Ecological Impacts of Fishing

Fishing is an ancient human tradition that not only satisfies our need for food, but is economically, socially, and culturally important. Today, however, tradition has been transformed in a worldwide resource extraction industry. Several decades of overfishing in all of the world's oceans has pushed commercially important species (such as cod) into steep decline. The United Nation's Food and Agriculture Organisation (FAO) reports that almost seven out of ten of the ocean's commercially targeted marine fish stocks are either fully or heavily exploited (44%), over-exploited (16%), depleted (6%), or very slowly recovering from previous overfishing (3%). The maximum sustainable yield has been exceeded by too many fishing vessels catching too many fish, often using wasteful and destructive methods.

Lost fishing gear (particularly drift nets) threatens marine life. Comprehensive data on ghost fishing impacts is not available, but entanglement in, and or ingestion of, fishing debris has been reported for over 250 marine species.

Over-capitalisation of the fishing industry has led to the build up of excessive fishing fleets, particularly of the large scale vessels. This has led to widespread overfishing (with many fish stocks at historic lows and fishing effort at unprecedented highs). Not only are the activities of these large vessels ecologically unsustainable in terms of fish stocks but, on average, for every calorie of fish caught, a fishing vessel uses 15 calories of fuel.

Bottom trawls and dredges cause large scale physical damage to the seafloor. Non-commercial, bottom-dwelling species in the path of the net can be uprooted, damaged, or killed, turning the seafloor into a barren, unproductive wasteland unable to sustain marine life. An area equal to half the world's continental shelves is now trawled every year. In other words, the world's seabed is being scraped 150 times faster than the world's forests are being clear-cut.

Due to the limited selectivity of fishing gear, millions of marine organisms are discarded for economic, legal, or personal reasons. Such organisms are defined as by-catch and include fish, invertebrates, protected marine mammals, sea turtles, and sea birds. Depending on the gear and handling techniques, some or all of the discarded animals die. A recent estimation of the worldwide by-catch is approximately 30 million tons per year, which is about one third of the estimated 85 million tons of catch that is retained each year.

Longline fishing (mainly for tuna) results in the death of 100,000 albatrosses and petrels every year in the southern Pacific alone. Six of the world's twenty albatross species are in serious decline and longline fishing is implicated in each case.

Over-harvesting of abundant species, or removal of too many reproductive individuals from a population, can have far reaching ecological effects. Modern boats, with their sophisticated fish-finding equipment, have the ability to catch entire schools of fish.

Fish farming, once thought to be the solution to the world's overfishing problems, actually accelerates the decline of wild fish stocks. Many farmed fish are fed meal made from wild fish, but it takes about one kilo of wild fish to grow 300 g of farmed fish. Some forms of fish farming destroy natural fish habitat and produce large scale effluent flows.

1. Explain the term over-exploitation in relation to commercial fisheries management:

2. Define the term by-catch:
The Peruvian Anchovy Fishery: An Example of Over-Exploitation

Before 1950, fish in Peru were harvested mainly for human consumption. The total annual catch was 86,000 tonnes. In 1953, the first fish meal plants were developed. Within nine years, Peru became the number one fishing nation in the world by volume; 1700 purse seiners exploited a seven month fishing season and Peru's economy was buoyant.

In 1970, fearing a crash, a group of scientists in the Peruvian government issued a warning. They estimated that the sustainable yield was around 9.5 million tonnes, a number that was being surpassed. The government decided to ignore this; due to the collapse of the Norwegian and Icelandic herring fisheries the previous year, Peru was the dominant player in the lucrative anchovy market. In 1970, the government allowed a harvest of 12.4 million tonnes. In 1971, 10.5 million tonnes were harvested. In 1972, the combination of environmental changes (El Niño) and prolonged overfishing led to a complete collapse of the fishery, which has never recovered.

3. Using an example, explain why a catch over the **maximum sustainable yield** will result in the collapse of a fishery:

4. Use the graph showing the relationship between age, biomass, and stock numbers in a commercially harvested fish population (below, right) to answer the following questions:

(a) State the optimum age at which the animals should be harvested:

(b) Identify the age range during which the greatest increase in biomass occurs:

(c) Suggest what other life history data would be required by fisheries scientists when deciding on the management plan for this population:

5. Discuss three methods by which fish populations can be conserved:

6. (a) Outline two advantages of marine fish farming:

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(b) Outline two disadvantages of marine fish farming:

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