

Revised estimates of harbour porpoise (*Phocoena phocoena*) bycatches in two Norwegian coastal gillnet fisheries

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ABSTRACT

Data from a monitoring segment (18 vessels) of the fleet of about 6000 small vessels operating gillnets in the coastal zone were used to estimate the bycatch rate, and landings statistics of the target species for the whole fleet using some gear types were used to extrapolate to the entire fisheries. The estimated annual bycatch of about 6900 harbour porpoises in the period 2006–2008 (Bjørge *et al.* 2013) was based on incorrect landings statistics of the target species provided by the Directorate of Fisheries. Using the same model and correct landings statistics the revised estimate is 3541 (CV 0.30) porpoises annually.

The bycatch for the entire period 2006–2014 is estimated by two methods: ratio-based approaches and model-based approaches. In the ratio-based approaches, the data were stratified according to five different stratification schemes, by month, by area, by region, and by each possible combination of area \times month and region \times month. The stratified ratio-based bycatch estimates ranged from 2317 (CV 0.17) to 3373 (CV 0.30) porpoises.

In the model-based approaches, generalized additive models (GAMs) were used to estimate the bycatch rate and to extrapolate to entire fisheries. Poisson and negative binomial distributions and their zero-inflated counterparts were compared. The Poisson distribution performed best, and the best model based on Akaike's Information Criterion adjusted for small samples, AICc, yielded an annual bycatch of 2936 (CV 0.11) porpoises.

KEY WORDS: HARBOUR PORPOISE, BYCATCH, GILLNET FISHERIES.

INTRODUCTION

Throughout their range, harbour porpoises (*Phocoena phocoena*) are notoriously vulnerable to incidental catches in gillnets (Jefferson and Curry, 1994; Read *et al.*, 2006; Vinther, 1999; Orphanides, 2009; IWC, 1992, 1996; ICES, 2008, 2011a). 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) should be used in gillnet fisheries in some areas and periods for vessels larger than 12m overall length, and obliges that observer programs should be established for vessels larger than 15m overall length. For small-sized fishing vessels less than 15m overall length, the EU regulation indicates that data on incidental catches of cetaceans should be collected through scientific studies or pilot projects. According to ICES (2011b), the measures of regulation 812/2004 have not been well implemented. A shortcoming of this regulation is that