Morlais Project

Marine Ornithology Collision Risk Modelling Note

Applicant: Menter Môn Morlais Limited

Document Reference: PB5034-RHD-ZZ-XX-NT-1010

Author: Royal HaskoningDHV

Morlais Document No.	Status:	Version No:	Date:
MOR/RHDHV/DOC/0115	FINAL	F1.0	25/03/2020

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1 Introduction

The first deployment phase for the proposed Morlais project may be reduced in scale primarily to reduce potential impacts on bottlenose dolphin through underwater collision risk. The maximum deployment resulting in no more than 0.7 bottlenose dolphin collisions per year has been calculated for each of eight different devices during consultation on marine mammal impacts of the proposed project.

The purpose of this document is to consider the significance of deployment of devices at such a scale (i.e. resulting in no more than 0.7 bottlenose dolphin collision) for seabirds, and to present revised collision estimates for marine ornithological receptors under such a scale of first deployment phase. This approach was agreed during a marine ornithology project meeting (at which both NRW and RSPB were represented) on 29/11/2019.

For each bird species reviewed, the worst-case device scenario modelled has been selected for review. The working supporting this is not shown here, but in summary was based on calculating a "collisions per MW" value for each technology under consideration and multiplying this by the maximum number of MW deployable under the 0.7 bottlenose dolphin scenario.

In addition, Population Viability Analysis (PVA) has been undertaken for three species; guillemot, razorbill and Manx shearwater (as agreed in the meeting of 29/11/2019) to provide further detail on potential population level effects.

Finally, the model outputs are used to assess the magnitude of impact and impact significance for the worst-case deployment scenario for each species.

This document should be read in conjunction with the following Environmental Statement (ES) documents:

- Chapter 5, EIA Methodology;
- Chapter 11, Marine Ornithology; and
- Chapter 11, Marine Ornithology, Technical Appendix 11.3.

2 Methodology and Scenarios Assessed

2.1 Estimating Collision Risk

The naming conventions for the devices included in the modelling are the same as in Chapter 11, Marine Ornithology. Whilst the same devices were modelled by the marine mammal assessment, the naming convention is different. The information in Table 2.1 indicates which device name in the ornithology assessments relates to which in the marine mammal assessment.

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Table 2.1. Differences in the naming conventions of devices between the ornithology and marine mammal assessments.

Ornithology Assessment	Marine Mammal Assessment
1F	1
2F	3
3F	2a
4F	4
5S	5a
6S	5b
7S	6a
8S	6b
9F	7a

The methodology for Encounter Rate Modelling (ERM) and Collision Risk Modelling (CRM) remains the same as that presented in the ES Chapter 11, Marine Ornithology and Technical Appendix 11.3, as do the biological season definitions. The outputs presented are a mean of ERM and CRM. The level of deployment of each device resulting in no more than 0.7 bottlenose dolphin collisions annually is presented in Table 2.1, along with an indication of which scenario results in the greatest number of predicted collisions by species.

Table 2.2. Deployment scenarios for first phase of proposed Morlais project, based on restricting bottlenose dolphin collisions to an annual maximum of 0.7, along with identification of worst case deployment for each seabird species under consideration. The device scenarios across the top of this table correspond to those originally presented in ES Chapter 11, Marine Ornithology.

Device	1F	3F	4F	5S	6S	7S	8S
MW	11.24	10.38	6.63	12.41	10.23	8.61	7.66
Guillemot					X		
Razorbill		X					
Puffin		X					
Red-throated Diver		X					
Manx shearwater	X						
Gannet		X					
Shag	X						

2.2 PVA

The PVA for guillemot and razorbill retains the same methodology, assumptions and inputs as the models previously presented in ES Chapter 11, Marine Ornithology and Technical Appendix 11.3. In addition to presenting the results of the modelling over a 25-year period, results over a five-year period are also presented, as this may be closer to the timeframe within which a second phase of deployment may be considered by the proposed project.

Manx shearwater PVA was carried out using a recently published online tool (Searle et al., 2019). The model selected was a deterministic model without density dependence. Manx shearwater demographic parameters were obtained from a recent review of seabird demographic rates (Horswill and Robinson, 2015). There are no published parameters for immature and juvenile survival rates in this species, and its unique ecological traits mean that the identification of an ecologically justifiable surrogate is challenging. On the basis of its similar age of first breeding and adult survival rate, according to Horswill and Robinson (2015), gannet was selected as a surrogate to obtain these parameters. The input parameters for Manx shearwater, along with the information sources from which these inputs were taken, are presented in Table 2.2.

Table 2.3. PVA input parameters for Manx shearwater.

Parameter	Value	Source
Starting population size (in terms of no. of breeding adults)	41,350 (Bardsey Island; 2016)	(JNCC, 2020)
Age of first breeding	5	(Horswill and Robinson, 2015)
Annual survival rate of breeding adults	0.870	(Horswill and Robinson, 2015)
Juvenile annual survival rate	0.424 (gannet surrogate)	(Horswill and Robinson, 2015)
Immature (1-2) annual survival rate	0.829 (gannet surrogate)	(Horswill and Robinson, 2015)
Immature (2-4) annual survival rate	As adult survival rate	(Horswill and Robinson, 2015)
Annual breeding success per active site	0.62 (Skomer Island average 2012 to 2016)	(Stubbings et al., 2017)

The annual harvest levels (i.e. predicted annual collision mortality) for the Manx shearwater PVA were taken from ES Chapter 11, Marine Ornithology and Technical Appendix 11.3, and are the worst-case deployment at 40MW, and an indicative 240MW array. The annual harvest levels are presented in Table 2.3.

It should be noted that PVA has been run for the population of Bardsey Island only, and not the Skomer population. The SNH apportioning tool (SNH, 2018) indicated that approximately 42% of birds at the Morlais Development Zone (MDZ) would originate from this colony, and 56% from Skomer. The PVA has assumed that 100% of the birds at the MDZ are from Bardsey Island, meaning that the model is precautionary in this respect. As the Skomer population of Manx shearwater is much larger than the Bardsey Island population (632,140 breeding adults versus 41,350), it is expected that population level effects at the Skomer colony will be reduced relative to the Bardsey population. Therefore, if very minor population level effects are predicted for the Bardsey Island population, the same can be assumed for the Skomer population.

Table 2.4. Annual harvest values for Manx shearwater.

Avoidance Rate	40MW Worst Case Scenario	240MW Indicative Array
0.000	31	186
0.500	16	93
0.900	3	19
0.950	2	9

Avoidance Rate	40MW Worst Case Scenario	240MW Indicative Array
0.980	1	4
0.990	0	2
0.995	0	1
0.999	0	0

2.3 Impact Assessment

The impact assessment presented uses the same approach and definitions provided in ES Chapter 5, EIA Methodology and Chapter 11, Marine Ornithology.

3 Model Results

3.1 Revised Collision Estimates

For each of the worst case scenarios presented in Table 2.1, the predicted number of collisions for each species by avoidance rate is presented in Table 3.1.

Table 3.1. Predicted collisions (mean of ERM and CRM) of worst-case scenario for each relevant species at a range of avoidance rates.

Avoidance Rate	Guillemot (B)	Guillemot (NB)	Razorbill (B)	Razorbill (NB)	Puffin (B)	Red-throated diver (All)	Manx shearwater (B)	Gannet (B)	Shag (B)
0.000	1249	268	394	393	6	39	10	1	1
0.500	625	134	197	196	3	20	5	<1	<1
0.900	125	27	39	39	1	4	1	<1	<1
0.950	62	13	20	20	<1	2	<1	<1	<1
0.980	25	5	8	8	<1	1	<1	<1	<1
0.990	12	3	4	4	<1	<1	<1	<1	<1
0.995	6	1	2	2	<1	<1	<1	<1	<1
0.999	1	<1	<1	<1	<1	<1	<1	<1	<1

3.2 Revised PVA Outputs

3.2.1 Guillemot

Table 3.2. PVA outputs for guillemot based on mortality rates presented in Table 3.1, over a 5-year period.

Avoidance Rate	Growth Rate	Population After 5 Years (total individual breeding adults)	Counterfactual of Growth Rate	Counterfactual of 5 Year Population	5 Year Population Relative to Current Population
Baseline	1.037	8,936	N/A	N/A	1.198

Avoidance Rate	Growth Rate	Population After 5 Years (total individual breeding adults)	Counterfactual of Growth Rate	Counterfactual of 5 Year Population	5 Year Population Relative to Current Population
0.950	1.032	8,753	0.996	0.980	1.174
0.980	1.035	8,846	0.998	0.990	1.186
0.990	1.035	8,876	0.999	0.994	1.190
0.995	1.036	8,890	0.999	0.995	1.192
0.999	1.036	8,901	0.999	0.997	1.194

Table 3.3. PVA outputs for guillemot based on mortality rates presented in Table 3.1, over a 25-year period.

Avoidance Rate	Growth Rate	Population After 25 Years (total individual breeding adults)	Counterfactual of Growth Rate	Counterfactual of 25 Year Population	25 Year Population Relative to Current Population
Baseline	1.037	18,353	N/A	N/A	2.461
0.950	1.032	16,550	0.996	0.902	2.219
0.980	1.035	17,445	0.998	0.951	2.339
0.990	1.035	17,749	0.999	0.967	2.380
0.995	1.036	17,886	0.999	0.975	2.399
0.999	1.036	18,000	0.999	0.981	2.414

3.2.2 Razorbill

Table 3.4. PVA outputs for razorbill based on mortality rates presented in Table 3.1, over a 5-year period.

Avoidance Rate	Growth Rate	Population After 5 Years (total individual breeding adults)	Counterfactual of Growth Rate	Counterfactual of 5 Year Population	5 Year Population Relative to Current Population
Baseline	1.035	1,737	N/A	N/A	1.225
0.950	1.026	1,668	0.992	0.960	1.137
0.980	1.031	1,707	0.996	0.982	1.163
0.990	1.032	1,716	0.998	0.988	1.170
0.995	1.033	1,720	0.998	0.990	1.173
0.999	1.033	1,724	0.998	0.992	1.175

Table 3.5. PVA outputs for razorbill based on mortality rates presented in Table 3.1, over a 25-year period.

Avoidance Rate	Growth Rate	Population After 25 Years (total individual breeding adults)	Counterfactual of Growth Rate	Counterfactual of 25 Year Population	25 Year Population Relative to Current Population
Baseline	1.035	3,430	N/A	N/A	2.338

Avoidance Rate	Growth Rate	Population After 25 Years (total individual breeding adults)	Counterfactual of Growth Rate	Counterfactual of 25 Year Population	25 Year Population Relative to Current Population
0.950	1.026	2,798	0.992	0.816	1.907
0.980	1.031	3,140	0.996	0.915	2.141
0.990	1.032	3,228	0.998	0.941	2.200
0.995	1.033	3,266	0.998	0.952	2.226
0.999	1.033	3,300	0.998	0.962	2.249

3.2.3 Manx Shearwater

Table 3.6. PVA outputs for Manx shearwater based on 40MW worst case deployment presented in Chapter 11, Marine Ornithology, over a 25-year period.

Avoidance Rate	Annual Harvest	Counterfactual of Growth Rate	Counterfactual of 25 Year Population
0.950	2	1.000	0.998
0.980	1	1.000	0.999
0.990	0	1.000	1.000
0.995	0	1.000	1.000
0.999	0	1.000	1.000

Table 3.7. PVA outputs for Manx shearwater based on 240MW indicative deployment presented in Chapter 11, Marine Ornithology, over a 25-year period.

Avoidance Rate	Annual Harvest	Counterfactual of Growth Rate	Counterfactual of 25 Year Population
0.950	9	1.000	0.993
0.980	4	1.000	0.997
0.990	2	1.000	0.998
0.995	1	1.000	0.999
0.999	0	1.000	1.000

4 Impact Assessment

4.1 Guillemot

ES Chapter 11, Marine Ornithology, assessed the sensitivity for guillemot as “High”. The magnitudes of impact and resulting impact significance for the different scenarios assessed are presented in Table 4.1, along with the impact assessment for the new scenarios.

Table 4.1. Impact assessment for guillemot under different deployment scenarios over a 25-year deployment. The 240MW indicative array and 40MW worst case scenarios were presented in ES Chapter 11, Marine Ornithology.

Scenario	Avoidance Rate	Magnitude of Impact	Impact Significance
240MW indicative array	0.950	Very high	Major adverse
	0.990	Medium	Not assessed
40MW worst case	0.950	Medium	Moderate adverse
	0.990	Low	Not assessed
0.7 bottlenose dolphin, worst case	0.950	Low	Minor adverse
	0.990	Low	Minor adverse

4.2 Razorbill

ES Chapter 11, Marine Ornithology, assessed the sensitivity for razorbill as “High”. The magnitudes of impact and resulting impact significance for the different scenarios assessed are presented in Table 4.2, along with the impact assessment for the new scenarios.

Table 4.2. Impact assessment for razorbill under different deployment scenarios over a 25-year deployment. The 240MW indicative array and 40MW worst case scenarios were presented in ES Chapter 11, Marine Ornithology.

Scenario	Avoidance Rate	Magnitude of Impact	Impact Significance
240MW indicative array	0.950	Very high	Major adverse
	0.990	High	Not assessed
40MW worst case	0.950	High	Moderate adverse
	0.990	Low	Not assessed
0.7 bottlenose dolphin, worst case	0.950	Low	Minor adverse
	0.990	Low	Minor adverse

4.3 Manx Shearwater

ES Chapter 11, Marine Ornithology, assessed the sensitivity for Manx shearwater as “High”, and the magnitude of impact “Negligible” at both 40MW worst case and 240MW indicative array deployment levels, using avoidance rates of 0.950 and 0.990. This resulted in a “Minor adverse” impact significance.

The use of the PVA confirms this to be the case.

5 References

Horswill, C., Robinson, R.A., 2015. Review of seabird demographic rates and density dependence (JNCC Report No. 552). JNCC, Peterborough.

JNCC, 2020. Seabird Monitoring Programme Online Database (Online Database). JNCC.

Searle, K., Mobbs, D., Daunt, F., Butler, A., 2019. A Population Viability Analysis Modelling Tool for Seabird Species (Natural England Commissioned Report No. ITT_4555).

SNH, 2018. Interim Guidance on Apportioning Impacts from Marine Renewable Developments to Breeding Seabird Populations in Special Protection Areas (Guidance note). Scottish Natural Heritage.

Stubbings, E., Büche, B., Riordan, J., Moss, J., Wood, M., 2017. Seabird monitoring on Skomer Island in 2017 (JNCC Report).