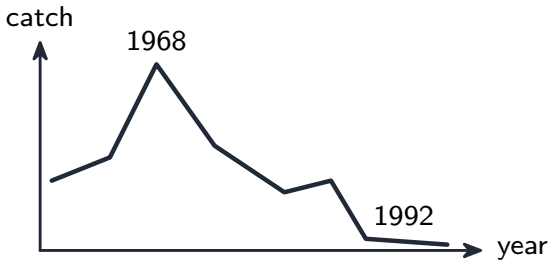
2.3 Explain **three** environmental impacts of farming shrimp in coastal ponds. [3]



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3 Exam-style questions

3.1 The graph shows the cod catch off Newfoundland, Canada.



(a) Describe the trend in the catch. [2]

(b) Explain why the stock has recovered only slowly since fishing stopped in 1992. [2]

3.2 A government wants to protect a declining fishery.



(a) Explain how **two** management methods would help the stock recover. [4]

(b) Suggest **one** reason why fishers may not follow the rules. [1]

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3.3 Some environmental groups say "eat farmed fish to save the oceans".



Evaluate this advice. [4]

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Solutions

Marking: **M1** a correct method, **A1** the correct answer, **B1** an independent mark.

Each answer shows the steps, then the **result**.

2.1

it is shared and owned by no one, so access is open to all; each fisher gains by catching more, while the loss of stock is shared, so overfishing results

2.2

(i) about half the carrying capacity, $K/2$; (ii) catch above MSY is larger than the yearly growth, so the stock falls; a smaller stock produces fewer young, so the growth and the possible catch fall further

2.3

mangroves are cleared, removing nursery habitat and coastal protection; waste, food and chemicals flow out and cause eutrophication; disease and antibiotics spread to wild populations / feed uses wild-caught fish

3.1

(a) catches rose to a peak in the late 1960s, fell, then collapsed to almost zero by the early 1990s

(b) the remaining population was very small, with few large breeding adults; the ecosystem changed: other species and predators took cod's place, and bycatch and cold water also slowed recovery

3.2

(a) any two, each explained: quotas keep the catch below the yearly growth; a larger mesh size lets young fish escape and breed; a closed season or area protects spawning fish

(b) loss of income or jobs / weak enforcement at sea / other countries keep fishing

3.3

award up to [4]: for: farming adds supply without catching wild stocks; herbivorous species such as carp or tilapia need little fish feed; against: carnivorous farmed fish (salmon) are fed fishmeal from wild fish; pollution, disease and escapes harm wild populations, and coastal habitats may be lost; conclusion: true for some species and well-run farms, not for all

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