Northern Fulmar *Fulmarus glacialis*

Summary

Northern Fulmar is projected to decline considerably in population size in the INTERREG VA area from 1998-2002 to 2050 under climate change, particularly in the Outer Hebrides. Overall, Northern Fulmar is projected (with poor confidence) to have high vulnerability under climate change in the INTERREG VA area.

Table 1. Current (observed) and future (projected) Northern Fulmar population size (breeding pairs) in GB & Ireland, INTERREG VA area and MarPAMM management areas.

Area	1998-2002	Projection for 2050
GB & Ireland	537,988	144,559 ↓ -73%
INTERREG VA area	145,607	50,441 ↓ -65%
Argyll	7904	3110 ↓ -65%
Co. Down – Co. Louth	31	20 ↓ -35%
N Coast Ireland – N Channel	11433	4765 ↓ -58%
Outer Hebrides	118072	39599 ↓ -66%

Under climate change, Northern Fulmar **population size** is projected to **decline** considerably in the INTERREG VA area between 1998-2002 and 2050, at a lower rate than across Britain and Ireland as a whole (Table 1, Fig. 2a).

Northern Fulmar is projected to **decline** in **abundance** everywhere across the INTERREG VA area, but at a greater rate in the Outer Hebrides (Fig. 2a). It is unlikely that new sites will become more suitable for Northern Fulmar under climate change (Fig. 2b); therefore this projected decline in abundance is unlikely to be compensated for by colonisation.

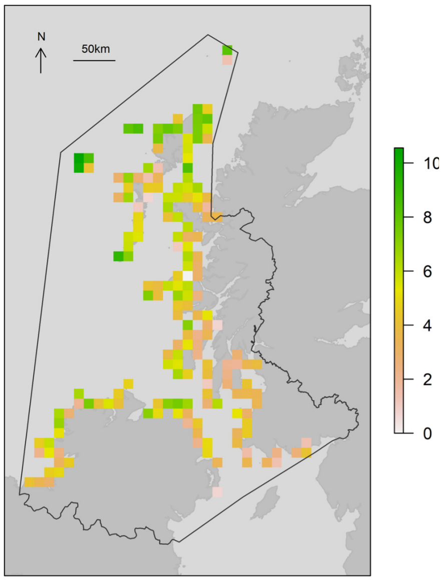

Figure 1. Observed Northern Fulmar abundance (log breeding pairs), 1998-2002. Black polygon = INTERREG VA area.

This work was produced as part of the Marine Protected Area Management and Monitoring (MarPAMM) project. MarPAMM has been supported by the European Union's INTERREG VA Programme, managed by the Special EU Programmes Body.

Projected change in breeding pairs | **Projected change in presence probability**

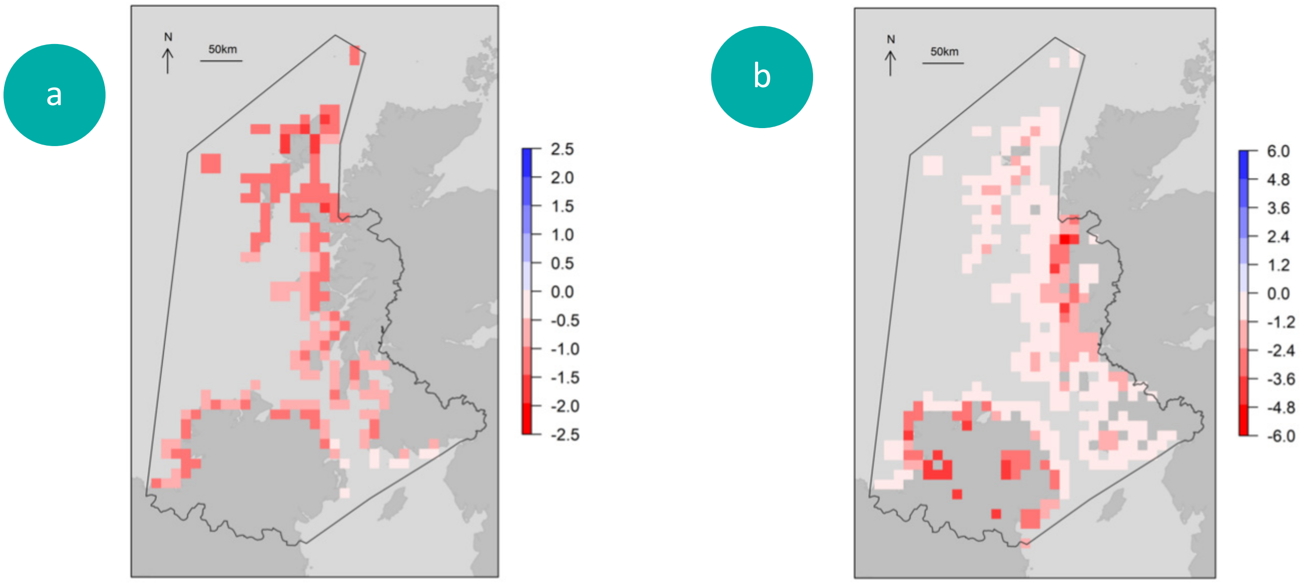

Figure 2. Projected change (1998-2002 to 2050; log proportional change) in: a) Northern Fulmar breeding pairs, for all cells where fulmar was present in 1998-2002; (b) Northern Fulmar presence probability for all squares where any seabird was censused in 1985-1988 or 1998-2002. White/blue = increase, red = decrease. Black polygon = INTERREG VA area.

Model predictive power was excellent for the presence/absence component of the model, and moderate for the abundance component*. Northern Fulmar presence/absence and abundance had significant relationships with terrestrial climate, oceanographic and nuisance variables (Table 2).

Table 2. Effect on presence and abundance for significant variables in model*. Variables included in table if significant in at least one model component; field left blank if variable not significant in that model component. Variables shown in parentheses represent quadratic terms. Projections made using full model (i.e. not just significant variables).

Variable	Presence	Abundance
Breeding season maximum temperature	-	-
(Winter minimum temperature)^2		+
(Breeding season precipitation)^2	-	
(Winter precipitation)^2	-	
Breeding season potential energy anomaly	+	
Winter potential energy anomaly	-	
(Breeding season sea surface temperature)^2	+	
Winter sea surface temperature	+	
(Winter sea surface temperature)^2	-	
Bathymetry	-	+
Coast length	+	+
Distance inside coast	-	-

Table 3. Projected change for Northern Fulmar at the ten sites with the most breeding pairs in 1998-2002. Sites are as defined in Seabird 2000 census. Superscript denotes MarPAMM management region, where applicable: [A], Argyll; [B], Co. Down - Co. Louth; [C], North Coast Ireland - North Channel; [D], Outer Hebrides.

Site	Breeding pairs, 1998-2002 (count)	Projected breeding pairs, 2050 (median & 95% CI*)	Projected % change in breeding pairs (median & 95% CI*)
Hirta, St Kilda[D]	42765	14423 (2827, 51858)	-66.3 (-93.4, +21.3)
Dun, St Kilda[D]	11216	3743 (815, 12345)	-66.6 (-92.7, +10.1)
Soay, St Kilda[D]	9359	3172 (589, 11854)	-66.1 (-93.7, +26.7)
Butt of Lewis to Gress - Lewis[D]	8693	2811 (810, 8979)	-67.7 (-90.7, +3.3)
Mingulay[D]	8424	3113 (698, 10935)	-63.1 (-91.7, +29.8)
Flannan Isles[D]	7735	2708 (521, 11535)	-65 (-93.3, +49.1)
Boreray, St Kilda[D]	5045	1650 (266, 7119)	-67.3 (-94.7, +41.1)
Shiant Islands[D]	4387	1498 (504, 3773)	-65.9 (-88.5, -14)
North Rona[D]	3520	1150 (263, 4602)	-67.3 (-92.5, +30.7)
Brenish to Valtos - Lewis[D]	3482	948 (310, 2983)	-72.8 (-91.1, -14.3)

* See main report for details of modelling, variables, categories of model predictive power and derivation of confidence intervals for projections.

Climate Change Mechanisms

The review of climate change mechanisms affecting seabirds (Johnston et al. 2021) identified various impacts of adverse weather on demographic parameters of the procellariforms in general, often operating in complex ways. For Northern Fulmar specifically, survival is negatively related to winter NAO, while high winds during the breeding season are associated with lower energetic costs and an increased foraging range.

Overall, climate change is projected (with **poor confidence**) to present Northern Fulmar with **very high risk** and **low opportunity** in the INTERREG VA area.

Citation: Northern Fulmar species factsheet. From Davies, J.G., Humphreys, E.M. & Pearce-Higgins, J.W. 2021. Projected future vulnerability of seabirds within the INTERREG VA area to climate change. Report to Agri-Food and Biosciences Institute and Marine Scotland Science as part of the MarPAMM Project. BTO, Thetford

BTO
Looking out for birds

For more information on the MarPAMM project please visit the project website:

www.mpa-management.eu