Exam Papers Practice

4.3 Aquatic Food Production Systems

Mark Schemes

Course	SL IB Environmental Systems & Societies (ESS)
Section	4. Water & Aquatic Food Production Systems & Societies
Topic	4.3 Aquatic Food Production Systems
Difficulty	Medium

To be used by all students preparing for
SL IB Environmental Systems & Societies (ESS)
Students of other boards may also find this useful

1a

Indicative Content	Commentary
Ammonia is converted into nitrates by: • Nitrifying bacteria / nitrification; [1 mark] • Ammonium is (first) converted to nitrite; [1 mark] • Nitrite is (then) converted to nitrate; [1 mark]	Be careful not to mix up **nitrifying** bacteria, which convert ammonia to nitrates, with **nitrogen fixing** bacteria, which convert nitrogen from the atmosphere into nitrates

1b

Indicative Content	Commentary
The multi-trophic level aquaculture system reduces environmental pollution and increases the profits of fish farming in the following ways: Any **five** from the following: • Waste food / faeces eaten/removed (by lobsters and crabs); [1 mark] • Less decomposition (occurs) / fewer decomposers/bacteria (are present); [1 mark] • Less disease/infection (due to reduced numbers of bacteria); [1 mark] • Less respiration (by bacteria/decomposers); [1 mark] • More oxygen in the water / less oxygen is removed (by the respiration of bacteria); [1 mark] • Nitrates/minerals/named minerals/nutrients / carbon dioxide are/is removed by seaweed (to use in building organic molecules); [1 mark] • Less algal growth/bloom / eutrophication (due to reduced availability of minerals in the water); [1 mark]	Most of this answer relates to the process of **eutrophication** and the main part of the mark scheme here focuses on this process, as well as adding in some detail relating to the commercial value of the farming technique You should

• More products can be sold / can sell lobsters/crabs/seaweed; [1 mark] • Food does not need to be bought for lobsters/crabs / mineral (fertilisers) not needed for seaweed; [1 mark] ***Accept*** *an increase in fish/animal respiration for marking point 4* ***Accept*** *seaweed releases oxygen (into the water during photosynthesis) for marking point 5* ***Accept*** *fish provide carbon dioxide for seaweed (to photosynthesise) for marking point 6*	note that the accepted answers in italics beneath the main mark scheme do not relate directly to eutrophication but are desirable and profitable side-effects of its prevention

2a

Indicative Content	Commentary
Comments on the changes in the mass of fish caught by traditional fishing and the mass of fish produced by fish farming from 1960 to 2016 could include: Any **five** from the following: *Traditional fishing graph:* • (Mass of fish caught by) traditional fishing increased (in all countries); [1 mark] • (It) increased by almost the same proportion/factor in each country; [1 mark] *Fish farming graph:* • Mass of fish produced by farming increased (in all countries); [1 mark] • (Mass of fish) increased most in A; [1 mark] • (There was) higher growth in C than B; [1 mark]	The command word **comment** is quite a broad instruction that requires you in this case to consider a number of variables from the data and to form a **judgement** on the data, so you need to pay

Comparing the graphs: • A greater mass / more tonnes from farming/graph 2 than from traditional fishing/catching in A/C **OR** a lower mass / fewer tonnes from farming/graph 2 than from traditional fishing/catching in B; [1 mark] • In both methods A has the highest mass (of fish); [1 mark] *Other points for comment:* • There is no information on fish species/type; [1 mark] • There is no information on sustainability (of each method); [1 mark] • Data is not expressed per capita / member of the population (so we don't know whether the mass of fish caught/produced is sufficient to feed the population / too much); [1 mark]	attention to all aspects of the information provided Marks are awarded for **descriptions** of individual pieces of data, for **data comparison**, and for points relating to the **usefulness** of the data provided

2b

Indicative Content	Commentary
The methods a fish farmer can use to maximise the production of fish include: Any **four** from the following: • Keep different species of fish separate / use nets to prevent predation; [1 mark] • Keep different sizes/ages of fish separate / use nets to prevent predation; [1 mark] • Provide food that is high in protein and in small quantities (to prevent waste building up); [1 mark] • Give fish antibiotics/antifungals/fungicides to reduce disease/infection; [1 mark]	Simple answers such as 'controlling diet' for marking point 3 or 'cleaning the water' for marking point 5 would not gain a

• (Filter water to) remove faeces/waste / algae / dead fish; [1 mark] • Aerate water / pump air through water to maintain oxygen levels; [1 mark] • Use selective breeding / genetic modification/GM (to maximise yield); [1 mark]	mark as they contain insufficient detail

3a

Indicative Content
Strategies that can be used to make wild capture fisheries more sustainable include: Any **four** of the following: • Implementation of fishing quotas / adherence to international regulations to combat overfishing / by-catch / capture of endangered species; [1 mark] • Establishment of marine protected areas / exclusion zones / limited fishing zones / designated fishing zones to limit fishing activities in sensitive areas / safeguard critical ecosystems; [1 mark] • Enforcement of restrictions/bans on specific types/sizes of fishing gear to prevent destructive practices / reduce bycatch e.g. mesh size / bottom trawling / drift nets / cyanide/dynamite fishing; [1 mark] • Implementation of controls on fishing time / season / (minimum) size / (minimum) age of catch to allow fish stocks to replenish / to ensure a balanced fish population; [1 mark] • Utilisation of technology/permits/licenses/fine to monitor/reduce/punish illegal fishing activities; [1 mark] • Investment in (international and local) research to scientifically/accurately determine the maximum sustainable yield / support the calculation of appropriate fishing limits; [1 mark] • Introduction of labelling schemes to provide consumers with information about the sustainability of fish products; [1 mark] • Promotion of campaigns to reduce wild fish consumption and encourage the adoption of responsible aquaculture practices

- Efforts to reduce pollution / plastic waste that harms fish and their habitats; [1 mark]

3b

Indicative Content
Negative environmental impacts of aquaculture include: Any **two** from the following: • Degradation/loss of natural habitats due to aquaculture operations / resulting from the clearance of land for aquaculture; [1 mark] • Entanglement of local/native/endemic species in aquaculture nets/cages; [1 mark] • Spread of diseases among farmed fish that can affect surrounding ecosystems **OR** high-density aquaculture leads to increased disease susceptibility / rate of disease transmission; [1 mark] • Pollution from organic waste / excess feed causing eutrophication / sediment build up; [1 mark] • Pollution resulting from the use of antibiotics / medications / growth hormones /pesticides in aquaculture; [1 mark] • Accidental escape of genetically modified organisms / GMOs / non-native species that negatively impact wild fish populations **OR** escaped farmed fish posing a threat to wild stocks through genetic mixing/degradation / disease transmission / competition; [1 mark] • Depletion of freshwater resources / aquifer depletion / salinisation due to aquaculture practices; [1 mark]

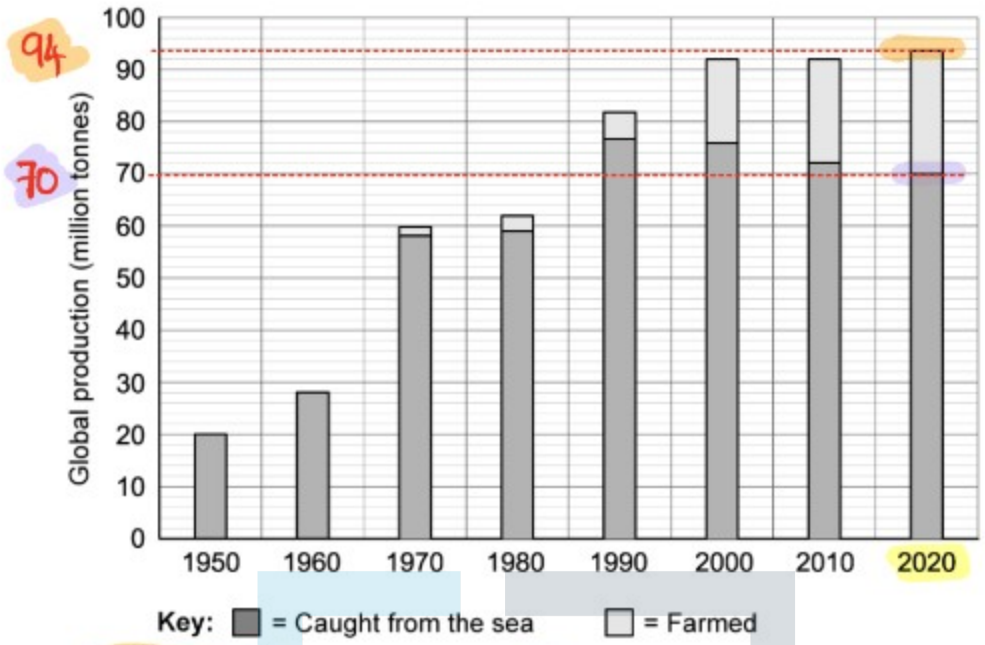
4a

Indicative Content	Commentary
An extinction of cod would have the following impact in the Atlantic Ocean: Any **three** from the following:	Changes at one part of a food web can have drastic effects on the food web as a

• Shrimp have fewer predators, so their population numbers would increase; [1 mark] • Resulting in a decrease in phytoplankton numbers; [1 mark] • Seals lose a food source so numbers decrease **OR** seals will have a greater reliance on penguins and squid; [1 mark] • Resulting in a decrease in penguin and squid numbers; [1 mark]	whole Atlantic cod stocks are currently depleted and overfished, with many populations showing significant declines and struggling to recover

4b

Indicative Content
i) Reasons for the increase in production of farmed fish and seafood between 1950 and 2020 include: Any **two** from the following: • Overfishing / fewer wild fish available to be caught; [1 mark] • Ability to control production / quality; [1 mark] • Increased demand for fish products; [1 mark] • Better (fish farming) technology available; [1 mark] • Economic benefits / cost; [1 mark] *ii) The percentage of the total catch made up of farmed fish in 2020 is:* • 94 - 70 = 24; [1 mark] • (24 ÷ 94) × 100% = 25.5% / 26%; [1 mark]



① Total caught in 2020 = 94 mt

② Total wild-caught from the sea in 2020 = 70 mt

③ Calculate the difference for farmed fish = 94 - 70 = 24 mt [1 mark]

④ Proportion of the total made up of farmed fish = $\frac{24}{94} \times 100\%$

= 25.5 or 26 % [1 mark]

[Total: 2 marks]