



Selective fishing could damage marine ecosystems

Selective fishing aims to prevent the overexploitation of target fish species and to protect by-catch species, but recent research has indicated that it could be having the opposite effect by damaging biodiversity and sustainability. An alternative approach called “balanced exploitation” works at the level of the ecosystem instead of selectively removing specific components from the ecosystem.

The **overexploitation of fish species** and the call for conservation have led to ecosystem-based fisheries management (EBFM). EBFM has two main goals: conserving ecosystems and satisfying human needs. This often involves selective fishing that applies to one or more of the “6-S” selections: species, stock, size, sex, season and space.

The study briefly reviewed recent research and analysed the impacts of selective fishing at the ecosystem level:

- **Species Selection** – When a species is targeted, its population declines not only from selective fishing but also from an increase in natural mortality due to increased predation and competition from species that have not been targeted. This can alter the structure of the food web and reduce the productivity of target species.
- **Stock Selection** – When some stocks of the same species are fished more than other stocks, the selection can lead to a change in biodiversity within the species and affect long-term sustainability. There is evidence of this in Atlantic cod and herring and sockeye salmon.
- **Size selection** – Smaller fish are protected to prevent their removal before reproduction or to optimise economic value from fishing larger fish. This may alter diversity within the species and trigger evolutionary changes that favour fish with genes that cause slower growth, earlier maturity and smaller size.
- **Sex selection** – This occurs if one sex is more valuable or females are protected to ensure reproduction. This may alter intra-species diversity and reduce reproductive success. For example, selective harvesting of large male shellfish can result in more mating by smaller males and, in the long-term, may cause genetic selection for smaller males.
- **Season selection** – Temporary fishery closures are often used to reduce fishing pressure. This can lead to more intensive fishing at other times and may change fish behaviour or cause offspring to be produced at unfavourable conditions.
- **Space selection** – This is often used to protect nursery grounds or refuges for slow-growing or protected species. This can result in concentrated fishing in open areas and unprotected fish can suffer disproportionately negative impacts.

There is growing evidence that the “6-S” selection has unintended consequences when viewed at the level of the ecosystem. The alternative concept of “balanced exploitation” proposes that nearly all species and stocks can withstand some level of exploitation. It has parallels to the modern tax system in that it recommends the fishing of all species, stocks, sizes and sexes, as long as their abundance and population growth rates are above certain thresholds.

It also proposes that more productive species and stocks should sustain higher fishing rates than less productive ones. This approach deals with the balance among species, stocks, sexes and sizes within an ecosystem, whereas conventional selective fishing focuses on one of these components of an ecosystem.

This concept would require broader sustainability assessments of the impacts of fishing and new fishing strategies that impose a rate of fishing mortality proportional to productivity across a range of species and not a subset of target species.

Source: Zhou, S., Smith, A.D.M., Punt, A.E. *et al.* (2010) Ecosystem-based fisheries management requires a change to the selective fishing philosophy. *Proceedings of the National Academy of Sciences*. Doi: 10/1073/pnas.0912771107.

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