

Sustainable exploitation of Aquatic Resources



Peter Henderson

Pisces Conservation Ltd.

www.irchouse.demon.co.uk

Peter@irchouse.demon.co.uk

Why have many fisheries collapsed?

The causes can be categorised under 3 headings

Over-fishing

The killing of too many animals for the population to replace itself.

Habitat damage

- ✚ Physical alteration to spawning grounds and habitat.
- ✚ Pollution.
- ✚ Obstructions to movement.

Climatic change

- ✚ Natural long-term changes and cycles
- ✚ Man-made climatic alteration

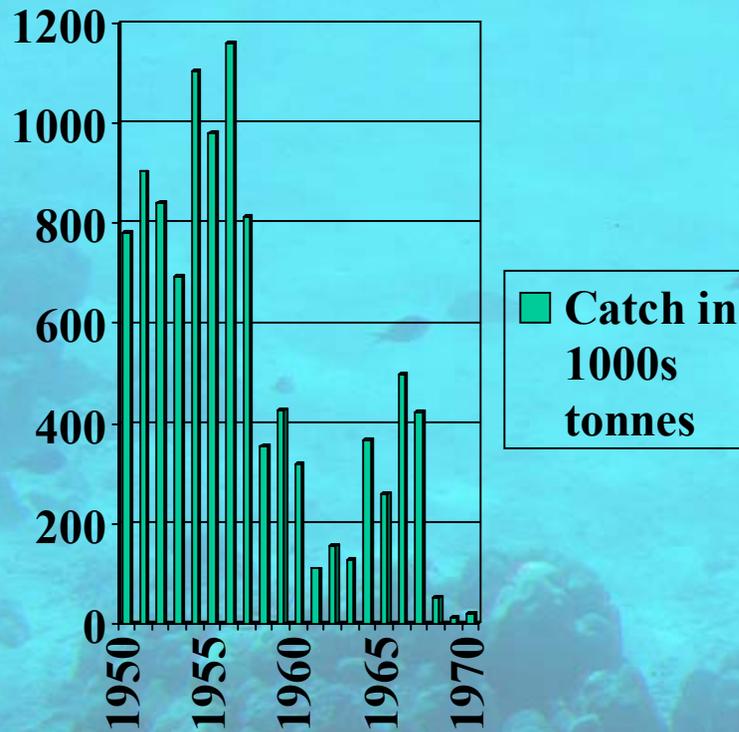
Over exploitation



There are many clear examples of over fishing in both freshwater and marine environments. The North Sea fishery has some particularly clear examples.

Over-exploitation in the North Sea 1.

The herring



- Clupeid fish are particularly vulnerable to over-fishing and almost all exploited stocks have collapsed. The graph shows the collapse of the Norwegian spring spawning herring. The population in British waters showed a similar dramatic collapse.
- The collapse was caused by over-fishing by purse-seiners who fished out the good year-classes.

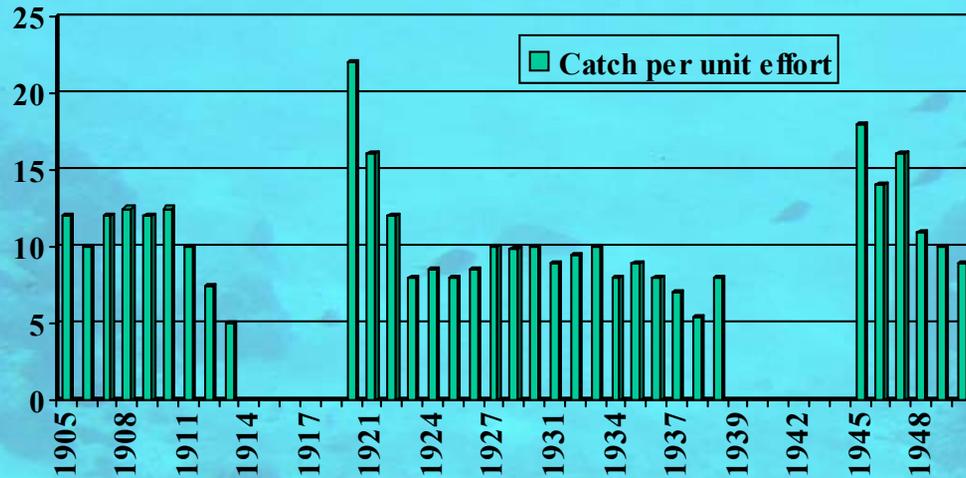
Further examples of over-exploitation of clupeids



- Downs herring
- Pacific sardine
- Far eastern sardine
- South African sardine
- Peruvian anchovy
- Menhaden
- Shad populations?

Over-exploitation in the North Sea

2. Haddock



One of the most well known examples used to show the impact of fishing is the effect of the two world wars on North Sea stocks. Reduced fishing during the wars lead to an increase in stocks.

Habitat damage



Fish which spawn in freshwater give particularly clear examples of the effects of habitat damage. One of the most important is the loss of good quality spawning grounds. Man has altered many rivers and streams by engineering works to reduce flooding. Some rivers have been converted into canal-like water bodies. Floodplains and salt marshes, which are important nursery areas, have been reclaimed.

The siltation of spawning gravels has affected salmon.

Habitat damage - Pollution



The Thames at Belvedere – still an impoverished and damaged habitat

Pollution of waters has had a devastating effect on some fish populations.

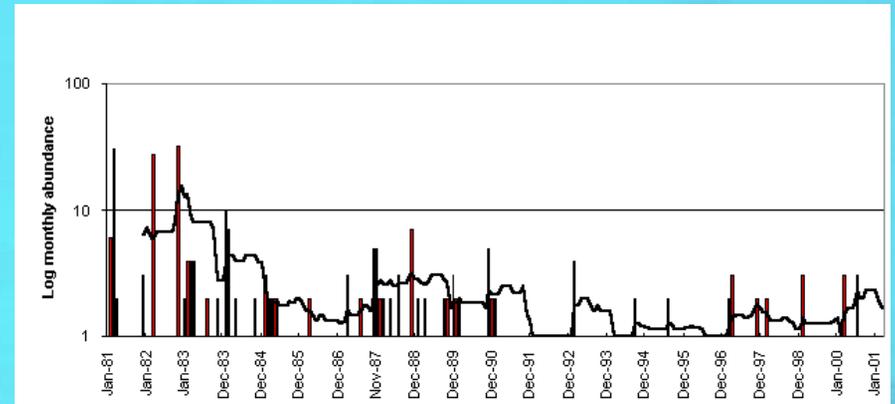
For example, in 1957 a 70 km stretch of the tidal Thames was fishless. Estuaries are important fish nurseries and their pollution has damaged fish populations.

Obstructions to movement- salmon, shad and lamprey



- Anadromous fish move from the sea up rivers to spawn. Obstructions to their movement have been particularly disastrous.
- For example: In the River Severn “*Lampreys too, which were formerly considered of more importance than salmon, and were caught in the upper Severn, have altogether ceased to visit it since the erection of the first weir in 1843*”.

Interference with movement and other factors in catadromous fish - eel



The monthly abundance of eel *Anguilla anguilla* between the years 1980 and 2001 in the Severn Estuary. The trend line is a 12 month moving average.

The abundance of eel has recently collapsed in many parts or the world.

Reasons include:

- Interference with migration
- Destruction in pumps etc.
- Disease introduction
- Over fishing - particularly for elvers which can sell for > £80/kg

Climatic change

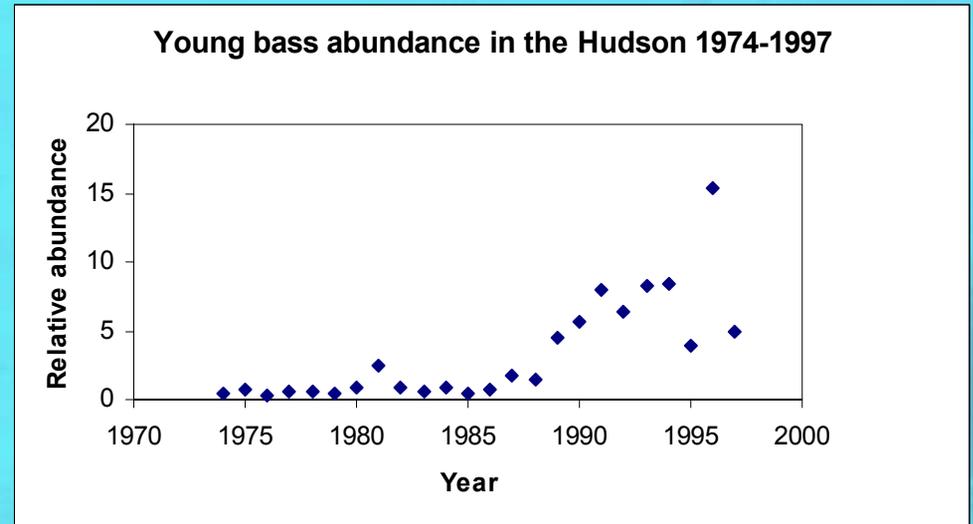
Climatic change can act to make the identification of a sustainable catch particularly difficult.

An example of major climatic change that is probably natural and is known to have a profound effect on fisheries is El Nino. The warming and cooling of the water greatly changes the anchoveta population off the coast of Peru.

The variability in climate also tends to produce confusion. A general decline in a population can be hidden by a short run of good years with high recruitment.

Striped bass in the Hudson - over-exploitation, pollution and recovery

Striped bass are an important commercial and sport fish in the USA. Over-exploitation caused a collapse in the Hudson River population. The pollution of the estuary by PCBs forced the closure of the commercial fishery and there has been a recent improvement in striped bass abundance. Recent improvements in water quality in the vicinity of New York is probably also aiding recovery

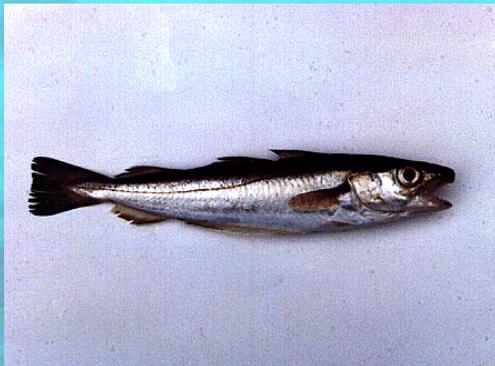


Decline is not inevitable

- The preceding examples might lead to the conclusion that it is impossible to achieve a sustainable harvest of fish and crustaceans. This is not true. With good planning, honesty, flexibility, care for the habitat and modest levels of harvest it can be achieved.

Examples of long-term stability in fish populations

Fish populations are generally less stable in estuaries because the populations usually comprise the younger age classes but, as is shown for the two common species, whiting and flounder, fish populations are also observed to be fluctuating around reasonably constant levels. These examples lend support to the view that density-dependent control is operating.



Whiting and flounder dynamics

Figure 2: The monthly abundance of whiting *Merlangius merlangus* between the years 1980 and 2001 in the Severn Estuary. The trend line is a 12 month moving average.

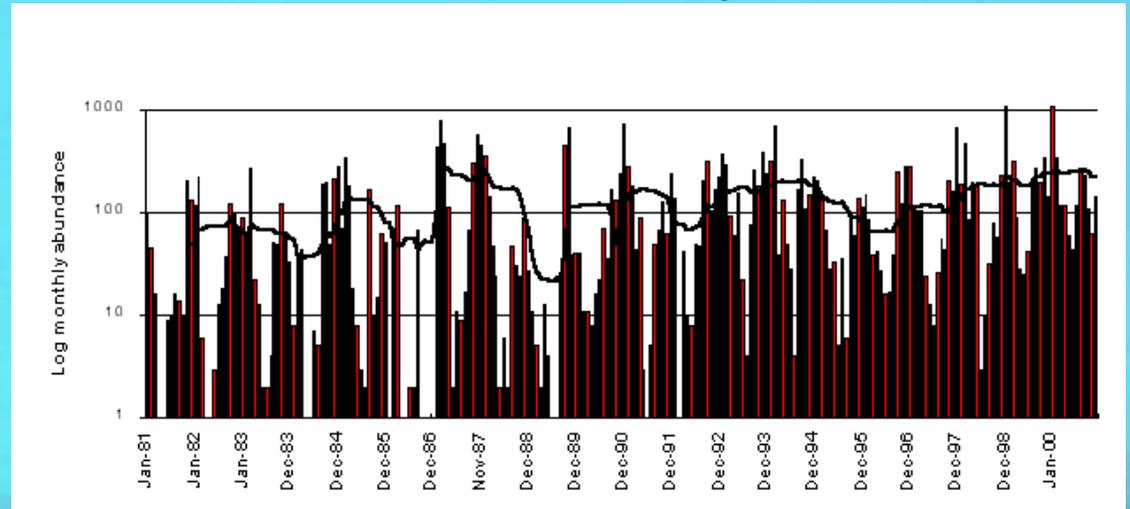
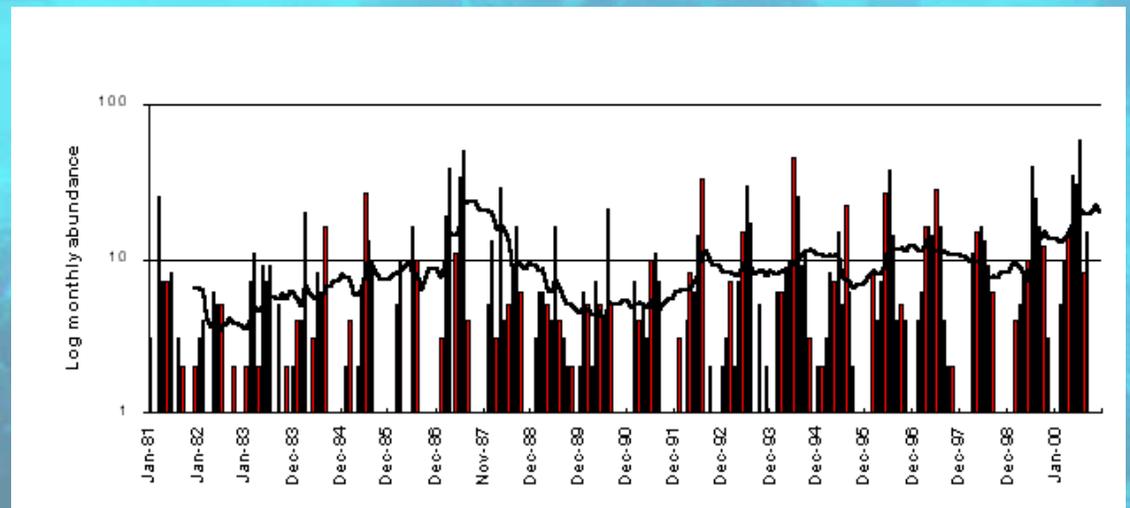


Figure 3: The monthly abundance of flounder *Platichthys flesus* between the years 1980 and 2001 in the Severn Estuary. The trend line is a 12 month moving average.



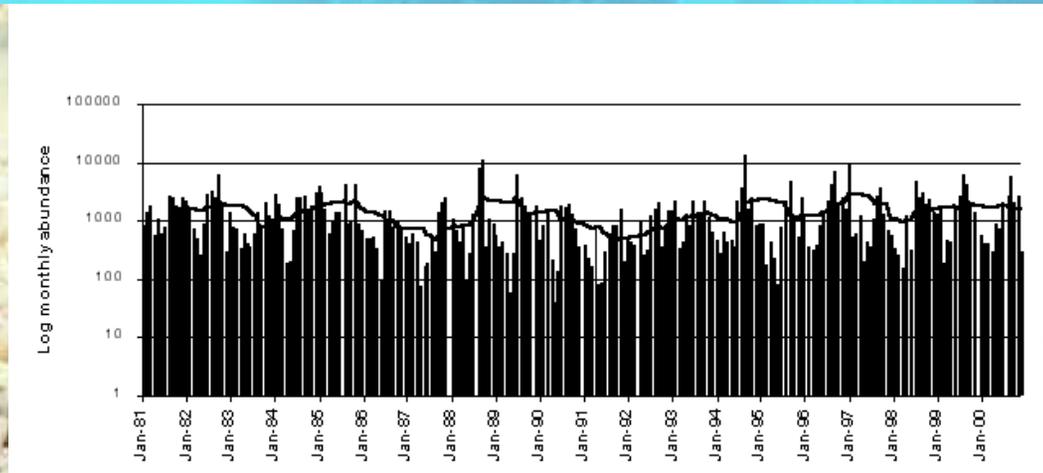
A clear example of sustainable exploitation- Shrimp in the Severn Estuary



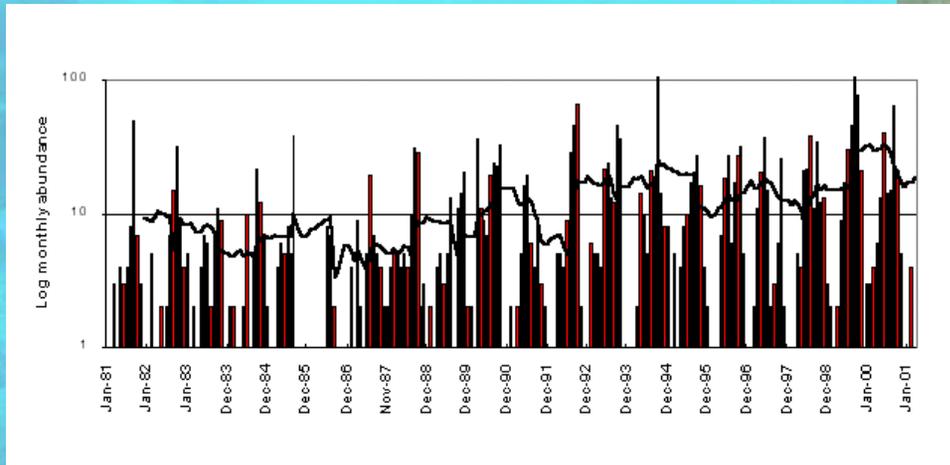
Fixed-net fishermen in the Severn Estuary are continuing a fishing tradition which was recorded in the Domesday book. Their principal catch is shrimps and prawns with smaller catches of fish such as sprat and sole from the intertidal areas of the Bristol Channel.

Shrimp: an example of stability with exploitation

The graph below shows the remarkable stability of shrimp *Crangon crangon* in the Severn Estuary in an area where fixed-net fishermen work. The population fluctuates around a long-term, markedly constant, mean.



Sole in SW British waters – an exploited population which is increasing.



Sustainable fishing in the Amazonian floodplain



Floodplain lakes are some of the most productive waters on the planet. Yet they are quite easily over exploited by commercial fishing. This has even occurred in the upper Amazon where animals are caught both for food and for live export for the aquarium trade. We will look at one example where a change in policy has brought rapid improvements that suggest sustainable exploitation can be achieved while improving the life of the local people.

Arapaima populations



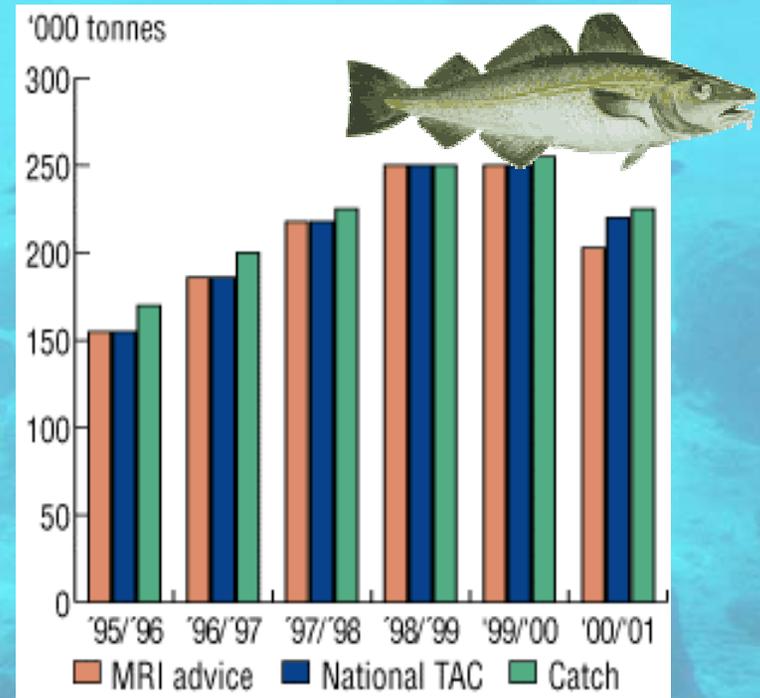
In the Mamiraua Reserve in the Amazon floodplain it has been possible to re-establish the Arapaima population following extensive over fishing, by the following steps:

- The overall structure and integrity of the habitat is protected by limiting deforestation etc.
- Large commercial fishing boats were only allowed to exploit a limited number of lakes.
- All other water bodies were under the control of the local communities and were divided into three groups.
- One group were never fished and are used as reproductive areas for the fish. A second group are resting from exploitation. The third group are fished.

Icelandic fishing has successfully maintained stocks

Careful control of the level of exploitation has allowed the Icelandic fishing industry to maintain large commercially important catches.

ATLANTIC COD
Gadus morhua



Conclusions - to achieve sustainable exploitation

- The habitats needed by animals must not be greatly damaged or reduced in extent. Particular care needs to be taken over spawning and nursery grounds.
- Exploitation must be planned to allow the survival of sufficient adults to produce strong recruitment
- The effects of climate need to be monitored and landings adjusted accordingly
- Exploitation needs to be at a level that does not radically change the age structure and life history of the animal.
- A precautionary approach must be taken. Present practise is to believe in compensatory responses and aim for the maximum possible catch - this approach has failed repeatedly.