Seabird bycatch in the Barents Sea.

The ICES Fisheries Overview of the Barents Sea Ecoregion (ICES 2019) provides little advice of seabird bycatch rates in the region. The report states that although “gillnet fishing primarily affects coastal and pelagic diving seabirds, while the surface-feeding species will be most affected by longline fishing”, documentation of the scale of bycatch is incomplete. The overview cites one publication on the issue (Fangel et al 2011). However, there are some more recent publications which have advanced knowledge of seabird bycatch.

Fangel et al. 2011 was a preliminary report on numbers of birds captured in coastal gillnet fisheries for cod and and lumpsucker off northern Norway (Troms and Finnmark regions), and in the Greenland halibut longline fishery in the same area. The results were presented in terms of bycatch per unit catch weight of the target species in these fisheries (Table 1).

Subsequent work and more extensive sampling by the same and additional authors (Fangel et al. 2015, 2017; Bærum et al. 2019) have greatly extended the observational database and understanding. Primarily, there is no evidence for a correlation between seabird bycatch and the catch rate of target fishery species. Hence, all subsequent data are presented in terms of bycatch per trip, or per net for gillnet fisheries, or per 1000 hooks in longline fisheries (Table 1).

In all studies, the primary species caught in the gillnet and longline fisheries have been Northern fulmar and Common guillemot, but other species include cormorants, black guillemots, Atlantic puffins and razorbills.

Not all studies have provided fleet annual bycatch estimates, based on extrapolating from the samples subset of the flee to the whole fleet, or at least not at a spatial granularity which allows us to extract values for the Barents Sea coast. Data identifiers 6, 7, 8 and 9 in Table 1 provide robust estimate of fleet annual bycatch in the Finmark/Troms region for 4 distinct fisheries (Table 2).

Raw data provided by Bærum et al. (2019) show that the majority of sampling by the available studies has been from vessels operating within 35km of the coast, i.e. within the inshore zone of the StrathE2E model. We have been unable to find any significant sampling for offshore areas. Hence we extrapolated the inshore bycatch quantities to encompass the offshore zone based on the proportional distributions of international gear activity rates, and assuming a uniform catch rate per unit time spent fishing (Table 3).

References

Bærum, K.M., Anker-Nilssen, T., Christensen-Dalsgaard, S., Fangel, K., Williams, T. & Vølstad, J.H. (2019) Spatial and temporal variations in seabird bycatch: Incidental bycatch in the Norwegian coastal gillnet-fishery. PLoS ONE 14(3): e0212786. https://doi.org/10.1371/journal. pone.0212786

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Table 1. Assembled data on seabird bycatch in coastal Norwegian fisheries. Articles: 1, Fangel et al. 2011; 2, Bærum et al 2019; 3. Fangel et al, 2015; 4, Fangel et al 2017. Sampling area 3, Finmark; 4, Troms; 5, Vesterålen. Fleet annual bycatch: ne = no estimate provided. The main bird species caught in all studies were fulmar and guillemot.

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| Id | Article | Period | Fishery area | Fishery method | Fishery target species | bycatch per unit effort | Units | Fleet annual bird bycatch | Comments |
| 1 | 1 | 2009-2010 | Sampling areas 3 4 5 | Gillnet | Cod | 0.070 | birds/tonne cod | ne | Preliminary study |
| 2 | 1 | 2009-2010 | Sampling areas 3 4 5 | Gillnet | Lumpsucker | 0.693 | birds/tonne lumpsucker | ne | Preliminary study |
| 3 | 1 | 2009-2010 | Sampling areas 3 4 5 | Longline | Greenland halibut | 0.759 | birds/tonne halibut | ne | Preliminary study |
| 4 | 2 | 2006-2015 | Sampling areas 2 3 4 extracted from raw data | Gillnet | Cod? not specified | 0.139 | birds/trip | ne | Annual bycatch estimate only provided for the whole Norwegian coast |
| 5 | 3 | 2009 | Sampling areas 3 4 5 | Longline | Halibut | 1.900 | birds/trip | 1500 | Small sample size |
| 6 | 3 | 2009 | Sampling areas 3 4 5 | Longline | Cod/haddock | 0.220 | birds/trip | 3300 | Robust annual estimate |
| 7 | 3 | 2009 | Sampling areas 3 4 5 | Gillnet | Lumpfish | 1.600 | birds/trip | 3200 | Robust annual estimate |
| 8 | 3 | 2009 | Sampling areas 3 4 5 | Gillnet | Cod | 0.100 | birds/trip | 3300 | Robust annual estimate |
| 9 | 4 | 2012-2014 | Sampling areas 3 4 5 | Longline | Greenland halibut | 0.240 | birds/trip | 153 | Robust annual estimate |

Table 2. Fleet annual bycatch (numbers of individiuals) for coastal fisheries in northern Norway (Finmark/Troms), extracted from Table 1.

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| --- | --- |
| Fishery | Annual seabird bycatch |
| Gillnet fishery for cod | 3,300 |
| Gillnet fishery for lumpsucker | 3,200 |
| Longline fishery for cod and haddock | 3,300 |
| Longline fishery for Greenland halibut | 153 |
| **Total gillnets** | **6,500** |
| **Total longlines** | **3,453** |

Table 3. Extrapolation of inshore seabird annual bycatch (individuals) by gear, to offshore bycatch and total Barents Sea. Conversion annual bycatch tonnes assuming typical weight of fulmar = 0.805 kg; guillemot = 0.947 kg, and equal numbers of each species.

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| Gear | Proportion of activity in the inshore zone | Inshore fleet annual seabird bycatch (ind.) | Extrapolated offshore annual bycatch (ind.) | Barents Sea fleet total annual bycatch (ind.) | **Barents Sea fleet total annual bycatch (tonnes)** |
| Gillnets | 0.5211 | 6,500 | 5,974 | 12,474 | **10.928** |
| Longlines | 0.4417 | 3,453 | 4,364 | 7,817 | **6.847** |