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Overfishing threats to some fish and ecosystems

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The impact of fishing on vulnerable fish and sensitive habitats concerns both demersal[1] and pelagic fisheries.

Global fishery production in marine waters was 82.6 million tonnes in 2011 and 79.7 million tonnes in 2012 a 3.5% decrease (FAO, 2014 [2]). The proportion of assessed marine fish stocks fished within biologically sustainable levels declined from 90 percent in 1974 to 71.2 percent in 2011, when 28.8 percent of fish stocks were estimated as fished at a biologically unsustainable level and, therefore, overfished. Of the stocks assessed in 2011, fully fished stocks accounted for 61.3 percent and under fished stocks 9.9 percent (FAO, 2014 [2]).

Industrialized fisheries typically reduced biomass of large predatory fishes by 80% within 15 years exploitation (Myers & Worm, 2003 [4]). Compensatory increase in fast-growing species were observed but often reversed within a decade. The declines of large predators in coastal regions have extended throughout the global ocean with potentially serious consequences for ecosystems (Myers & Worm, 2003 [4]). The most overfished and endangered fishes are selachians because of their biology and ecology and because they are by catches of many fisheries both pelagic and demersal.

Among 84 chondrichthyan species present in the Mediterranean and Black Sea, the conservation status of 71 species have been evaluated by IUCN (Cavanagh & Gibson, 2007 [1]). Critically endangered are 13, Endangered 8, Vulnerable 9, Not Threatened 13, Least Concern 10, Data deficient 18; there is a concern for 30 species about 42% of the species evaluated.

Among bony fish great concern is for sturgeons (*Acipenser* spp.) and European eel (*Anguilla anguilla*) dramatically declined, for groupers (*Epinephelus* spp.) and tunas in particular Northern Bluefin Tuna (*Thunnus thynnus*). The last one was erroneously considered critically endangered and at present the stock is in quite good state, managed by ICCAT (International Commission for the Conservation of Atlantic Tunas, Mediterranean enclosed) with quotas (TAC). The concern derived from massive fishing and fattening in cages.

The European eel (*Anguilla anguilla*) is heavily exploited at all stages of its long and peculiar life cycle.

Eels migrate from rivers and other inland water bodies to the sea to breed and spawn in the middle of the Atlantic Ocean in the Sargasso Sea. The larvae (leptocephalus) travel with the Gulf Stream across the Atlantic Ocean and reach Europe after 1-3 years and 8-9 cm in length. Having arrived in the continental shelf leptocephali metamorphose into glass eel (an high price delicacy) which colonize coastal and inland

[1] Demersal are organisms living on the bottom or near the bottom typically fished by bottom trawl.

waters. At this stage their skin begins to develop pigmentation and they metamorphose into elvers small juvenile eel heavily collected for farming. Most of the surviving eels migrate upstream into freshwater during their first year or as juvenile yellow eel in subsequent years. They are fished with different traps. At 60-80 cm in length (6-20 years old) they are sexually mature, turn into the silver form and begin migration to Sargasso Sea but are obliged to go across some fishing devices.

Artificial reproduction of eel has not yet been achieved commercially and so the global commercial farming is totally dependent on the availability of wild glass eels and elvers. As above mentioned the eels are heavily fished at different stages of life cycle for direct consumption or farming. The consequence is a dramatic decline of quantities harvested in all European waters. Interesting is a 30 year English study (Henderson *et al*., 2012 [3]) in Bridgwater Bay Somerset. The study shows that the population number of *A. anguilla* has collapsed. Since 1980 the decline has averaged 15% per year. The quantity of eel in 2009 is estimated at only 1% of that in 1980. Following this paper this is one of the greatest systematically quantified crashes of a fish population ever reported (Henderson *et al*., 2012 [3]).

Sturgeons at present are very rare and critically endangered species throughout the Mediterranean Sea due to destruction of their habitats, river barrages, pollution and overfishing. They are extinct in most rivers and adjacent seas. Some species are maintained in captivity and artificially reared also for possible restocking.

The main sensitive and protected habitats (ecosystems) damaged by fishery often illegal are *Posidonia oceanica* beds, coralligenous bioconcretions, rhodolith beds, deep white corals (*Madrepora oculata*, *Lophelia pertusa*). All fishing operations can have negative impact, also scuba divers. But illegal trawling and dredging probably are the worst fishing activity, because they mechanically and directly destroy the above mentioned habitats, and at the same time increase water turbidity, and also contribute to the dispersion of alien species like *Caulerpa taxifolia* and *C. racemosa.* Generally trawling is carried out with a conical sack-shaped net, with an entrance kept open at the sides by two gates (otter boards) and vertical by flotation (a float-line in the upper part) and a series of weights on the lower edge (footrope), to keep the net dragging along the seabed. Two trawl gates are connected to the boat with steel cables (12-18 mm in diameter) of varying lengths, according to the depth. As well as the trawl net, the parts causing the most damage are the footrope and particularly the otter boards, which may weigh 100 kg each and are dragged along at a speed of 1-2 knots. It is not difficult to imagine the catastrophic consequences of their passage to all marine biocoenoses. Trawling is particularly harmful to white corals, because fishermen tow the gear close to the coral banks, despite the risk they run of having their equipment entangled or trapped in the concretions.

Seagrass meadows are, to many aspects, exceptional seabed bottoms. The species the situation of which raises more concern is the endemic Mediterranean angiosperm species *Posidonia oceanica* which is the most common one in the Mediterranean Sea. This species inhabits large areas of coastal seabed down to depths of 40 m. Seagrass beds are spatially complex and biologically productive ecosystems that provide habitats and food resources for a diversified fish fauna and act as an important nursery area for many species. Furthermore these meadows contribute to production of oxygen and to the protection of the shore against the erosion of current and waves by trapping the sediment within the leaves of the grass.

International concern about the conservation of this particular habitat led to the banning of trawling on seagrasses in EC waters, and the listing and designation of Posidonia beds in Annex 1 of the EC Habitats Directive (92/43 CEE) as special conservation areas.

Illegal mechanized fishing, and trawling in particular, is very probably the main cause of the destruction of phanerogams, especially Neptune grass meadows, in many Mediterranean areas. In Latium, it has been

estimated that 40% of the reduction in surface area occupied by Neptune grass meadows is due primarily to trawling. The damage it causes may be summarized as follows:

- reduction in the surface area covered by phanerogams;
- creation of furrows and areas without Neptune grass, due to uprooting of leaf bundles and rhizomes;
- ascent to the surface of large mounds of leaves and tufts, which then reach the shore and increase the litter on the beach;
- contribution to the reduction in biomass and density of the fish fauna, particularly that of commercial interest;
- modification of the habitat, with the formation of large areas of sand or sandy mud, with no vegetation, which attract other types of fauna, including fish.

Regulation (CE) n°1967/2006 prohibits the use of towed gears within 3 nautical miles of the coast or within the 50 m isobath where that depth is reached at shorter distance from the coast and also at depths beyond 1000 m.

There are many other national and international laws, EC regulations, international agreements (for instance Barcelona convention) to protect marine species and habitats but often are not respected.

For more information:

[1] Cavanagh R.D. & Gibson C. (2007). *Overview of the Conservation Status of Cartilaginous Fishes (Chondrichthyans) in the Mediterranean Sea*. IUCN, Gland, Switzerland and Malaga, Spain, vi + 42 p.
[2] FAO (2014). *The State of World Fisheries and Aquaculture 2014*. Rome, 223 p.
[3] Henderson P.A., Plenty S.J., Newton L.C. & Bird D.J. (2012). Evidence for a population collapse of European eel (Anguilla anguilla) in the Bristol Channel. *Journal of the Marine Biological Association of the United Kingdom*, 92(4), 843-851.
[4] Myers A. & Worm B. (2003). Rapid worldwide depletion of predatory fish communities. *Nature*, 423, 280-283.