OVER FISHING AND MITIGATION

Key words: Economy, Population, Mitigation

INTRODUCTION

Overfishing can be defined in a number of ways. However, everything comes down to one simple point: Catching too much fish for the system to support leads to an overall degradation to the system. Overfishing is a non-sustainable use of the oceans.

Below are a few definitions in use by organizations and governments.

The practice of commercial and non-commercial fishing which depletes a fishery by catching so many adult fish that not enough remain to breed and replenish the population. Overfishing exceeds the carrying capacity of a fishery.

Catching too many fish; fishing so much that the fish cannot sustain their population. The fish get fewer and fewer, until finally there are none to catch.

Fishing with a sufficiently high intensity to reduce the breeding stock levels to such an extent that they will no longer support a sufficient quantity of fish for sport or commercial harvest.

Worldwide, fishing fleets are two to three times as large as needed to take present day catches of fish and other marine species and as what our oceans can sustainably support. On a global scale we have enough fishing capacity to cover at least four Earth like planets.

On top of the overcapacity many fishing methods are unsustainable in their own way. These methods have a large impact on the basic functioning of our marine ecosystems. These unselective fishing practices and gear cause tremendous destruction on non target species. By catch discards and bottom trawling destruction are two examples of this.

Overfishing occurs when fishing activities reduce fish stocks below an **acceptable level**. This can occur in any body of water from a pond to the oceans. The notion of overfishing hinges on what is meant by an acceptable level of fishing. More precise biological and bioeconomic terms define acceptable level as follows:

Biological overfishing occurs when fishing mortality has reached a level where the stock biomass has negative marginal growth (slowing down biomass growth), as indicated by the red area in the figure. (Fish are being taken out of the water so quickly that the replenishment of stock by breeding slows down. If the replenishment continues to slow down for long enough, replenishment will go into reverse and the population will decrease.)

Economic* or *bioeconomic overfishing additionally considers the cost of fishing and defines overfishing as a situation of negative marginal growth of resource rent. (Fish are being taken out of the water so quickly that the growth in the profitability of fishing slows down. If this continues for long enough, profitability will decrease.) Resource rent is an economic term of abnormal or supernormal profit which derives from the exploitation of natural resources. A more dynamic definition of economic overfishing may also include a relevant discount rate and present value of flow of resource rent over all future catches.Ultimately overfishing may lead to resource depletion in cases of subsidized fishing, low biological growth rates and critical low biomass levels. Particularly, overfishing of sharks has led to the upset of entire marine ecosystems.

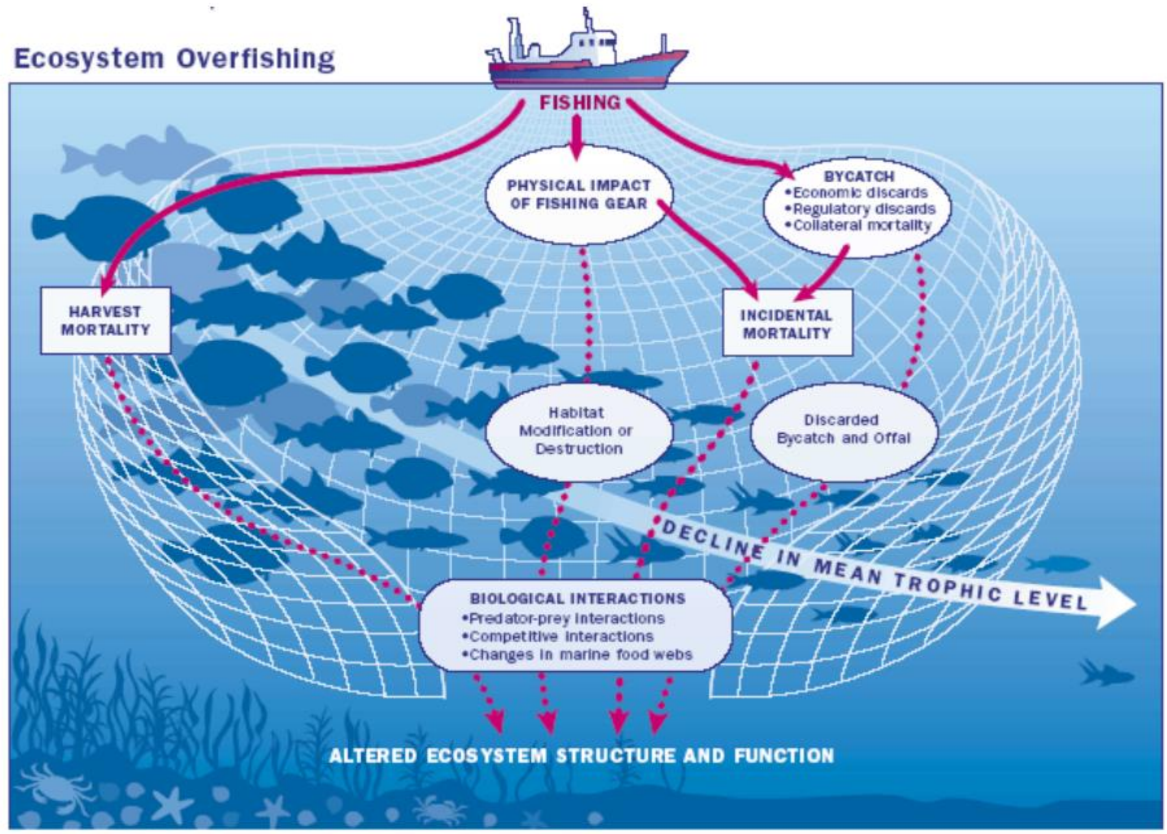
The ability of the fisheries to naturally recover also depends on whether the conditions of the ecosystems are suitable for population growth. Dramatic changes in species composition may establish other equilibrium energy flows that involve other species compositions than had been present before (ecosystem shift). For example, remove nearly all the trout and the carp might take over and make it nearly impossible for the trout to re-establish a breeding population.

Types of overfishing:

There are three recognized types of overfishing:

1. Growth overfishing
2. Recruit overfishing
3. Ecosystem overfishing

Growth overfishing is when fishes are harvested at an average size that is smaller than the size that would produce the maximum yield per recruit. Thus making the total yield less than it would be if the fish were allowed to grow to a reasonable size. Reducing fishing mortality to lower levels and increasing the average size of the fishes harvested to a length that would allow maximum yield per recruit.



Source: Adapted from Pauly et al., 1998; Goñi, 2000. Art: John Michael Yanson

Fig – 5.1

Recruit overfishing is when the mature adult (spawning biomass) population is depleted to a level where it no longer has the reproductive capacity to replenish itself. There are not enough adults to produce offspring. Increasing the spawning stock biomass to a target level is the approach taken by managers to restore an overfished population to sustainable levels. This is generally accomplished by placing moratoriums, quotas and minimum size limits on a fish population.

Ecosystem overfishing is when the balance of the ecosystem is altered due to overfishing. Declines in the abundances of large predatory species declines and in turn small forage type species increase in abundance, causing a shift in the balance of the ecosystem towards smaller species of fish.

Instances of Overfishing:

The number of endangered fishes in the United States continues to grow at a frightening rate. From the time of the first Anglo-European settlement in the New World, one-fourth of all fish species have become imperiled or gone extinct. The same holds true for one-half of freshwater mussel species, one-third of native crayfish, and one-fourth of all amphibian species.

In many cases their numbers have been driven below critical levels by ***over-fishing***. This has occurred to the Atlantic cod of the North Atlantic, the salmon of the Pacific Northwest, and to many species in estuaries near cities, such as rockfish and lingcod. Traditionally, fish populations were believed to be almost fantastically resilient. In the beginning, there were so many fish that people had trouble believing they could ever make a dent in their populations. A good example of this was the Pacific salmon, which at one time provided an abundance of cheap and tasty protein to residents of the West Coast. There are tales of salmon as big as a man, and so many swimming at once in a stream that a person could walk across their backs to the other bank. Atlantic cod, too, provided livings for fishing families in America for over two hundred years.

Fish Populations

This idea of resilient populations was in many ways made worse by population research techniques which mathematically indicated that the harder a population was fished, the more fishes the system would produce. There were several problems with this. First, the harder a population is fished, the smaller the individuals become. This means fishermen must catch more of them, wiping out any advantage of greater numbers.

Second, there is a critical level below which the population must not fall, else it will likely be doomed to extinction. Over-fishing, to succeed, depends on total cooperation from commercial interests as well as intimate knowledge of population numbers by scientists. We have learned, tragically, that only rarely will commercial interests cooperate with management measures. Basically, the race is on to scoop up as many fishes as possible in the shortest period of time. Worse, we've learned that our best scientific techniques will not allow us to accurately project populations, or even to accurately determine a current population. Over-fishing is not the great idea it used to be--and without the ability to determine current populations, it has become impossible to draw the line between ***sustainable fishing*** and over-fishing.

Finally, even when the line between over-fishing and sustainable fishing is accurately drawn, the whole concept falls apart in the face of catastrophic events. When drought strikes, or a chemical spill, or unseasonable weather, or a failure of a food source, or a disease, fishes need the extra numbers in order to buffer the loss to their populations. Without the extra numbers, populations sink below the critical levels. In short, there was a reason for the abundance of animals in a healthy, undamaged environment. Without enough animals, populations can go extinct during even the most minor of the periodic crises that nature provides.

Mitigation: Trying to Replace What's Gone

Mitigation is a popular strategy for managing endangered fish populations. Mitigation is the process of trying to replace something that has been lost. When a commercial interest plans to destroy an environment, for example to drain a marsh, build a dam, or build close enough to a water body that its health will be endangered, environmental protection agencies are called in to evaluate the situation and use federal and state law to assist endangered species.

Mitigation has been presented in these laws as a viable solution to any kind of development. Therefore, in only rare cases is a commercial interest required to modify its plans in any way, and almost never to cancel them. Instead, it spends money on mitigation. For example, a company may drain and pave over a marsh that served as habitat for endangered species and a resting stop for migrating birds, and replace it with an artificial pond ten miles away. In reality, even when such effort and expense is made that the new artificial environment looks just like the old to an inexperienced eye, it is nevertheless a sterile, lifeless environment that will be incapable of supporting the wildlife of the environment that it replaces for many decades or even centuries.

Legislation now requires rehabilitation of certain areas, e.g. creation of wetland. Wetland (or other habitat) would be created to “mitigate” or offset (compensate for) losses elsewhere. Mitigation is really restoration in where the targeted habitat never existed. Compensatory mitigation involves the creation of a habitat of equal size/value in trade for the loss/destruction of existing habitat. In most cases, mitigation requires creating more habitat (2 to 1, 3 to 1) than what is lost to development. The problem is the certain destruction of a vanishing habitat for the uncertain promise of similar habitat, very contentious issue

Problems with Mitigation:

- Often the local flow regime or sediment types are inappropriate for creating the new habitat
- To create a new habitat, the existing habitat, desirable or not, is destroyed
- Mitigation can proceed at a site some distance from the damage

With present and forecast levels of the world population it is not possible to solve the overfishing issue; however, there are mitigation measures that can save selected fisheries and forestall the collapse of others.
In order to meet the problems of overfishing, a precautionary approach and Harvest Control Rule (HCR) management principles have been introduced in the main fisheries around the world. The Traffic Light colour convention introduces sets of rules based on predefined critical values, which could be adjusted as more information is gained.

Habitat conservation

- Our tendency to be reactive instead of proactive is self-destructive and is contrary to the essence of life: to maintain our existence.
- Both ocean and land conservation is important

- Preserving habitats is essential to preserving biodiversity
  Establishing protected areas
    Zone Reserve Model
    Marine Protected Areas and Marine Reserves
      ex: NOAA Marine Sanctuary USA
      Marine Reserves in New Zealand

NOAA’s Center for Coastal Fisheries and Habitat Research

A mission was undertaken which provides coastal managers with scientific information and tools to make informed stewardship decisions about one of NOAA's protected areas—the Tortugas North Ecological Reserve. The Reserve was designated in July 2001 to protect and preserve the diverse marine life and special habitats in critical areas of the Florida Keys National Marine Sanctuary. In doing this, NOAA strives to balance society's environmental, social, and economic goals.

Fig – 5.2

The Reserve, located west of the Dry Tortugas National Park, has an area of 90 square nautical miles. It includes the coral reefs of the Tortugas Banks and the soft-bottom habitats of the West Florida Shelf. An ecological reserve is one type of marine zoning intended to protect habitats and the species using those habitats – an element of marine spatial planning.