Razorbill *Alca torda*

Summary

Razorbill is projected to decline considerably in population size in the INTERREG VA area from 1998-2002 to 2050 under climate change, particularly in the south and east. Overall, razorbill is projected (with poor confidence) to have moderate vulnerability under climate change in the INTERREG VA area.

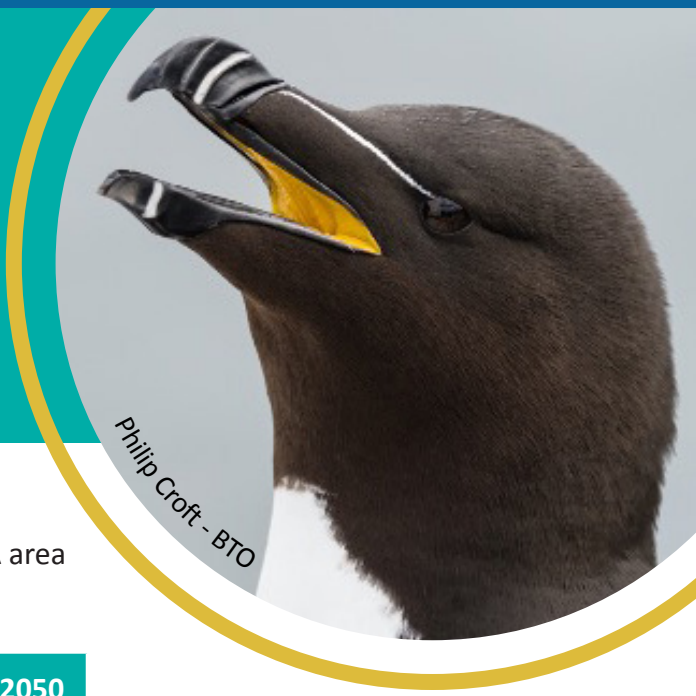

Table 1. Current (observed) and future (projected) razorbill population size (breeding pairs) in GB & Ireland, INTERREG VA area and MarPAMM management areas.

Area	1998-2002	Projection for 2050	
GB & Ireland	216060	107029	↓-51%
INTERREG VA area	82617	44669	↓-46%
Argyll	6109	2875	↓-53%
Co. Down – Co. Louth	0	0	
N Coast Ireland – N Channel	32305	15781	↓-51%
Outer Hebrides	37434	22892	↓-39%

Under climate change, razorbill **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).

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

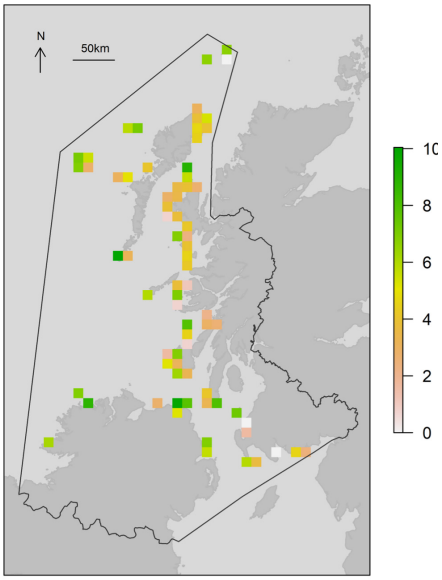

Figure 1. Observed Razorbill abundance (log breeding pairs), 1998-2002. Black polygon = INTERREG VA area.

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

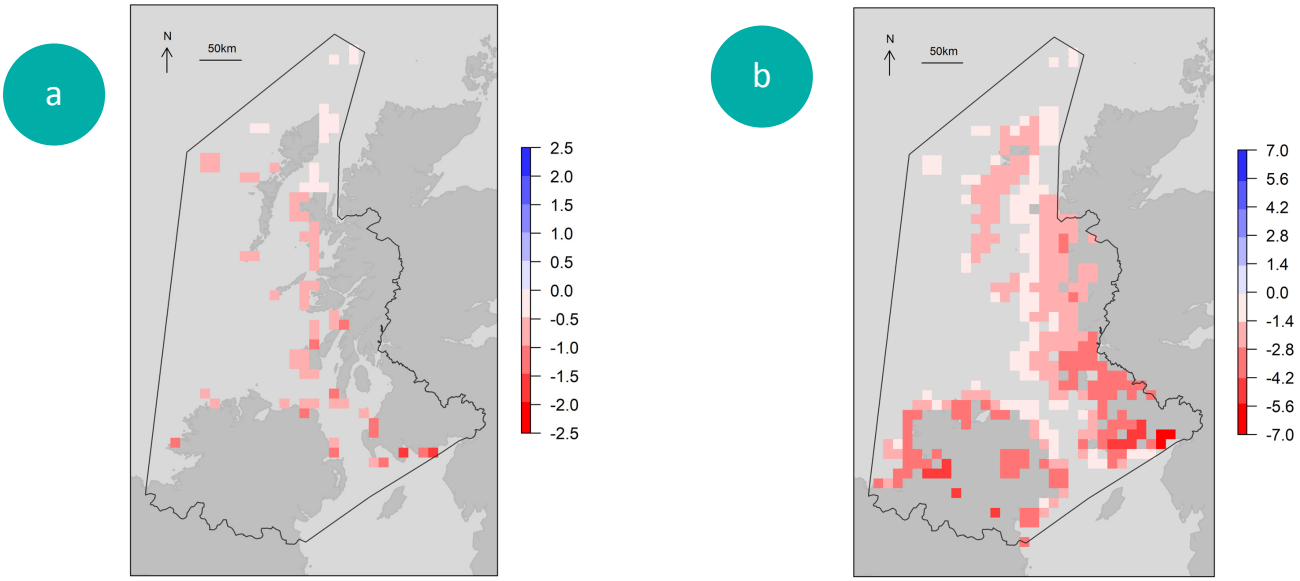

Figure 2. Projected change (1998-2002 to 2050; log proportional change) in: a) Razorbill breeding pairs, for all cells where Razorbill was present in 1998-2002; (b) Razorbill presence probability for all squares where any seabird was censused in 1985-1988 or 1998-2002. White/blue = increase, red = decrease.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

Model predictive power was good for the presence/absence component of the model, but very poor for the abundance component*. Razorbill 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 precipitation	-	-
Winter sea surface temperature	-	
Bathymetry	+	
Coast length	+	+
Distance inside coast	-	-

Table 3. Projected change for Razorbill 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*)
Rathlin Island[C]	20860	10915 (1997, 47411)	-47.7 (-90.4, +127.3)
Berneray[D]	16513	9302 (1197, 45786)	-43.7 (-92.8, +177.3)
Shiant Islands[D]	8046	5673 (1297, 19542)	-29.5 (-83.9, +142.9)
Horn Head[C]	6739	2744 (844, 8511)	-59.3 (-87.5, +26.3)
Mingulay[D]	6387	3598 (463, 17709)	-43.7 (-92.8, +177.3)
Sanda Island, Sheep Island and Glunimore Island	2910	1278 (170, 7219)	-56.1 (-94.1, +148.1)
Isle of Colonsay[A]	2742	1314 (106, 7164)	-52.1 (-93.7, +161.3)
Flannan Isles[D]	1569	1113 (106, 7875)	-29 (-93.2, +401.9)
Ailsa Craig	1471	561 (60, 3508)	-61.9 (-95.9, +138.5)
Hirta, St Kilda[D]	1233	695 (62, 4573)	-43.7 (-95, +270.9)

* 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 a wide range of direct and indirect effects of climatic variation on Razorbill demography. Among cliff-nesting species, Razorbill productivity is particularly sensitive to high winds, due to the species' light weight. Razorbill productivity is negatively related to winter and spring SST and spring NAO, probably due to effects on sandeels or herring. Similar effects on prey availability may explain relationships between NAO or SST and Razorbill survival. Furthermore, Razorbill breeding phenology is related to SST and winter NAO.

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

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

www.mpa-management.eu