Great Cormorant *Phalacrocorax carbo*

Summary

Great Cormorant is projected to decline slightly in population size in the INTERREG VA area from 1998-2002 to 2050 under climate change, particularly in the south. Overall, climate change is projected (with poor confidence) to have low impact on Great Cormorant in the INTERREG VA area.

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

Area	1998-2002	Projection for 2050
GB & Ireland	13586	14799 ↓-11%
INTERREG VA area	3407	3300 ↓-3%
Argyll	138	156 ↑+13%
Co. Down – Co. Louth	278	315 ↑+13%
N Coast Ireland – N Channel	1025	1126 ↑+10%
Outer Hebrides	445	554 ↑+24%

Under climate change, Great Cormorant **population size** is projected to **decline** slightly 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).

Great Cormorant **abundance** trend is projected to **vary** across the INTERREG VA area, with declines more likely in the south (Fig. 2a). Some new sites in the north of the area are projected to become more suitable for Great Cormorant under climate change (Fig. 2b); therefore this projected decline in abundance may be compensated to some extent for by colonisation.

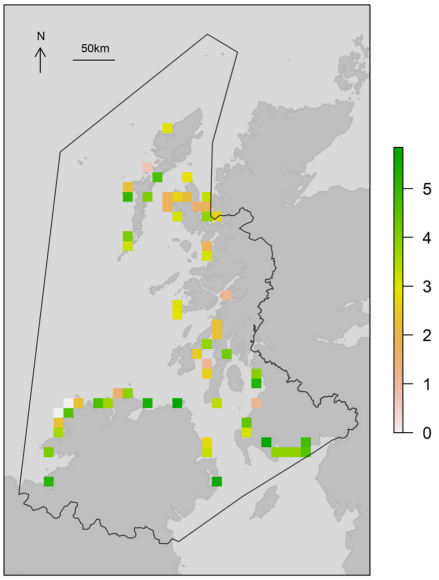

Figure 1. Observed Great Cormorant abundance (log breeding pairs), 1998-2002. Black polygon = INTERREG VA area.

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

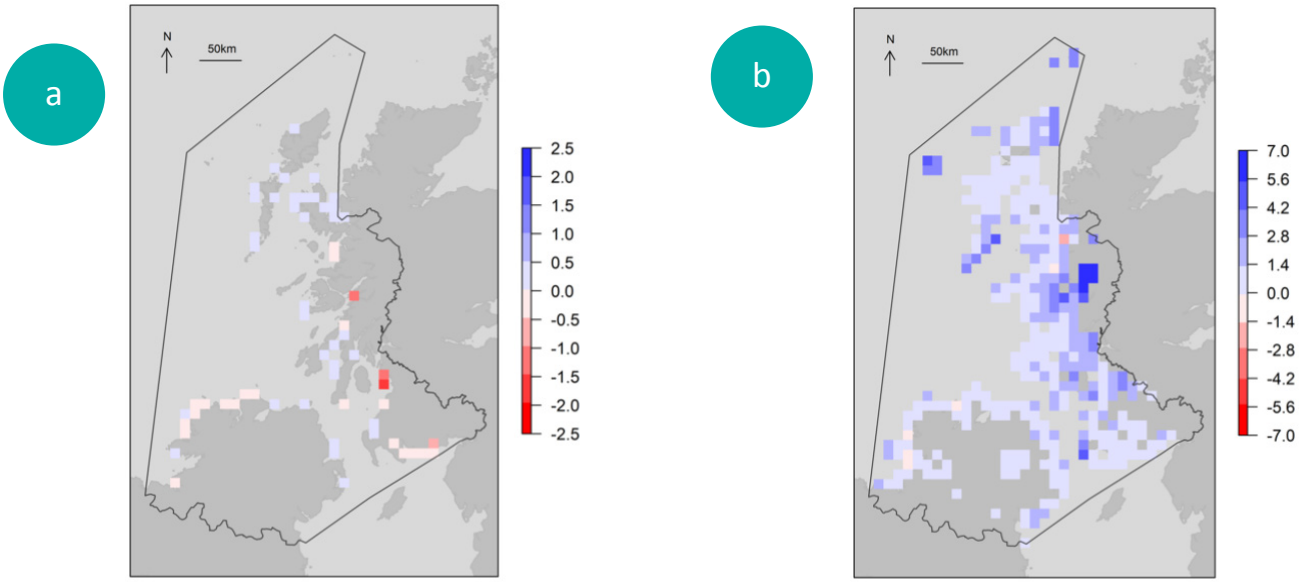

Figure 2. Projected change (1998-2002 to 2050; log proportional change) in: a) Great Cormorant breeding pairs, for all cells where Great Cormorant was present in 1998-2002; (b) Great Cormorant presence probability for all squares where any seabird was censused in 1985-1988 or 1998-2002. White/blue =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

Model predictive power was moderate for the presence/absence component of the model, and poor for the abundance component*. Great Cormorant 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
Winter minimum temperature	+	
(Winter precipitation)^2	-	
Breeding season potential energy anomaly	-	
Winter potential energy anomaly	+	
(Winter potential energy anomaly)^2	-	
Bathymetry	+	-
(Bathymetry)^2	-	
Distance inside coast	-	

Table 3. Projected change for Great Cormorant 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*)
Sheep Island, Causeway Coast[C]	344	461 (43, 2217)	+34.1 (-87.4, +544.6)
Loch Ryan, Mochram Lochs, Gennom Rocks	343	230 (64, 693)	-33 (-81.3, +102)
Strangford Lough[B]	278	315 (35, 1659)	+13.3 (-87.5, +496.6)
Inishowen Head[C]	225	231 (30, 1155)	+2.5 (-86.6, +413.1)
Lady Isle	198	36 (0, 584)	-81.6 (-99.8, +194.9)
Sligo Bay	179	156 (21, 759)	-12.7 (-88.2, +324.1)
Monach Islands[D]	158	172 (26, 695)	+9.1 (-83.3, +340)
North Donegal[C]	148	142 (15, 819)	-4.2 (-89.9, +453)
Port O'Warren	126	70 (18, 222)	-44.4 (-86.1, +76.2)
Lingay - Harris[D]	112	145 (17, 698)	+29.4 (-84.6, +522.9)

* 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 relatively few relationships between climatic variation and Great Cormorant demography. In the north Atlantic, Great Cormorant population size is positively related to SST. Great Cormorant breeding can be delayed under low SST, while high wind can negatively affect breeding success.

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

Citation: Great Cormorant 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

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www.mpa-management.eu