# Strategic Compensation Studies

## Hornsea Project Four– Offshore Bycatch Monitoring Executive Summary

THE CROWN ESTATE

OffshoreWind IndustryCouncil

SCS

Offshore Wind Evidence + Change Programme

# Document Control

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**About OWEC SCS Project:** The Strategic Compensation Studies (SCS) is a £3.5 million project running until the end of 2027 which forms part of the Offshore Wind Evidence and Change programme (OWEC), led by The Crown Estate (in partnership with the Department for Energy Security and Net Zero and Department for Environment, Food & Rural Affairs). Alongside the OWEC programme funding, the SCS project is supported through financial and in-kind contributions from participating Offshore Wind Industry Council (OWIC) members.

Further information can be found via the Strategic Compensation Studies webpage.

**Purpose of this Report:** This study aims to aid the understanding of whether bycatch mitigation could be used as a strategic compensation measure for the offshore wind industry. There is a need for additional monitoring of fisheries bycatch to better understand the scale of the issue, the species impacted and hotspots, which in turn, will help to inform the development of appropriate mitigation measures.

This study undertook monitoring of two fishing vessels to aid in understanding the prevalence of seabird bycatch off the coast of Cornwall. The key aims were to report recorded bycatch (focusing on common guillemot), compare bycatch rates with published estimates and to identify potential relationships between common guillemot bycatch and temporal, spatial and operational variables.


# Hornsea Project Four

## Executive Summary – Offshore Bycatch Monitoring

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# Acknowledgements

This study was funded in part by the Offshore Wind Evidence and Change (OWEC) Strategic Compensation Studies (SCS) project.

## 1 Introduction

1.1.1.1 Hornsea Project Four undertook monitoring on fishing vessels to aid in understanding the prevalence of seabird bycatch off the coast of Cornwall. The overarching aim of the study was to:

- Report on recorded bycatch (all seabird species, with a particular focus on common guillemot, *Uria aalge*, hereafter referred to as 'guillemot');
- Compare the recorded bycatch rates with published estimates; and
- Identify any potential relationship between guillemot bycatch and a range of temporal, spatial and operational (fishery gear and approach) variables.

## 2 Methodology

2.1.1.1 Two >10m long vessels were fitted with electronic monitoring equipment (EM) (a V7 EMObserve system with complementary EMInterpret analysis software), and were monitored over two years, October 2022 to April 2023 (Year 1, one vessel) and October 2023 to September 2024 (Year 2, two vessels). A total of 102 fishing trips with 837 hauls were recorded, and a subset of these hauls were reviewed (40% of fishing effort; 236 gillnet hauls, 76 trammel net hauls, 7 wreck net hauls and 14 tangle net hauls). Instances of bycatch were mapped in GIS, along with fishing effort, to visually interpret spatial patterns.

2.1.1.2 In order to standardise data, bycatch events were controlled for effort by calculating the 'bycatch per unit effort' (BPUE) on a species-by-species basis. BPUE was defined as the number of birds divided by the length of net soaked (km) and by the soak time in a 24-hour period (i.e. birds per kilometre per day). In order to be able to compare recorded bycatch against published estimates, bycatch rate (as per Northridge *et al*., 2020) was also calculated. This is done by dividing the total number of birds bycaught by the total number of hauls, multiplied by 1,000.

2.1.1.3 To investigate potential relationships between guillemot bycatch with temporal and operational variables, a Generalised Additive Mixed Model (GAMM) was applied using the mgcv package in R (Wood, 2017). Month, soak time, and net length were included as explanatory variables.

## 3 Results

3.1.1.1 From the 333 hauls reviewed a total of 212 seabird bycatch events were recorded, 74% (156) of which were identified to be guillemot. The findings show that guillemot was by far the most widely bycaught seabird species by vessels monitored. The study found a 36 times higher guillemot bycatch rate (154.30 guillemot per 1,000 hauls) compared to the estimated rate in Northridge *et al*. (2020) for >10m length vessels; (4.22 guillemot per 1,000 hauls), and a seven times higher bycatch rate when compared to <10m length vessels (20.07 guillemot per 1,000 hauls).

3.1.1.2 Spatial mapping of fishing effort and guillemot bycatch events suggested strong spatial patchiness in bycatch occurrence. This recorded variability in bycatch events is consistent with the current knowledge of bycatch being patchy and irregular both spatially and temporally. Furthermore, spatial mapping indicated hauls containing guillemot bycatch often occurred relatively close to one another or within similar locations across months. It is speculated that these locations may represent preferred guillemot foraging habitat compared to the other areas with observed fishing effort.

3.1.1.3 The GAMM results highlighted key relationships between the temporal and operational variables and seabird bycatch rates. Month showed a significant relationship with bycatch rate (edf = 2.181, F = 5.667, $p < 0.001$), indicating strong seasonal variation in bycatch rates. Subsequent analysis of monthly bycatch showed that guillemot bycatch occurred during the non-breeding season and beginning of the breeding season only

(between November and April), when individuals are likely still returning to their breeding colonies (bio-seasons defined as per Furness (2015)). Net length also exhibited a significant relationship (edf = 2.364, F = 3.203, p = 0.025), indicating that bycatch rates increased with longer nets, potentially due to a greater likelihood of interaction between nets and seabirds. Soak time had no significant relationship with bycatch rates (edf = 1.000, F = 0.075, p = 0.781), suggesting that the duration of net deployment did not meaningfully influence bycatch within the studied range.

3.1.1.4 Time of day of potential bycatch was also reviewed qualitatively. However, the soak time with guillemot bycatch was between 17 and 25 hrs, therefore the net would have likely been active within daylight, dusk and night. With the available data, it could therefore not be identified at what time the individuals were bycaught from assessing set time. Auks are pursuit divers that dive longer during the day and are relatively inactive during the night (Loredo *et al*., 2019). As such, it is less likely that most auk bycatch would occur at night. Furthermore, guillemot were not recorded by fishers to be foraging in the net as it was being hauled, as such these birds are more likely to be bycaught during the soak time of the net rather than when the net is being hauled.

3.1.1.5 A range of other seabird species were also bycaught (56 incidences in total), namely razorbill, *Alca torda* (six); northern gannet, *Morus bassanus* (28); herring gull, *Larus argentatus* (one); Manx shearwater, *Puffinus puffinus* (two); great shearwater, *Puffinus gravis* (14) and sooty shearwater, *Puffinus griseus* (five). Further information on the other seabird species bycaught is provided in 1 below.

**Table 1: Overview of seabird bycatch recorded during the monitoring period.**

| Species | Months Recorded as Bycatch | Spatial Patterns | Bycatch Risk |
|---|---|---|---|
| Razorbill | January and November | Razorbill bycatch occurred both within the north and south of Isles of Scilly, aligning with the areas of higher fishing effort. | Razorbill were only recorded as bycatch in relatively low numbers. Although razorbill have a similar foraging ecology to guillemot, the lower bycatch rates could be due to the lower local abundances of razorbill, as well as potential differences in dive depth. However this cannot be confirmed. |
| Gannet | March and April<br>Gannet bycatch likely coincided during the spring return migration as they undertake a clockwise migration (Furness *et al.*, 2018). | All gannet bycatch occurred south of the Isles of Scilly, overlapping with the higher fishing effort in this region. | The majority of gannet bycatch was caused by gannet diving into the net as it was being hauled (to forage on the caught fish). This was noted by the fishers, and suggested within the data as 22 of the 28 gannet bycaught were released alive. |
| Herring gull | One instance in December 2022 | The only instance of herring gull bycatch occurred north of the Isles of Scilly. | Similarly to gannet, herring gull were recorded to be foraging from the net, therefore the herring gull was most likely caught when the net was being hauled. |
| Manx shearwater | September and November | All shearwater bycatch occurred south of the Isles of Scilly, overlapping with the higher fishing effort in this region. | Shearwaters are surface feeders or surface divers (BirdLife International, 2023), so are unlikely to be caught in the net once it has been set. It is therefore most likely that the shearwaters may have been bycaught during hauling, however this cannot be confirmed. |
| Great shearwater | November (2023 only)<br>Great shearwaters usually migrate from UK waters in early autumn, with breeding commencing in South America in October (BTO, 2024). However, November 2023 had higher than average sea surface temperatures (Copernicus, 2023; NCEI, 2023), which in turn could impact the abundance of shearwater prey species. The bycatch instances identified within this monitoring study therefore may be correlated to sea surface temperature increases in November 2023. | | |
| Sooty shearwater | November (2023 only) | | |

# 4 Discussion

4.1.1.1 The bycatch rates recorded in this Hornsea Four bycatch monitoring study builds upon the information set out in Northridge *et al*. (2020) and other recent bycatch monitoring programmes by providing additional insight into the bycatch rates observed in UK waters. It confirms that guillemot bycatch, as well as bycatch of other species, is occurring offshore of the South and Southwest coast, potentially at a much higher rate than previously thought. As noted in **B2.8.1 Compensation measures for FFC SPA: Bycatch Reduction: Ecological Evidence (APP-194)**[1], the Northridge *et al*. (2020) bycatch estimates have a great level of uncertainty due to both the data collection methodology of the UK BMP dataset, and the extrapolation applied in the Northridge *et al.* (2020) study. Less than 1% of static net vessels were sampled as part of UK BMP; therefore, the bycatch rates were based on assumptions for 99% of the UK fishing fleet. There are a range of factors that may impact the bycatch rate, e.g. spatial/temporal differences in seabird density, net length/soak time and target catch, however these were not taken into consideration in the Northridge *et al*. (2020) analyses. Whilst this study was carried out using two vessels only, the vessels were monitored over an extended period with a substantial number of hauls monitored. Sample size (number of vessels and hauls), fishing parameters (net length and soak time) and months of data collection varied between months, as well as years. However, where possible, this variation is factored into the bycatch rate calculation (i.e. taking into consideration variation in hauls) and BPUE calculation (i.e. taking into consideration fishing parameters).

4.1.1.2 The analysis within this monitoring study revealed that month and net length significantly influenced guillemot bycatch rates, with seasonal patterns and longer nets contributing to variations in bycatch. Soak time did not significantly affect the rates, suggesting that net length and temporal factors may be more critical drivers. Although the model explained a small portion of the variance, it provides a foundation for targeted management strategies, such as adjusting fishing practices during high-risk months. Limiting net lengths to reduce bycatch is not likely to be a feasible strategy due to potential impacts on fishers. Further investigation incorporating additional ecological and environmental variables may improve predictive capacity.

[1] https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/EN010098/EN010098-000511-B2.8.1%20RP%20Volume%20B2%20Annex%208.1%20Compensation%20measures%20for%20FFC%20SPA%20Bycatch%20Reduction%20Ecological%20Evidence.pdf

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