

Scientists investigate whether fish could evolve to become less catchable

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A school of sardines in Italy. Credit: Wikimedia / Alessandro Duci

Intensive fishing prompts much concern and debate over sustainability of fish stocks, but could it also be driving evolutionary changes that render fish of the future less catchable?

There are many examples of an evolutionary 'arms race' between

predator and prey, where adaptations that help hunted animals avoid capture prompt changes in hunters that help them become more deadly.

Scientists at the University of Glasgow investigating whether commercial trawling is similarly driving [evolutionary change](#) in [fish](#) have found fitter fish are better at evading capture. They speculate that, over time, this could lead to physiological changes in future [fish populations](#).

Dr Shaun Killen of the Institute of Biodiversity, Animal Health and Comparative Medicine, said: "There is a lot of concern on how overfishing is affecting the abundance of wild fish, consequences for the economy, employment and the ecosystem as a whole.

"But one aspect that is often overlooked is that intense fishing pressure may cause evolutionary changes to remaining the fish that are not captured."

A study led by Dr Killen, published in the journal *Proceedings of the Royal Society B*, used simulated trawling with schools of wild minnows to investigate two key questions around fisheries-induced evolution.

The researchers wanted to know whether some individuals within a fish shoal were consistently more susceptible to capture by trawling than others, and if so, was susceptibility related to individual differences in swimming performance and metabolism?

The researchers measured the swimming ability, metabolic rate, and indicators of aerobic and anaerobic physical fitness of 43 individual fish. They then placed them in a tank with a trawling net in a simulation that was repeated several times, enabling the identification of individuals which were more susceptible to capture.

Dr Killen said: "Fish being trawled will try to swim at a steady pace

ahead of the mouth of the net for as long as possible, but a proportion will eventually tire and fall back into the net.

"Fish that escape trawling are those that can propel themselves ahead of the net or move around the outside of the net. The key question is whether those that escape are somehow physiologically or behaviourally different than those that are captured. Most trawlers travel at the about same speed as the upper limit of the swim speed of the species they are targeting.

"While trawling nets can be in the water anywhere between 10 minutes to several hours, whether or not fish enter the net is generally decided within a few minutes of when they end up at the trawl mouth."

he results of the simulation revealed that some fish were indeed more susceptible to capture than others and this was strongly related to anaerobic capacity – the ability to engage in short periods of intense physical activity which demands more oxygen than is available from breathing alone.

Maximum aerobic swim speed was also negatively correlated with vulnerability to trawling. Metabolic rate – an indicator of how much energy an animal needs to live – was highest among fish that were least vulnerable to trawling but this relationship probably arose through correlations with anaerobic capacity.

Dr Killen said: "Humans are effective predators, and selective harvest of animals by humans probably represents one of the strongest drivers of evolutionary change for wild animal populations. "Hunting and fishing are selective processes which often remove individuals that, under normal circumstances, may have the highest reproductive potential. Available evidence suggests selective harvest can lead to genetic change within wild populations for specific traits.

"Using simulated trawling, our study provides the first evidence better swimming fish, and those with higher metabolic rates, are more likely to escape capture. "Over time, the selective removal of poor-swimming fish could alter the fundamental physiological makeup of descendant populations that avoid fisheries capture."

The researchers now want to study fish in the wild to see if they get the same results.

More information: "Vulnerability of individual fish to capture by trawling is influenced by capacity for anaerobic metabolism." *Proc. R. Soc. B* 2015 282 20150603; [DOI: 10.1098/rspb.2015.0603](https://doi.org/10.1098/rspb.2015.0603)

Provided by University of Glasgow

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