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**IB ESS**

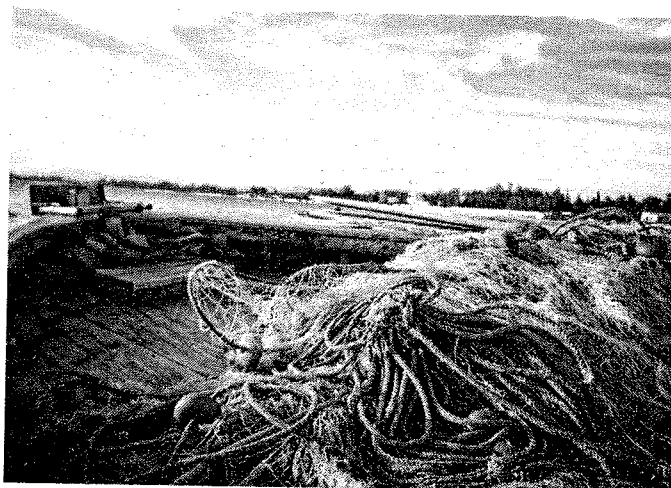
# 4.3 Aquatic Food Production Systems

## Significant ideas:

Aquatic systems provide a source of food production.

Unsustainable use of aquatic ecosystems can lead to environmental degradation and collapse of wild fisheries.

Aquaculture provides potential for increased food production.



## Aquatic Food Webs

1. State the trophic level of phytoplankton in an aquatic food web.

Primary producers / first trophic level

2. Distinguish between benthic and pelagic marine organisms.

Benthic organisms live and feed on sea floor eg. corals and  
pelagic organisms swim in the water column eg. tuna

3. Explain the distribution of varying productivity in marine ecosystems.

Not all regions of the sea are equally productive. The growth of phytoplankton population is dependent on light levels and nutrient availability. Growth of phytoplankton in the tropical and subtropical gyres is generally limited by nutrient supply, while light often limits phytoplankton growth in subarctic gyres. Nutrient upwellings along the coast, combined with agricultural run-off can also lead to increased primary productivity closer to continental shelves when compared with open water.

4. Explain why the territorial water of a country is of significant value to a nation.

They provide food and income. Globally fishing provides more than 1.5 billion people with almost 20% of their average intake of animal protein. Most tropical coral is found within territorial water - these regions are extremely biodiverse and attract tourism.



## (Un-) Sustainable Fishing

1. State and explain the trend in demand for aquatic food resources over time.

Demand is increasing. As a greater proportion of the population becomes wealthier (particularly in China and India) they can afford to eat seafood. The price has dropped and consuming fish has health benefits.

2. Describe what is meant by the term "aquaculture".

Farming of aquatic organisms. This can involve breeding, rearing, and harvesting of fish, shellfish, plants and algae in both marine and freshwater environments.

3. The amount of food provided by wild-catch fish is plateauing worldwide, while the amount provided by aquaculture is increasing. Suggest reasons for this.

Wild stocks are dwindling due to overfishing and mis-management. Aquaculture is being more widely used and advancing technology enables greater productivity.

4. Explain the need for more sustainable aquaculture.

- Aquaculture can be quite harmful to the environment since;
  - If fish escape their pens they can outcompete native/local fish → invasive
  - Breeding fish in close proximity can lead to disease outbreaks
  - Breeding in large quantities can lead to high levels of faecal matter entering the water which can lead to eutrophication
  - Set up can involve clearing coastal habitats eg mangroves + less biodiversity

5. Describe ways in which aquaculture is becoming more sustainable.

- Pens are being moved to offshore locations so no coastal habitats have been destroyed
- Polyculture farming is being developed so that faecal matter is being consumed by other organisms eg sea cucumbers or algae. This reduces nutrient levels in the water and prevents eutrophication
- Native fish are being farmed so if they escape they have less impact on the local ecosystem
- Feeding fish pellets made from insects rather than other fish



6. Outline an aquaculture system that is unsustainable, and explain the ways in which it is unsustainable.

Open-ocean cage aquaculture - can be unsustainable if the site selected has to be cleared (reef or mangrove). Extra fish add effluent to the waterway, which can lead to eutrophication. If fish escape pens they can compete with local native fish.

Terrestrial tank aquaculture - requires land to be set aside for farm. Everything is externally controlled, from the temperature of the water to filtration of waste and added feed.

Often carnivorous fish are bred, which involves feeding fish other fish (which does not reduce wild fish pressures).

Large volumes of waste are produced that need to be processed and often end up in rivers or sent to landfills.



7. Explain how modern fishing practices and technology contribute to the unsustainability of the wild fishing industry. Use the table to guide your answers.

GPS navigation	GPS fish finders enable fishermen to locate fish in the water enabling them to find fish quickly and concentrate fishing in areas with known stocks
At-sea refrigeration techniques	Enables fishermen to snap freeze fish as they are caught. Ships can stay out longer and catch more fish as they do not have to get fish to market
Factory vessels	A ship with extensive on-board facilities for processing and freezing fish. Capable of storing tonnes of fish and trawling for weeks at a time.
Indiscriminate fishing equipment	Large amounts of by-catch (animals that were not meant to be caught including smaller fish, turtles, dolphins). Do not have high survival rate.
Use of trawlers	Trawlers are indiscriminate as the boats throw large nets into the water. They can be destructive if using bottom trawlers that damage sea floor ecosystems (reefs) as they drag across them.



8. Summarise ways in which unsustainable exploitation of aquatic systems can be mitigated.

Moratorium on fishing

Marine reserves set up - seasonally or permanently

Net hole sizing that is more specific for target species

Long lining rather than trawling

Education to reduce consumption of endangered species or species

whose harvesting is particularly damaging such as wild caught prawns.

9. Evaluate the above strategies.

Marine reserves are one of the better methods to mitigate aquatic exploitation. When regions of the ocean are set aside, fish populations rebound e.g. Apo Island in the Philippines. By conserving a habitat an increasing abundance of fish inside the marine reserve follow. This also increases the production and spillover of fish outside the marine reserve so fishermen benefit.

However setting up a marine reserve requires policing of the

waterways to ensure that people do not fish in the reserve.

Fish can still be fished outside the reserve so ensuring that nursery sections of the environment are under protection is very important.



## Controversial Fishing

1. Describe what is meant by the term "biorights".

An organism has the biological right to exist, live and breed independent of human value systems.

Equivalent of human rights.

2. What type of environmental value system is expressed by a person who puts a strong emphasis on biorights?

Ecocentric or deep ecologist.

3. Summarise the arguments against harvesting of seals and whales.

Seal and whale hunting methods are considered brutal and cruel.

The populations of seals and whales are vulnerable (or endangered) and so need conserving.

Seals and whales play an important role in the ecosystem.

4. List some of the products made from whales.

Meat (food) Blubber (oil for lamps) bones (umbrellas and corsets) ambergris (perfume).

5. State and justify your opinion on the harvesting of whales.

In some cases such as the North American Inuit population whaling is a central part of their culture and provides a vital source of protein in their diet. They only hunt bowhead whales which are not endangered so the hunt is sustainable. Commercial whaling, however, is not as sustainable and so should be discontinued.



## Controversial Fishing – CASE STUDY

To answer the following questions you will need to conduct your own research into whaling in Iceland, and amongst Inuit people. You can use the following resources as a starting point:

[iwc.int/](http://iwc.int/)

[iwc.int/aboriginal](http://iwc.int/aboriginal)

[uk.whales.org/issues/whaling-in-iceland](http://uk.whales.org/issues/whaling-in-iceland)

1. What is the International Whaling Commission and what is their role? [iwc.int.org](http://iwc.int.org)

The IWC is the global body charged with the conservation of whales and the management of whaling. Set up in 1946. Today addresses other issues such as bycatch and entanglement, ocean noise pollution and debris, collisions between whales and ships and sustainable whale watching. Oman joined 1980.

2. There is currently a moratorium on whaling. Explain what this means.

Moratorium is a temporary ban on activity. In 1982 the IWC decided that there should be a pause in commercial whaling on all whale species + populations from 1985/1986 season onwards.

3. Summarise Iceland's historical relationship with the IWC.

The IWC agreed to stop all commercial whaling by 1986. Iceland, however, continued its scientific whaling programme. Since then Iceland has continued whaling approximately 200 whales per year.

In 2019 Iceland stopped hunting whale due to change in public opinion and declining whale meat consumption.

4. Despite being a member of the IWC and therefore subject to the moratorium, Iceland continued to hunt fin whales (amongst other whale species). What loophole did they use?

Iceland filed a reservation to the treaty as the whaling commission doesn't create binding laws. It's more a formal agreement of faith.

4. State and explain the current ruling on whaling for aboriginal groups such as Inuits.

IWC always recognized the difference. Aboriginal whaling does not seek to maximise catches or profit. It is categorised differently by the IWC and so not subject to the moratorium. It is a part of cultural practise and the numbers killed are low.





5. Compare whaling practices and justification by Iceland with those of the Inuit people.

Whaling is part of the culture of Inuit people. Subsistence whaling is important as it provides more than half of the Inuit diet. The rest is made up of caribou, walrus and other animals whose populations are predicted to rapidly decline if whaling was stopped. The Inuit hunt less than 5 whales per annum - this number is too low to have an impact on the overall population.

In comparison, whale meat is not culturally significant in Iceland and does not form part of the traditional diet.

A 2016 survey revealed that only 1.5% of the population regularly purchases whale meat. Most of the whales hunted in Iceland are exported to Japan for commercial gain and most of the whale meat from minke whales is fed to tourists. By contrast the Inuit consume all of the meat from their hunt.

Today the hunt in Iceland is declining but the Inuit hunt will continue for the foreseeable future.



