



Science for Environment Policy

Marine protected areas increase survival of Atlantic cod

Marine protected areas (MPAs) are widely used to safeguard marine ecosystems across Europe. This study investigated the effect of a partially protected area (PPA) off the coast of Norway on a population of Atlantic cod (*Gadus morhua*). The PPA reduced the number of deaths due to fishing, increased survival and stimulated movement to surrounding areas. The authors say that preventing fishing altogether would increase survival even further and recommend no-take zones in areas where populations are severely reduced.

Marine fish populations are in decline worldwide. Of the 600 [marine fish](#) stocks monitored by the [Food and Agriculture Organization of the United Nations](#) (FAO), 69% are fully or over-exploited¹. To rebuild fish populations, [MPAs](#), which ban some or all fishing activities in an area, have become widely used. Under the [Natura 2000 network](#), almost 4% of European waters have been designated as MPAs². Despite their widespread use, understanding of how MPAs affect [harvested fish populations](#) remains poor, especially for areas where some fishing is still permitted (PPAs).

This study investigated the effect of a PPA on Atlantic cod (*Gadus morhua*) along the southeast Norwegian coast of Skagerrak. In 2006, a 1 km² PPA was established in the region, where only hook and line fishing and research sampling (which involves fixed nets that do not harm the fish, so they can be captured and released alive) are permitted.

The researchers wanted to know whether implementation of the PPA changed fishing mortality proportions, and also if the protection caused survival rates to increase. To investigate this, they collected data on live re-captures and dead recoveries of cod before and after its implementation, as well as at several unprotected sites along the coastline.

Data was collected from 2005–2013 along Skagerrak. Each year, from April to July, Atlantic cod were captured, tagged and released, following a 'Before-After Control-Impact' approach. The researchers recorded the site where the cod was re-encountered, its body length, and whether the fish was alive.

The data was entered into a 'capture-recapture model', which integrated information on the site, time and cause of death with data about individual live fish, to link changes in survival to fishing pressure.

Data from a total of 10 764 fish clearly showed that the PPA had positive effects on the Atlantic cod population. After its implementation, the annual proportion of deaths due to fishing at the site decreased from 0.59 to 0.32 (where 1 = all fish deaths are due to fishing activities). Annual survival increased by 167% for small cod (16–44 cm in size) and 83% for large cod (45–97 cm). The PPA also acted as a source population, as migration into surrounding areas increased in the final years of the study.

Finally, the authors looked at what would happen if the PPA became a 'no-take zone', i.e. if no fishing activity were permitted at all. They found that banning fishing activity in the area would further increase annual survival — of large fish by an additional 44% and small fish by 100%. The authors therefore conclude that PPAs benefit Atlantic cod in Skagerrak by reducing fishing mortality, increasing survival and facilitating movement to open areas.

These findings will be important for future management strategies. The authors say MPAs that are no-take zones can increase survival, which may result in increases in population density and beneficial spill over to surrounding areas, and are likely to be most effective in areas where local populations are particularly reduced.



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1. Food and Agriculture Organization of the United Nations: General situation of world fish stocks. See: <http://www.fao.org/newsroom/common/ecg/1000505/en/stocks.pdf>
2. <http://biodiversity.euro.pa.eu/topics/protected-areas/marine-protected-areas>