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Abstract

A short review is presented here of some of the evidence showing that there is a realistic expectation that bycatch mitigation measures will allow the recovery of cetacean populations. For example, in the Monterey Bay Region, the harbour porpoise population has grown from some 1,486 in 1987 to some 3,760 in 2013, further to a ban on gillnets there. Whilst some care needs to be taken in extrapolating from the situation in the USA to elsewhere in the world, this helps to illustrate that removing the threat from fisheries can aid population recovery.

Introduction

Bycatch is recognized around the world as a serious threat to small cetaceans, including porpoise species and populations. In Europe, the harbour porpoise (*Phocoena phocoena*) faces unsustainable levels of bycatch in a number of locations (Carlén *et al*., 2021). The Baltic Sea Proper harbour porpoise, for example, is critically endangered (Hammond *et al*., 2008) and bycatch is considered a major threat to its survival (ICES, 2020).

Bycatch mitigation in North America

In North America, changes to fisheries practices have helped to reduce bycatch in some areas and have allowed harbour porpoise populations to recover. The reduction of gillnet fishing effort in the Morro Bay area of California, for example, has allowed the population there to increase from 570 in 1991 to about 4,200 individuals (Forney *et al*., 2020).

Furthermore, in California, in the Monterey Bay Region, set gillnet fishing was permanently prohibited in 2002 and bycatch was, therefore, eliminated (Forney *et al*., 2020). The mean annual growth rate of the harbour porpoise population increased when this happened. The abundance estimate for 1987 was 1,486 and in 2013 it was 3,760. The gillnet ban was implemented for the area between Point Reyes to the north and Point Arguello some 330 miles to the south banning gill and trammel nets in waters of 60 fathoms or less[1].

In the San Francisco-Russian River population, gillnets and trammel nets were eliminated in 1987 and rapid population growth was seen between 1988 and 2005 (Forney *et al*., 2020).

In field trials conducted in July and August in both 1996 and 1997, demersal gillnets with acoustic alarms were reported to have reduced harbour porpoise bycatch by 77% in the lower Bay of Fundy (Trippel *et al*., 1998).

[1] California Code of Regulations, Title 14, Section 104.1 (14 CCR 104.1).

However, not all attempts to reduce bycatch in North America have been successful. On the East coast of the USA, the United States National Marine Fisheries Service (NMFS), for example, implemented time/area closures in the Gulf of Maine sink gillnet fishery during 1994 in an attempt to reduce harbour porpoise bycatch (Murray *et al*., 2000). These closures did not reduce bycatch and one of the reasons was the displacement of fishing effort and porpoise bycatch to areas outside the closed areas.

In 1998, a rule was published in the Federal Register to implement the Harbor Porpoise Take Reduction Plan (HPTRP) in the Gulf of Maine and Mid-Atlantic (NOAA, 2021b). It has since been amended and the most recent version is from 2013. In New England, seasonal time and area closures correspond with the periods with the highest abundances of harbour porpoises (NOAA, 2015a). Acoustic alarms or pingers are also required seasonally in specific management areas. In the Mid-Atlantic, time and area closures are combined with seasonal gear modification requirements. See NOAA (2015a) and NOAA (2015b) for details of management areas, closure areas, pinger requirements and gear specifications. Take Reduction Plans aim to reduce bycatch to below Potential Biological Removal (PBR) within the first 6 months of the Plan being implemented and then have a long-term goal of reducing bycatch to levels approaching a zero mortality and serious injury rate known as a "Zero Mortality Rate Goal" (ZMRG) which is equivalent to 10% of PBR (McDonald *et al*., 2016).

Orphanides and Palka (2013) found that the HPTRP led to a reduction in bycatch in the first few years of its implementation but that bycatch then increased to unacceptable levels. According to McDonald *et al.* (2016) the HPTRP only resulted in bycatch being under PBR in some years and that it was rarely below ZMRG. Lack of compliance with pinger requirements and variation in fishing effort have been identified as reasons for continued bycatch (Orphanides and Palka, 2013; McDonald *et al*., 2016). Orphanides (2020) found that adherence to HPTRP regulations on observed hauls in the Mid-Atlantic gillnet fishery in 2017 was low for large (50%) and small (59%) mesh gillnets.

Conclusions

Some of the lessons that could be taken from the experience of efforts at bycatch mitigation in North America include that mitigation, in the form of removal of gillnets from an area, can potentially be highly effective. However, in order to extrapolate to other populations, some caution should be applied. For example, the USA has legislation in place that requires conservation actions and has significant scientific infrastructure which facilitates monitoring. The same is not necessarily true in other parts of the world. It should also be noted that the effective fishing bans were implemented across large sea areas. Smaller piecemeal bans may be less effective. Another negative factor in play could be displacement of a fishery to another area where it may impact porpoises or other species. Additionally, there could be factors that will not allow the population to recover as rapidly as those from the USA. Hence there should be no simple extrapolation from the recovery rates seen in the USA to other parts of the world. For example, in the case of the Baltic harbour porpoise, its reproduction may be impacted by chronic persistent pollutants (Carlén *et al*., 2021).

The evidence with respect to acoustic deterrents is more equivocal (e.g. Dawson *et al*., 2013). The key issue may not be the effectiveness of the deterrents themselves when deployed properly, but the failure to deploy them effectively. This raises a common issue in bycatch and fisheries management which is ensuring that the rules are followed.

The FAO has recently developed guidelines for preventing and reducing marine mammal bycatch (FAO, 2021). In its document it reviews the benefits and disbenefits of spatial closures:

Benefits: Eliminates all or nearly all bycatch within the designated area (when effectively enforced); May have other ecosystem benefits during the period the closure is in effect, such as avoiding environmental consequences from fishing or helping to rebuild fish populations.

Disbenefits: Does not always achieve the ultimate conservation benefit of population recovery; Requires reliable information on marine mammals (such as foraging areas) and fisheries activity, as well as effective management, monitoring and enforcement; Benefits limited to the designated area(s); Can concentrate fishing effort outside the boundary in a small area, which can increase bycatch; and Generally unpopular with fishers, who become excluded from their preferred fishing grounds.

Whilst we welcome the serious assessment brought to this issue by the FAO, their guidelines appear unduly negative; especially as the latest results from North America, as outlined in this brief review, support the notion that removal of fisheries with high bycatch, can allow porpoise populations to recover. However, we strongly agree with the need for reliable information, effective monitoring and enforcement.

The fishing industry, its managers and those in governments with appropriate responsibilities need to give serious consideration to addressing porpoise and other bycatch (an issue which is causing increasing public concern) and bring forward effective and appropriately monitored and enforced measures.

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