

Estimated bycatch of harbour porpoise (*Phocoena phocoena*) in two coastal gillnet fisheries in Norway, 2006-2008. Mitigation and implications for conservation.

Arne Bjørge and Mette Skern-Mauritzen
Institute of Marine Research, Norway

Independent onboard observers are recommended as the best way to obtain reliable bycatch data for marine mammals in fisheries. EU has introduced a regulation for monitoring and mitigating bycatches of small cetaceans in European Union fisheries (EU Regulation 812/2004). This regulation mandates that Acoustic Deterrent Devices (ADDs or pingers) be used in gillnet fisheries in some areas and periods for vessels larger than 12m overall length, and recommends observer programs on vessels larger than 15m overall length. For small-sized fishing vessels less than 15m overall length, which sometimes are unable to accommodate an additional person on board as an observer, the EU regulation indicates that data on incidental catches of cetaceans should be collected through scientific studies or pilot projects.

The coastal gillnet fisheries in Norway are prosecuted primarily by small vessels with a total length of less than 15 m, not suitable for carrying independent observers. Therefore, in this paper, we estimate the bycatch of harbour porpoises in the cod and monkfish coastal gillnet fisheries based on fishery-dependent data from a monitored segment of the coastal gillnet fleet. The Institute of Marine Research contracted two small (<15 m) fishing vessels in each of nine coastal statistical areas (Fig. 1) to monitor fishing effort, all catch and bycatch. Using the harbour porpoise bycatch rate, estimated as number of harbour porpoises caught per kg catch of monkfish or cod, in the monitored segment of the fleet, we derive the total porpoise bycatch in the monkfish and cod gillnet fisheries by applying the bycatch rate to the overall catches of cod and monkfish in these fisheries (landings statistics provided by the Directorate of Fisheries). We used catch and bycatch data from 2006-2008 and general additive models (GAMs) to model bycatch rates, where number of harbour porpoises entered as the response variable, catch by the fisheries was entered as offset, and fisheries, geographic areas and seasons as predictors. To develop a robust estimate of bycatch, we decided to down weight the influence of a few incidents on the predicted bycatch numbers. We therefore conducted analyses at a coarser spatial and temporal scale than month and statistical area. To model geographic patterns, we combined neighbouring areas into a factor variable *region* with four levels; region 1 consisting of areas 03, 04 and 05; region 2 containing only area 00; region 3 composed of areas 06 and 07; and finally, region 4 comprising areas 28, 08, and 09. A combination of observed bycatch frequency and temporal and spatial patterns in the fisheries were used to combine areas. Area 00 had elevated bycatch numbers in both the cod and monkfish fisheries relative to all other areas, and was associated with a high bycatch rate in the cod fishery while an intermediate bycatch rate in the monkfish fishery. Therefore, area 00 was included in its own region (i.e., region 2).

We also tested a smoothed function of area, by using the relative position of each area along the coast (numbered from 1 to 9) as a continuous variable. In this way, the estimated bycatch rate in one area would be related to the bycatch rates in neighbouring areas. However, this approach would also smooth bycatch rates between neighbouring areas having potentially very different bycatch rates, such as between areas 05 and 00.

To model seasonal effects, we selected half year (January – June; July – December) as a factor variable. A pronounced seasonal shift in catches occurs in both the cod and monkfish

fisheries, but porpoise bycatch rates were higher in each fishery during the second half of the year than in the first.

The two best models predicted the total number of porpoise bycatch for the period 2006- 2008 to 20,719 and 20,989 porpoises, with CVs 36.05% and 27.33%, respectively. Thus, the models predict annual total bycatches of about 6,900 porpoises in the two fisheries.

The minimum fishing depths ranged from 5-200m for cod and 20-400m for monkfish nets. In cod nets porpoise bycatch rate decreased rapidly with increasing depth from 5m to 50m and then levelled off. The bycatch rate decreased linearly with increasing depth throughout the depth range for monkfish nets.

According to the criteria advised by ASCOBANS (bycatches should not exceed 1.7% of the best population estimate), a population in excess of 400,000 is required to sustain an annual bycatch of 6,900 porpoises. One third of the Norwegian coast is bordering the North Sea where the abundance of porpoise is estimated at approximately 1/3 million. The abundance along the remaining Norwegian coast is not known. Mitigation is required for animal welfare reasons, and we assume also for sustainability. Currently no porpoise bycatch mitigation measures exist in Norway. However, a variety of approaches are available for mitigating bycatches of small cetaceans including time and area closures, the use of acoustic deterrent devices (pingers), and deployment of acoustic reflective nets.

To test the efficacy of pingers under conditions typical for Norwegian coastal gillnet fisheries, we plan to conduct a controlled experiment using the pinger AQUAmark 100 in the area of highest harbour porpoise bycatch rates. The AQUAmark 100 has been tested to 200m depth, but is anticipated to work at depths of 400m (information from producer). In our experiment, we will collaborate with the contracted vessels.

If the experiment demonstrates that ADDs significantly reduce porpoise bycatches, we will recommend a combination of 'closed areas' and the use of pingers. Porpoise bycatch rates increase with decreasing depth in the coastal gillnet fishery for monkfish. We therefore recommend the prohibition of large-mesh gillnets in waters shallower than 50m as a proxy for the closed area approach.

Keywords: harbour porpoise, bycatch, mitigation

Contact author: Arne Bjørge, Institute of Marine Research, arne.bjorge@imr.no.

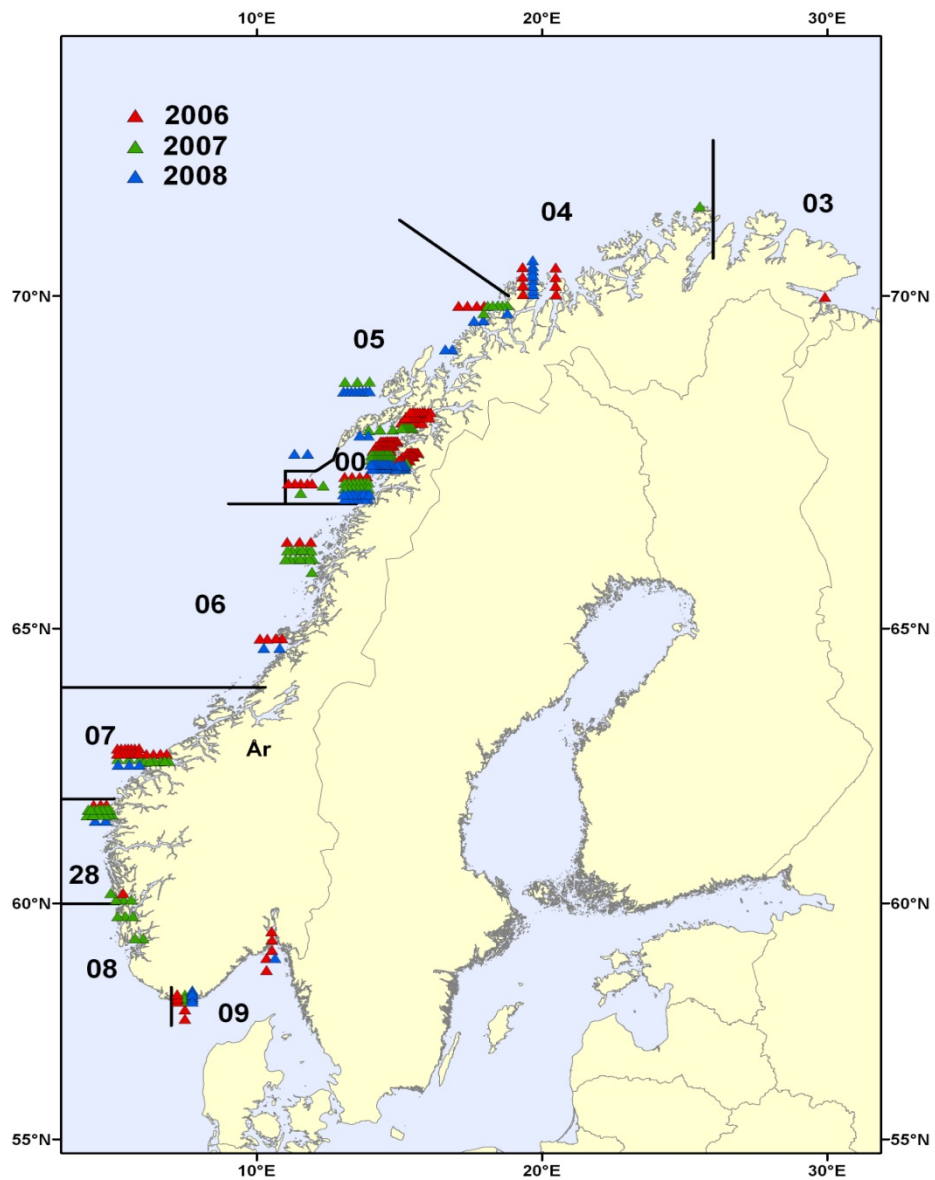


Fig. 1. Nine domestic Norwegian coastal fishery statistics areas and the distribution of porpoises caught on gillnets set for monkfish or cod by the monitored segment of the fleet in 2006, 2007 and 2008.