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Morlais Project

Marine Mammals
Addition Collision Risk Modelling

Applicant: Menter Môn Morlais Limited

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1 Introduction

The following memo outlines the updated collision risk modelling that has been undertaken on the Morlais project, in response to comments received from Natural Resources Wales (NRW).

1.1 Requirement for additional modelling

During post-submission consultation with NRW, the following actions were placed on the Applicant to provide additional information to NRW in order for NRW to make an informed decision on the Morlais project. These actions are outlined below, and the following sections of this note provide the information requested in response to the following actions:

1. Update collision risk modelling of bottlenose dolphin to be below 0.7 bottlenose dolphins, in line with current potential biological removal (PBR) rates.
2. Update the collision risk modelling for all species to take account possible scenario of 620 devices.
3. Update to the presentation of collision risk tables.
4. Present all avoidance rates for additional modelling.

This is an updated version of the previous note sent to NRW: Morlais: Updated Collision Risk Modelling dated 18th February 2020.

2 Methodology

2.1 Bottlenose dolphin – current PBR

NRW updated the PBR values for three marine mammal species, including bottlenose dolphin *Tursiops truncatus*, harbour porpoise *Phocoena phocoena* and grey seal *Halichoerus grypus.* These current PBRs are based on the best available information on each of the species' population scale, and are considered to the limit of anthropogenic mortality in each of the relevant Management Units (MUs); a higher mortality value would be considered to cause an adverse effect of the population.

For bottlenose dolphin, the current PBR value is 0.7, for harbour porpoise the PBR is 559.5, and for grey seal the PBR value is 282.9. All collision risk for the Morlais project must therefore be within those PBR values, to ensure there is no adverse effect on the populations. For bottlenose dolphin, the collisions risk modelling resulted in less than one bottlenose dolphin being at risk of fatal collision, and further modelling is required to determine the maximum number of devices for each device type that could be deployed during the first phase of the project, and still be within the bottlenose dolphin 0.7 PBR value. **Section 3.1** of this memo sets out the results of that updated modelling.

In order to determine the maximum number of devices, and MW output that could be possible, for each of the device types, while remaining within the 0.7 limit for bottlenose dolphin collision risk, the bottlenose dolphin collision per MW, per device, was determined, and used to show the rate of collision with increasing MW. This linear model was then used to determine the maximum number of devices for each type that could be deployed within the first phase, within the bottlenose dolphin 0.7 limit. As each of the device type parameters shown are examples only, and the final design (including the MW output) is still to be determined, results are shown as an example for a number of these devices, and for the maximum MW possible for each of the device types.

2.2 Updated modelling for 620 devices

Chapter 4 of the ES states that the absolute maximum number of devices that could be deployed, for the full deployment of the project, is 620 devices. Due to the 240MW capacity of the Morlais project, the only devices that could be deployed in this number are device types 6a, with a 0.3MW and 0.1MW output per device

respectively. **Section 3.2** includes an updated collision risk assessment for the possible scenario of up to 620 devices of either type 6a.

3 Results

3.1 Additional collision risk modelling for 0.7 bottlenose dolphin

3.1.1 Linear results

As described in **Section** Error! Reference source not found. above, in order to determine the maximum number of devices possible to be deployed, and be within the PBR limit of 0.7 bottlenose dolphins, the bottlenose dolphin collision risk per MW (assuming a 98% avoidance rate) has been calculated (**Table 3-1** and **Table 3-2**) and used to generate a linear model to show the total MW for each device type (

Graph 3-1 and **Graph 3-2**).

It is important to note the collision risk modelling and assessments are based on the collision risk for one device and then multiplied up for the different MW and number of device scenarios. There is currently no information on the collision risk for multiple devices in an array, taking into account the layout of the devices in an array. It is unlikely that animals would encounter each device in an array equally. Therefore, by basing the collision risk on values multiplied up from one device is a worst-case scenario.

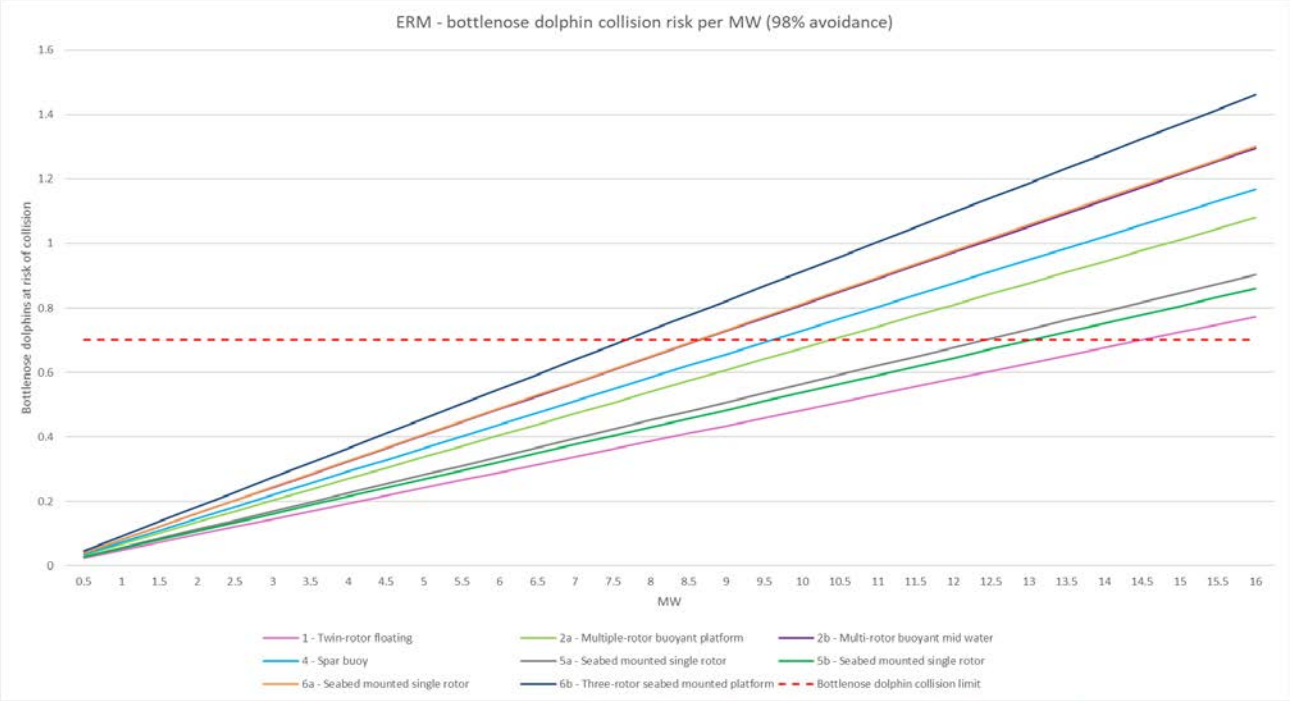
3.1.2 Encounter Rate Model

Table 3-1 and **Graph 3-1** show that, using the ERM, the device with the highest collision risk per MW is device 6b (three-rotor seabed mounted platform), reaching 0.7 bottlenose dolphin at the lowest generating capacity (7.66MW), and the lowest collision risk per MW is device 1 (twin-rotor floating), reaching 0.7 bottlenose dolphin at the highest capacity (14.49MW).

Table 3-1 Bottlenose collision risk per MW, for each device type, using the Encounter Rate Model (ERM) with 0% and 98% avoidance

Device Group	1	2a	2b	4	5a	5b	6a	6b
MW of Device	**2**	**1.5**	**1.25**	**1**	**1**	**1.5**	**0.3**	**1.2**
Bottlenose dolphin collision per device (no avoidance)	4.83	5.06	5.06	3.65	2.82	4.03	1.22	5.48
Bottlenose dolphin collision per MW (no avoidance)	2.42	3.37	4.05	3.65	2.82	2.69	4.07	4.57
Bottlenose dolphin collision per MW (98% avoidance)	**0.048**	**0.067**	**0.08**	**0.073**	**0.056**	**0.054**	**0.081**	**0.091**
Maximum MW possible within bottlenose dolphin PBR limit of 0.7	**14.49**	10.38	8.65	9.59	12.41	13.03	8.61	7.66

Graph 3-1 Bottlenose collision risk per MW linear model, using the ERM collision rates per MW (shown in Table 3-1). PBR of 0.7 for bottlenose dolphins shown in red



3.1.3 Collision Rate Model

Table 3-2 and **Graph 3-2** show that, using the CRM, the device with the highest collision risk per MW is device 4 (spar-buoy), reaching 0.7 bottlenose dolphin at the lowest capacity (6.63MW), and the lowest collision risk per MW is device 5a (seabed mounted single rotor), reaching 0.7 bottlenose dolphin at the highest capacity (19.77MW).

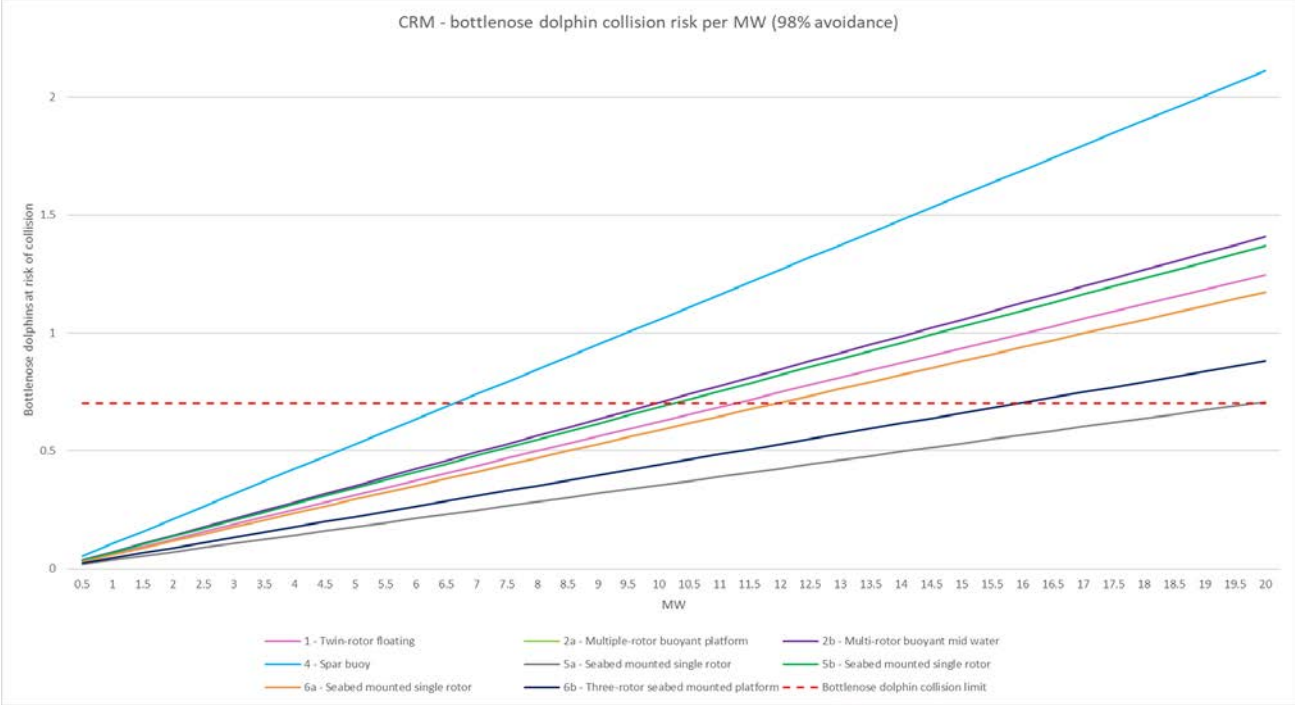
These are different to both the highest risk and lowest risk under the ERM[1], therefore, to determine the number of devices that are possible to be deployed, and the maximum possible MW for each, the highest collision risk for each device for both models (ERM and CRM) must be taken into account, and the following section outlines the maximum number of each device, or maximum MW of each device, that would be possible and be within the 0.7 bottlenose dolphin PBR limit for both models.

Table 3-2 Bottlenose collision risk per MW, for each device type, using the Collision Risk Model (CRM) with 0% and 98% avoidance

Device Group	1	2a	2b	4	5a	5b	6a	6b
MW of Device	**2**	**1.5**	**1.25**	**1**	**1**	**1.5**	**0.3**	**1.2**
Bottlenose dolphin collision per device (no avoidance)	6.23	4.4	4.4	5.28	1.77	5.13	0.88	2.64
Bottlenose dolphin collision per MW (no avoidance)	3.12	2.93	3.52	5.28	1.77	3.42	2.93	2.20
Bottlenose dolphin collision per MW (98% avoidance)	**0.062**	**0.059**	**0.070**	**0.11**	**0.035**	**0.068**	**0.059**	**0.044**
Maximum MW possible within bottlenose dolphin PBR limit of 0.7	11.24	11.93	9.94	6.63	19.77	10.23	11.93	15.91

[1] Due to the difference in the way that collision risk is calculated within the models (the biggest difference being that ERM assesses the collision risk for each blade of a device and CRM assesses the collision risk for each rotor of a device).

Graph 3-2 Bottlenose collision risk per MW linear model, using the CRM collision rates per MW (shown in Table 3-2)[2]. PBR of 0.7 for bottlenose dolphins shown in red.



3.1.4 Maximum number of devices

From the results as shown in

Graph 3-1 and **Graph 3-2** above, the maximum MW possible under each device has been calculated and is shown below, for either the ERM or CRM results (assuming a 98% avoidance).

Table 3-3 shows the maximum possible MW within the PBR of 0.7 for bottlenose dolphin, for either the ERM or CRM results (dependant on which is the worst-case), and **Table 3-4** shows the maximum number of devices (note that these show different results, as **Table 3-3** is based on MW not number of devices, to account for the different MW of each device that might be present in the final devices).

Table 3-3 Maximum possible MW for each device type within the bottlenose PBR of 0.7, for each possible device, for either ERM or CRM (whichever is the worst-case), based on MW for each device type

Device Group	1	2a	2b	4	5a	5b	6a	6b
MW of Device	**2**	**1.5**	**1.25**	**1**	**1**	**1.5**	**0.3**	**1.2**
Model with the worst-case collision risk	CRM	ERM	ERM	CRM	ERM	CRM	ERM	ERM
Bottlenose dolphin collision per device (assuming no avoidance)	6.23	5.06	5.06	5.28	2.82	5.13	1.22	5.48
Number of Devices	**5.62**	**6.92**	**6.92**	**6.63**	**12.41**	**6.82**	**28.69**	**6.39**
Total MW of devices	**11.24**	**10.38**	**8.65**	**6.63**	**12.41**	**10.23**	**8.61**	**7.66**
Bottlenose dolphin collision risk for all devices (98% avoidance)	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70

[2] 6a and 2a have the same collision risk per MW, so have the same line on Graph 3-2, as shown by Table 3-2

Table 3-4 Maximum possible MW for each device within the bottlenose PBR of 0.7, for each possible device, for either ERM or CRM (whichever is the worst-case), based on number of devices

Device Group	1	2a	2b	4	5a	5b	6a	6b
MW of Device	**2**	**1.5**	**1.25**	**1**	**1**	**1.5**	**0.3**	**1.2**
Model with the worst-case collision risk	CRM	ERM	ERM	CRM	ERM	CRM	ERM	ERM
Bottlenose dolphin collision per device (assuming no avoidance)	6.23	5.06	5.06	5.28	2.82	5.13	1.22	5.48
Number of Devices	**5**	**6**	**6**	**6**	**12**	**6**	**28**	**6**
Total MW of devices	**10**	**9**	**7.5**	**6**	**12**	**9**	**8.4**	**7.2**
Bottlenose dolphin collision risk for all devices (98% avoidance)	0.623	0.607	0.607	0.634	0.677	0.616	0.683	0.658

3.2 Update to assessments of collision risk

3.2.1 Impact assessment in the ES

The indicative number of each device, as shown in **Table 3-3** and **Table 3-4** above, have been used to update the impact assessment for all marine mammal species, in order to represent the potential first phase of deployment. Note that all other parameters remain as included within the collision risk modelling undertaken within the ES (including marine mammal and device parameters). The section below shows the collision risk for each species, for the maximum MW of each device type that could be deployed under the updated bottlenose dolphin scenario. **Table 3-5** and **Table 3-6** provides indicative scenarios for the maximum number of each type of device for collision risk of 0.7 bottlenose dolphin or less, using the ERM and CRM (showing the number of individuals per year, and percentage of reference population), respectively, based on 98% avoidance.

It is important to note that the output of the devices (MW) used in the assessments are indicative and have been based on the current minimum rating, as a worst-case scenario and prior to deployment it is expected that the rating (MW) for the devices deployed would be higher, although the other parameters are unlikely to change. Therefore, an assessment has also been presented on the maximum possible MW, rather than the maximum number of each device type.

For each of the marine mammal species included in **Table 3-5** and **Table 3-6** below, the worst-case device (i.e. the device with the potential for the highest number of collisions) is shown in bold, and the resultant magnitude of effect is based off that device. For this scenario, only one type of device is to be deployed during the first phase of the project, and therefore only the worst-case device is used within the subsequent assessments, and all other devices are considered to have less of an effect than that worst-case device.

Table 3-5 ERM assessment with 98% avoidance for maximum number (and MW) of each type of device for collision risk of 0.7 or less bottlenose dolphin (number of individuals / year and % of reference population[3])

Tidal device category	1	2a	2b	4	5a	5b	6a	6b	Magnitude of effect for worst-case device
Number	**7.25**	**6.917**	**6.92**	**9.59**	**12.41**	**8.68**	**28.69**	**6.39**	
Total MW	**14.49**	**10.38**	**8.65**	**12.41**	**13.03**	**8.61**	**7.66**	**14.49**	
Bottlenose dolphin	**0.70 (0.18%)**	**0.70 (0.18%)**	**0.70 (0.18%)**	**0.70 (0.18%)**	**0.70 (0.18%)**	**0.70 (0.18%)**	**0.70 (0.18%)**	**0.70 (0.18%)**	Potential permanent effect with **medium** magnitude for worst-case device (0.01-1% of the reference population anticipated to be exposed to effect).
Harbour porpoise	**24.89 (0.024%)**	19.43 (0.019%)	16.06 (0.015%)	15.20 (0.015%)	5.00 (0.005%)	8.97 (0.009%)	2.99 (0.003%)	2.39 (0.002%)	
Risso's dolphin	**1.02 (0.01%)**	1.00 (0.01%)	1.00 (0.01%)	1.01 (0.01%)	0.99 (0.01%)	1.01 (0.01%)	1.00 (0.01%)	1.00 (0.01%)	Potential permanent effect with **medium** magnitude for worst-case device (0.01-1% of the reference population anticipated to be exposed to effect).
Common dolphin	**6.05 (0.01%)**	5.42 (0.01%)	5.42 (0.01%)	5.73 (0.01%)	5.50 (0.01%)	5.71 (0.01%)	5.42 (0.01%)	5.43 (0.01%)	
Minke whale	1.71 (0.007%)	2.34 (0.009%)	2.34 (0.009%)	1.90 (0.008%)	2.19 (0.009%)	1.92 (0.008%)	2.32 (0.01%)	**2.33 (0.01%)**	
Grey seal	**3.94 (0.066%) (0.005%)**	3.23 (0.054%) (0.004%)	3.23 (0.054%) (0.004%)	3.26 (0.054%) (0.004%)	2.48 (0.041%) (0.003%)	2.80 (0.047%) (0.003%)	2.26 (0.038%) (0.003%)	2.26 (0.038%) (0.003%)	Potential permanent effect with **medium** magnitude for worst-case device (0.01-1% of the reference population anticipated to be exposed to effect).
Harbour seal	0.011 (0.021%) (0.00002%)	0.010 (0.021%) (0.00002%)	0.010 (0.019%) (0.00002%)	**0.012 (0.024%) (0.00002%)**	0.011 (0.021%) (0.00002%)	0.010 (0.019%) (0.00002%)	0.011 (0.023%) (0.00002%)	0.006 (0.012%) (0.00001%)	

[3] All reference populations are the same as presented in the ES

Table 3-6 CRM assessment with 98% avoidance for maximum number (and MW) of each type of device for collision risk of 0.7 or less bottlenose dolphin (number of individuals / year and % of reference population)

Tidal device category	1	2a	2b	4	5a	5b	6a	6b	Magnitude of effect for worst-case device
Number	**5.62**	**7.95**	**7.95**	**19.77**	**6.82**	**39.77**	**13.26**	**5.62**	
Total MW	**11.24**	**11.93**	**9.94**	**19.77**	**10.23**	**11.93**	**15.91**	**11.24**	
Bottlenose dolphin	**0.70 (0.18%)**	**0.70 (0.18%)**	**0.70 (0.18%)**	**0.70 (0.18%)**	**0.70 (0.18%)**	**0.70 (0.18%)**	**0.70 (0.18%)**	**0.70 (0.18%)**	Potential permanent effect with **medium** magnitude for worst-case device (0.01-1% of the reference population anticipated to be exposed to effect).
Harbour porpoise	**21.13 (0.02%)**	18.85 (0.018%)	15.58 (0.015%)	14.03 (0.013%)	4.92 (0.005%)	8.35 (0.008%)	2.89 (0.003%)	2.31 (0.002%)	
Risso's dolphin	1.002 (0.01%)	0.996 (0.01%)	0.996 (0.01%)	**1.003 (0.01%)**	0.999 (0.01%)	1.002 (0.01%)	0.997 (0.01%)	0.997 (0.01%)	
Common dolphin	5.413 (0.0096%)	5.306 (0.009%)	5.306 (0.009%)	5.434 (0.0096%)	5.369 (0.0095%)	**5.432 (0.0096%)**	5.309 (0.009%)	5.310 (0.009%)	Potential permanent effect with **low** magnitude for worst-case device (0.001-0.01% of the reference population anticipated to be exposed to effect).
Minke whale	1.251 (0.005%)	1.420 (0.006%)	1.420 (0.006%)	1.206 (0.005%)	1.306 (0.006%)	1.211 (0.005%)	**1.421 (0.006%)**	**1.421 (0.006%)**	
Grey seal	**3.55 (0.059%) (0.004%)**	3.14 (0.052%) (0.004%)	3.14 (0.052%) (0.004%)	3.10 (0.052%) (0.004%)	2.39 (0.040%) (0.003%)	2.66 (0.044%) (0.003%)	2.20 (0.037%) (0.003%)	2.20 (0.037%) (0.003%)	Potential permanent effect with **medium** magnitude for worst-case device (0.01-1% of the reference population anticipated to be exposed to effect).
Harbour seal	0.009 (0.0%) (0.00001%)	0.010 (0.020%) (0.00002%)	0.009 (0.018%) (0.000014%)	**0.011 (0.022%) (0.00002%)**	0.010 (0.020%) (0.00002%)	0.009 (0.018%) (0.00001%)	**0.011 (0.022%) (0.00002%)**	0.006 (0.011%) (0.00001%)	

The overall magnitude of effect for all species, based on the worst-case for either the ERM or CRM, remains the same as what was presented within the ES, and therefore for the scenario of less than 0.7 bottlenose dolphin, the impact significance is the same for all species as concluded within the ES (**Table 3-8**).

Table 3-7 Maximum number of individuals (and % of reference population) that could be at risk of collision with operational tidal devices at Morlais (based on scenarios for less than 0.7 bottlenose dolphin)

Species	Worst-case magnitude (ERM and CRM) in the ES	Worst-case magnitude (ERM and CRM) for the updated modelling
Harbour porpoise	20-23 individuals (0.02% of MU). Potential permanent effect with **medium** magnitude (0.01-1% of the reference population anticipated to be exposed to effect).	21-25 individuals (0.02% of MU). Potential permanent effect with **medium** magnitude (0.01-1% of the reference population anticipated to be exposed to effect).
Bottlenose dolphin	0.99 individuals (0.25% of MU). Potential permanent effect with **medium** magnitude (0.01-1% of the reference population anticipated to be exposed to effect).	0.7 individuals (0.18% of MU). Potential permanent effect with **medium** magnitude (0.01-1% of the reference population anticipated to be exposed to effect).
Risso's dolphin	1.4 individuals (0.02% of MU). Potential permanent effect with **medium** magnitude (0.01-1% of the reference population anticipated to be exposed to effect).	1 individual (0.01% of MU). Potential permanent effect with **medium** magnitude (0.01-1% of the reference population anticipated to be exposed to effect).
Common dolphin	8 individuals (0.01% of MU) Potential permanent effect with **medium** magnitude (0.01-1% of the reference population anticipated to be exposed to effect).	5-6 individuals (0.0096-0.01% of MU) Potential permanent effect with **medium** magnitude (0.01-1% of the reference population anticipated to be exposed to effect).
Minke whale	2-3 individuals (0.01%) Potential permanent effect with **medium** magnitude (0.01-1% of the reference population anticipated to be exposed to effect).	1-2 individuals (0.006-0.009%) Potential permanent effect with **medium** magnitude (0.01-1% of the reference population anticipated to be exposed to effect).
Grey seal	4-5 individuals (0.08% of MU) Potential permanent effect with **medium** magnitude (0.01-1% of the reference population anticipated to be exposed to effect).	3.5-4 individuals (0.06-0.07% of MU) Potential permanent effect with **medium** magnitude (0.01-1% of the reference population anticipated to be exposed to effect).
Harbour seal	0.01 individuals (0.03% of MU) Potential permanent effect with **medium** magnitude (0.01-1% of the reference population anticipated to be exposed to effect).	0.01 individuals (0.02% of MU) Potential permanent effect with **medium** magnitude (0.01-1% of the reference population anticipated to be exposed to effect).

Table 3-8 Assessment of impact significance for collision risk with operational turbines at MDZ

Potential Impact	Receptor	Sensitivity (sensitivity of Welsh population)	Magnitude	Significance	Mitigation	Residual Impact
Collision risk for less than 0.7 bottlenose dolphin scenarios	Harbour porpoise	Low (Low)	Medium	Minor	Phased deployment, monitoring and mitigation (EMMP)	Minor (not significant)
	Bottlenose dolphin	Low (High)	Medium	Minor (Major)		Minor (not significant)
	Risso's dolphin	Low (Low)	Medium	Minor		Minor (not significant)

Potential Impact	Receptor	Sensitivity (sensitivity of Welsh population)	Magnitude	Significance	Mitigation	Residual Impact
	Common dolphin	Low (Low)	Medium	Minor		Minor (not significant)
	Minke whale	Low (Low)	Medium	Minor		Minor (not significant)
	Grey seal	Low (Low)	Medium	Minor		Minor (not significant)
	Harbour seal	Low (Low)	Medium	Minor		Minor (not significant)

3.2.2 Cumulative Impact Assessment

The cumulative projects screened into this updated assessment are based upon those within the ES, with the exception of the following updates:

- The current construction start data for the Wylfa Newydd project is 2026, and it is therefore expected that the first phase of the Morlais project will be operational, and the monitoring and mitigation period, including conclusions on the actual risk of collision to all marine mammal species, would be completed prior to Wylfa Newydd beginning its construction. On that basis, the Applicant believes that there would be no cumulative risk of collision with the Morlais project. In the unlikely case that construction of the Wylfa Newydd project and the operation of Morlais could be at the same time, prior to the monitoring and mitigation period being completed, then the Applicant is committed to undertake additional assessments to ensure that the cumulative collision risk is not increased. On this basis, the Wylfa Newydd project has been screened out of further assessment.

- At present, it is unknown when the Minesto Holyhead Deep project could commence its second phase, however, as the planning application has not yet been submitted, it is also considered unlikely that the Minesto project would be operational prior to the first phase of Morlais (including the monitoring and mitigation period) being completed. On that basis, the Applicant believes that there would be no cumulative risk of collision with the Morlais project. In the unlikely case that operation of the Minesto Holyhead Deep Phase 2 project, and the first phase of Morlais, could be at the same time, prior to the monitoring and mitigation period being completed, then the Applicant is committed to undertake additional assessments to ensure that the cumulative collision risk is not increased. On this basis, Phase 2 of the Minesto Holyhead Deep project has been screened out of further assessment.

This cumulative impact assessment has therefore been updated in line with the above changes to the collision risk modelling, and the above changes to the screening of other projects. **Table 3-9** below updates the cumulative assessment for collision risk (those projects that were listed as N/A or having no collision risk for all species within the ES have not been included here). The projects that have now been screened out of further assessment (Wylfa Newydd and Minesto Holyhead Deep Phase 2) have been included here for comparison only and are not included in the overall cumulative assessment. There are no changes to the overall magnitude off effect compared to the ES, and therefore no change to the overall impact significance as presented in the ES (**Table 3-10**).

Table 3-9 Cumulative impact assessment for collision risk with tidal devices and vessels for harbour porpoise (HP), bottlenose dolphin (BND), Risso's dolphin (RD), common dolphin (CD), minke whale (MW), grey seal (GS) and harbour seal (HS) (N/A = not available) (values used within the cumulative impact assessment of the ES are shown below the values used for this assessment, in square brackets)

Project	Potential Cumulative Impact	Assessment of Cumulative Impact (maximum number of individuals at increased risk)						
		HP	BND	RD	CD	MW	GS	HS
Morlais	Collision risk with tidal devices	25	0.7	1	6	2	4	0.01
	Collision risk with vessels	1.2	0.03	0.05	0.34	0.03	0.24	0.0007
~~**Holyhead Deep Tidal Array – 80MW**~~	~~Collision risk with vessels~~	~~0.15-0.3~~	~~0.0025-0.05~~	~~0.014-0.03~~	~~0.004-0.008~~	~~0.001-0.002~~	~~0.65-1.3~~	~~0.0025-0.005~~
~~**Wylfa Nuclear Power Plant**~~	~~Collision risk with vessels~~	~~5.5~~	~~0.75~~	~~0~~	~~0~~	~~0~~	~~0.3~~	~~0.0015~~
West of Islay Tidal Energy Park	Collision risk with tidal devices	-	-	N/A	N/A	N/A	17	14.14
Overall Cumulative Impact Assessment (maximum number of individuals at possible risk)		**Up to 27 [up to 30]**	**Up to 1 [up to 2]**	**Up to 2 [up to 2]**	**Up to 7 [up to 9]**	**Up to 3 [up to 3]**	**Up to 22 [up to 24]**	**Up to 15 [up to15]**
Percentage of reference population		**0.03% [0.03%]**	**0.25% [0.5%]**	**0.02% [0.02%]**	**0.01% [0.02%]**	**0.01% [0.01%]**	**0.05% [0.06%]**	**0.05% [0.05%]**
Magnitude for any long-term effect		**Medium [medium]**	**Medium [medium]**	**Medium [medium]**	**Medium [medium]**	**Medium [medium]**	**Medium [medium]**	**Medium [medium]**

Table 3-10 Assessment of impact significance for potential cumulative impacts

Potential Cumulative Impact	Receptor	Sensitivity	Magnitude	Significance	Mitigation	Residual Impact
Collision risk with tidal devices and vessels	Harbour porpoise	Low	Medium	Minor	Phased deployment, monitoring and mitigation	Minor (not significant)
	Bottlenose dolphin		Medium	Minor		Minor (not significant)
	Risso's dolphin		Medium	Minor		Minor (not significant)
	Common dolphin		Medium	Minor		Minor (not significant)
	Minke whale		Medium	Minor		Minor (not significant)
	Grey seal		Medium	Minor		Minor (not significant)
	Harbour seal		Medium	Minor		Minor (not significant)

3.2.3 Habitats Regulation Assessments

Table 3-5 and **Table 3-6** provides indicative scenarios for the maximum number of each type of device for collision risk of 0.7 bottlenose dolphin or less, using the ERM and CRM (showing the number of individuals per year, and percentage of reference population), respectively, based on 98% avoidance. This is based on only one type of device is to be deployed during the first phase of the project, and therefore only the worst-case device is used within the assessment, as all other devices are considered to have less of an effect than that worst-case device.

For the HRA, the collision risk assessments were based on indicative scenarios for the combination of different types of devices where the collision risk is predicted to be less than one bottlenose dolphin (based on the scenarios with the current maximum MW). This has been compared to the updated modelling of the maximum MW of each device type that could be deployed under the updated 0.7 bottlenose dolphin scenario (**Table 3-11** and **Table 3-12**).

For harbour porpoise, although the potential collision risk has increased slightly based on the ERM for the updated modelling of the 0.7 bottlenose dolphin scenarios (**Table 3-11**), this does not change the outcomes of the assessments for SACs where harbour porpoise is a designated feature. The number of harbour porpoise that could be at risk is also well below the NRW PBR values. Therefore, there would be no adverse effect on the integrity of the SACs in relation to the Conservation Objectives for harbour porpoise (i.e. Conservation Objective 1: harbour porpoise is a viable component of the site), especially when taking into account the mitigation and monitoring (EMMP).

For bottlenose dolphin, the potential collision risk for the updated modelling is less than the what was assessed in the HRA, therefore this does not change the outcomes of the assessments for SACs where bottlenose dolphin is a designated feature and there would be no adverse effect on the integrity of the SACs in relation to the Conservation Objectives for bottlenose dolphin (i.e. Conservation Objective 1: the populations are maintained on a long-term basis as a viable component of its natural habitat), especially when taking into account the mitigation and monitoring (EMMP).

For grey seal, the potential collision risk has decreased slightly based on the ERM and CRM for the updated modelling of the 0.7 bottlenose dolphin scenarios (**Table 3-11** and **Table 3-12**), this does not change the outcomes of the assessments for SACs where grey seal is a designated feature. The number of grey seal that could be at risk is also well below the NRW PBR values. Therefore, there would be no adverse effect on the integrity of the SACs in relation to the Conservation Objectives for grey seal (i.e. Conservation Objective 1: the populations are maintained on a long-term basis as a viable component of its natural habitat), especially when taking into account the mitigation and monitoring (EMMP).

For harbour seal there is no difference in the assessments for the updated modelling of the 0.7 bottlenose dolphin scenarios and the worst-case assessed in the HRA (**Table 3-11** and **Table 3-12**). Therefore, this does not change the outcomes of the assessments for SACs where harbour seal is a designated feature and there would be no adverse effect on the integrity of the SACs in relation to the Conservation Objectives for harbour seal, especially when taking into account the mitigation and monitoring (EMMP).

Table 3-11 Worst-case ERM assessment with 98% avoidance for maximum number (and MW) for collision risk of 0.7 or less bottlenose dolphin (number of individuals / year and % of reference population[4]) compared with worst-case assessed in HRA

Species	Worst-case assessed for updated modelling for 0.7 BND	Worst-case assessed in HRA
Bottlenose dolphin	0.70 (0.18% of MU) (0.2% of SACs)	0.99 (0.25% of MU) (0.3%of SACs)
Harbour porpoise	24.89 (0.024% of MU)	22.76 (0.02% of MU)

[4] All reference populations are the same as presented in the ES

Species	Worst-case assessed for updated modelling for 0.7 BND	Worst-case assessed in HRA
Grey seal	3.94 (0.07% of MU)	4.6 (0.08% of MU)
Harbour seal	0.012 (0.024%)	0.01 (0.03% of MU)

Table 3-12 Worst-case CRM assessment with 98% avoidance for maximum number (and MW) for collision risk of 0.7 or less bottlenose dolphin (number of individuals / year and % of reference population[5]) compared with worst-case assessed in HRA

Species	Worst-case assessed for updated modelling for 0.7 BND	Worst-case assessed in HRA
Bottlenose dolphin	0.70 (0.18% of MU) (0.2% of SACs)	**0.99** **(0.25% of MU)** **(0.3% of SACs)**
Harbour porpoise	**21.13** **(0.02% of MU)**	19.69 (0.02% of MU)
Grey seal	**3.55** **(0.06% of MU)**	4.3 (0.07% of MU)
Harbour seal	0.011 (0.022% of MU)	0.01 (0.03% of MU)

In-combination assessment

The updated cumulative impact assessment (**Table 3-9**), indicates there are no significant changes to the in-combination assessments in the HRA.

Overall the number of harbour porpoise that could be at risk has decreased slightly with the updated modelling and assessment, from 30 to 27 individuals (**Table 3-9**). However, this does not change the outcomes of the in-combination assessments for SACs where harbour porpoise is a designated feature. The number of harbour porpoise that could be at risk is also well below the NRW PBR values. Therefore, there would be no adverse effect on the integrity of the SACs in relation to the Conservation Objectives for harbour porpoise (i.e. Conservation Objective 1: harbour porpoise is a viable component of the site), especially when taking into account the mitigation and monitoring (EMMP).

For bottlenose dolphin, the potential collision risk for the updated modelling is less than the what was assessed in the in-combination assessments for the HRA (**Table 3-9**), therefore this does not change the outcomes of the assessments for SACs where bottlenose dolphin is a designated feature and there would be no adverse effect on the integrity of the SACs in relation to the Conservation Objectives for bottlenose dolphin (i.e. Conservation Objective 1: the populations are maintained on a long-term basis as a viable component of its natural habitat), especially when taking into account the mitigation and monitoring (EMMP).

The number of grey seal has decreased slightly and the number of harbour seal remains the same, there is no difference to the in-combination assessments in the HRA (**Table 3-9**).

4 Updated modelling for 620 devices

An additional scenario has been modelled to take into account the absolute maximum number of devices possible for full deployment of the Morlais project. The absolute maximum number of devices that could be deployed, for the full deployment of the project, is 620 devices. Due to the 240MW capacity of the Morlais

[5] All reference populations are the same as presented in the ES

project, the only devices that could be deployed in this number is 6a, with a 0.3MW output per device (note that under this scenario, only device 6a would be deployed). It should be noted that it is considered to be unrealistic that the full project would consist of only one type of device, and therefore the scenario of 240MW from a range of devices, as presented within the ES, is considered to be more realistic.

Table 4-1 and **Table 4-2** below show the collision risk, for each marine mammal species, under the scenario that a maximum of 620 devices could be deployed. As noted above, this is only relevant for the smaller device due to the project capacity limit of 240MW. As shown in **Table 4-1** and **Table 4-2** below, the collision risk for marine mammal species under the 620 device scenario would be less than the scenario of the maximum 240MW scenario as presented within the ES (included in the table below for ease of comparison). The magnitude of effect for all species, under both models, remains the same as those for the maximum 240MW build scenario as presented within the ES.

Table 4-1 ERM assessment (number of individuals / year and % of reference population) with 98% avoidance for maximum number of devices (620) vs the indicative 240MW scenario as presented within the ES for all marine mammal species (worst-case scenario is shown in bold)

	Updated scenario for 620 devices		**Scenario for 240MW full build scenario, with a combination of devices (30MW each) as presented within the ES**	
Tidal device category	**6a**	**Magnitude of effect for worst-case device**	**240MW of all devices, combined scenario**	**Magnitude of effect for worst-case device**
Number	**620**			
Total MW	**186**			
Bottlenose dolphin	15.1 (3.8%)	Potential permanent effect with **high** magnitude (more than 1% of the reference population anticipated to be exposed to effect).	**18.2** **(4.58%)**	Potential permanent effect with **high** magnitude (more than 1% of the reference population anticipated to be exposed to effect).
Harbour porpoise	64.5 (0.06%)	Potential permanent effect with **medium** magnitude for worst-case device (0.01-1% of the reference population anticipated to be exposed to effect).	**407.6** **(0.39%)**	Potential permanent effect with **medium** magnitude (0.01-1% of the reference population anticipated to be exposed to effect).
Risso's dolphin	21.5 (0.24%)		**26.1** **(0.30%)**	
Common dolphin	117.0 (0.21%)		**145.8** **(0.26%)**	
Minke whale	50.2 (0.21%)		**55.4** **(0.24%)**	
Grey seal	48.8 (0.81%) (0.12%)	Potential permanent effect with **high** magnitude (more than 1% of the reference population anticipated to be exposed to effect).	**84.2** **(1.4%)** **(0.21%)**	Potential permanent effect with **high** magnitude (more than 1% of the reference population anticipated to be exposed to effect).
Harbour seal	0.246 (0.492%) (0.0008%)	Potential permanent effect with **medium** magnitude for worst-case device (0.01-1% of the reference population anticipated to be exposed to effect).	**0.247** **(0.494%)** **(0.0008%)**	Potential permanent effect with **medium** magnitude for worst-case device (0.01-1% of the reference population anticipated to be exposed to effect).

Table 4-2 CRM assessment (number of individuals / year and % of reference population) with 98% avoidance for maximum number of devices (620) vs the indicative 240MW scenario as presented within the ES for all marine mammal species (worst-case device under 620 scenario is shown in bold)

	Updated scenario for 620 devices		Scenario for 240MW full build scenario, with a combination of devices (30MW each) as presented within the ES	
Tidal device category	**6a**	**Magnitude of effect for worst-case device**	**240MW of all devices, combined scenario**	**Magnitude of effect for worst-case device**
Number	**620**			
Total MW	**186**			
Bottlenose dolphin	10.9 (2.8%)	Potential permanent effect with **high** magnitude (more than 1% of the reference population anticipated to be exposed to effect).	**18.41 (4.64%)**	Potential permanent effect with **high** magnitude (more than 1% of the reference population anticipated to be exposed to effect).
Harbour porpoise	45.0 (0.04%)	Potential permanent effect with **medium** magnitude for worst-case device (0.01-1% of the reference population anticipated to be exposed to effect).	**414.84 (0.40%)**	Potential permanent effect with **medium** magnitude (0.01-1% of the reference population anticipated to be exposed to effect).
Risso's dolphin	15.5 (0.18%)		**26.26 (0.30%)**	
Common dolphin	82.8 (0.15%)		**140.93 (0.25%)**	
Minke whale	22.2 (0.09%)		**36.26 (0.15%)**	
Grey seal	34.2 (0.57%) (0.09%)	Potential permanent effect with **high** magnitude (more than 1% of the reference population anticipated to be exposed to effect).	**83.63 (1.39%) (0.21%)**	Potential permanent effect with **high** magnitude (more than 1% of the reference population anticipated to be exposed to effect).
Harbour seal	0.17 (0.34%) (0.0005%)	Potential permanent effect with **medium** magnitude for worst-case device (0.01-1% of the reference population anticipated to be exposed to effect).	**0.24 (0.47%) (0.0008%)**	Potential permanent effect with **medium** magnitude for worst-case device (0.01-1% of the reference population anticipated to be exposed to effect).

5 Appendix 1: All avoidance rates for additional modelling

The following sections presents the avoidance rates (0%, 50%, 90%, 95%, 98% and 99%) for each species for the updated modelling for the 0.7 bottlenose dolphin scenarios for each device type.

5.1 Bottlenose dolphin avoidance rates

Table 5-1 ERM assessment for all bottlenose dolphin avoidance rates for maximum number (and MW) of each type of device for collision risk of 0.7 or less bottlenose dolphin (number of individuals / year)

Tidal device category	1	2a	2b	4	5a	5b	6a	6b
Number	**7.25**	**6.917**	**6.92**	**9.59**	**12.41**	**8.68**	**28.69**	**6.39**
Total MW	**14.49**	**10.38**	**8.65**	**12.41**	**13.03**	**8.61**	**7.66**	**14.49**
0%	35.02	35.01	35.03	35.03	35.01	35.01	34.95	35.03
50%	17.51	17.51	17.51	17.51	17.51	17.51	17.48	17.52
90%	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50
95%	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75
98%	**0.70**	**0.70**	**0.70**	**0.70**	**0.70**	**0.70**	**0.70**	**0.70**
99%	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35

Table 5-2 CRM assessment for all bottlenose dolphin avoidance rates for maximum number (and MW) of each type of device for collision risk of 0.7 or less bottlenose dolphin (number of individuals / year)

Tidal device category	1	2a	2b	4	5a	5b	6a	6b
Number	**5.62**	**7.95**	**7.95**	**19.77**	**6.82**	**39.77**	**13.26**	**5.62**
Total MW	**11.24**	**11.93**	**9.94**	**19.77**	**10.23**	**11.93**	**15.91**	**11.24**
0%	35.03	34.98	34.98	35.00	34.97	35.00	35.00	35.01
50%	17.52	17.49	17.49	17.50	17.48	17.50	17.50	17.50
90%	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50
95%	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75
98%	**0.70**	**0.70**	**0.70**	**0.70**	**0.70**	**0.70**	**0.70**	**0.70**
99%	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35

5.2 Harbour porpoise avoidance rates

Table 5-3 ERM assessment for all harbour porpoise avoidance rates for maximum number (and MW) of each type of device for collision risk of 0.7 or less bottlenose dolphin (number of individuals / year)

Tidal device category	1	2a	2b	4	5a	5b	6a	6b
Number	**7.25**	**6.917**	**6.92**	**9.59**	**12.41**	**8.68**	**28.69**	**6.39**
Total MW	**14.49**	**10.38**	**8.65**	**12.41**	**13.03**	**8.61**	**7.66**	**14.49**
0%	1244.33	971.27	803.13	760.08	250.22	448.74	149.30	119.71
50%	622.17	485.63	401.56	380.04	125.11	224.37	74.65	59.86
90%	124.43	97.13	80.31	76.01	25.02	44.87	14.93	11.97
95%	62.22	48.56	40.16	38.00	12.51	22.44	7.47	5.99
98%	**24.89**	**19.43**	**16.06**	**15.20**	**5.00**	**8.97**	**2.99**	**2.39**
99%	12.44	9.71	8.03	7.60	2.50	4.49	1.49	1.20

Table 5-4 CRM assessment for all harbour porpoise avoidance rates for maximum number (and MW) of each type of device for collision risk of 0.7 or less bottlenose dolphin (number of individuals / year)

Tidal device category	1	2a	2b	4	5a	5b	6a	6b
Number	**5.62**	**7.95**	**7.95**	**19.77**	**6.82**	**39.77**	**13.26**	**5.62**
Total MW	**11.24**	**11.93**	**9.94**	**19.77**	**10.23**	**11.93**	**15.91**	**11.24**
0%	1056.56	942.54	779.04	701.37	245.97	417.40	144.34	115.50
50%	528.28	471.27	389.52	350.68	122.98	208.70	72.17	57.75
90%	105.66	94.25	77.90	70.14	24.60	41.74	14.43	11.55
95%	52.83	47.13	38.95	35.07	12.30	20.87	7.22	5.78
98%	**21.13**	**18.85**	**15.58**	**14.03**	**4.92**	**8.35**	**2.89**	**2.31**
99%	10.57	9.43	7.79	7.01	2.46	4.17	1.44	1.16

5.3 Risso's dolphin avoidance rates

Table 5-5 ERM assessment for all Risso's dolphin avoidance rates for maximum number (and MW) of each type of device for collision risk of 0.7 or less bottlenose dolphin (number of individuals / year)

Tidal device category	1	2a	2b	4	5a	5b	6a	6b
Number	**7.25**	**6.917**	**6.92**	**9.59**	**12.41**	**8.68**	**28.69**	**6.39**
Total MW	**14.49**	**10.38**	**8.65**	**12.41**	**13.03**	**8.61**	**7.66**	**14.49**
0%	51.07	49.83	49.85	50.61	49.75	50.47	49.83	49.94
50%	25.54	24.92	24.93	25.30	24.87	25.24	24.92	24.97
90%	5.11	4.98	4.99	5.06	4.97	5.05	4.98	4.99
95%	2.55	2.49	2.49	2.53	2.49	2.52	2.49	2.50
98%	**1.02**	**1.00**	**1.00**	**1.01**	**0.99**	**1.01**	**1.00**	**1.00**
99%	0.51	0.50	0.50	0.51	0.50	0.50	0.50	0.50

Table 5-6 CRM assessment for all Risso's dolphin avoidance rates for maximum number (and MW) of each type of device for collision risk of 0.7 or less bottlenose dolphin (number of individuals / year)

Tidal device category	1	2a	2b	4	5a	5b	6a	6b
Number	**5.62**	**7.95**	**7.95**	**19.77**	**6.82**	**39.77**	**13.26**	**5.62**
Total MW	**11.24**	**11.93**	**9.94**	**19.77**	**10.23**	**11.93**	**15.91**	**11.24**
0%	50.11	49.81	49.81	50.13	49.94	50.12	49.84	49.85
50%	25.06	24.91	24.91	25.06	24.97	25.06	24.92	24.92
90%	5.01	4.98	4.98	5.01	4.99	5.01	4.98	4.98
95%	2.51	2.49	2.49	2.51	2.50	2.51	2.49	2.49
98%	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**
99%	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50

5.4 Common dolphin avoidance rates

Table 5-7 ERM assessment for all common dolphin avoidance rates for maximum number (and MW) of each type of device for collision risk of 0.7 or less bottlenose dolphin (number of individuals / year)

Tidal device category	1	2a	2b	4	5a	5b	6a	6b
Number	**7.25**	**6.917**	**6.92**	**9.59**	**12.41**	**8.68**	**28.69**	**6.39**
Total MW	**14.49**	**10.38**	**8.65**	**12.41**	**13.03**	**8.61**	**7.66**	**14.49**
0%	302.42	270.81	270.92	286.41	274.99	285.53	270.80	271.41
50%	151.21	135.40	135.46	143.21	137.49	142.76	135.40	135.70
90%	30.24	27.08	27.09	28.64	27.50	28.55	27.08	27.14
95%	15.12	13.54	13.55	14.32	13.75	14.28	13.54	13.57
98%	**6.05**	**5.42**	**5.42**	**5.73**	**5.50**	**5.71**	**5.42**	**5.43**
99%	3.02	2.71	2.71	2.86	2.75	2.86	2.71	2.71

Table 5-8 CRM assessment for all common dolphin avoidance rates for maximum number (and MW) of each type of device for collision risk of 0.7 or less bottlenose dolphin (number of individuals / year)

Tidal device category	1	2a	2b	4	5a	5b	6a	6b
Number	**5.62**	**7.95**	**7.95**	**19.77**	**6.82**	**39.77**	**13.26**	**5.62**
Total MW	**11.24**	**11.93**	**9.94**	**19.77**	**10.23**	**11.93**	**15.91**	**11.24**
0%	270.64	265.30	265.30	271.72	268.46	271.58	265.43	265.50
50%	135.32	132.65	132.65	135.86	134.23	135.79	132.71	132.75
90%	27.06	26.53	26.53	27.17	26.85	27.16	26.54	26.55
95%	13.53	13.26	13.26	13.59	13.42	13.58	13.27	13.27
98%	**5.41**	**5.31**	**5.31**	**5.43**	**5.37**	**5.43**	**5.31**	**5.31**
99%	2.71	2.65	2.65	2.72	2.68	2.72	2.65	2.65

5.5 Minke whale avoidance rates

Table 5-9 ERM assessment for all minke whale avoidance rates for maximum number (and MW) of each type of device for collision risk of 0.7 or less bottlenose dolphin (number of individuals / year)

Tidal device category	1	2a	2b	4	5a	5b	6a	6b
Number	**7.25**	**6.917**	**6.92**	**9.59**	**12.41**	**8.68**	**28.69**	**6.39**
Total MW	**14.49**	**10.38**	**8.65**	**12.41**	**13.03**	**8.61**	**7.66**	**14.49**
0%	85.64	116.96	117.01	94.86	109.33	95.81	116.15	116.41
50%	42.82	58.48	58.51	47.43	54.67	47.90	58.08	58.21
90%	8.56	11.70	11.70	9.49	10.93	9.58	11.62	11.64
95%	4.28	5.85	5.85	4.74	5.47	4.79	5.81	5.82
98%	**1.71**	**2.34**	**2.34**	**1.90**	**2.19**	**1.92**	**2.32**	**2.33**
99%	0.86	1.17	1.17	0.95	1.09	0.96	1.16	1.16

Table 5-10 CRM assessment for all minke whale avoidance rates for maximum number (and MW) of each type of device for collision risk of 0.7 or less bottlenose dolphin (number of individuals / year)

Tidal device category	1	2a	2b	4	5a	5b	6a	6b
Number	**5.62**	**7.95**	**7.95**	**19.77**	**6.82**	**39.77**	**13.26**	**5.62**
Total MW	**11.24**	**11.93**	**9.94**	**19.77**	**10.23**	**11.93**	**15.91**	**11.24**
0%	62.57	71.00	71.00	60.30	65.29	60.54	71.03	71.05
50%	31.28	35.50	35.50	30.15	32.64	30.27	35.52	35.53
90%	6.26	7.10	7.10	6.03	6.53	6.05	7.10	7.11
95%	3.13	3.55	3.55	3.01	3.26	3.03	3.55	3.55
98%	**1.25**	**1.42**	**1.42**	**1.21**	**1.31**	**1.21**	**1.42**	**1.42**
99%	0.63	0.71	0.71	0.60	0.65	0.61	0.71	0.71

5.6 Grey seal avoidance rates

Table 5-11 ERM assessment for all grey seal avoidance rates for maximum number (and MW) of each type of device for collision risk of 0.7 or less bottlenose dolphin (number of individuals / year)

Tidal device category	1	2a	2b	4	5a	5b	6a	6b
Number	**7.25**	**6.917**	**6.92**	**9.59**	**12.41**	**8.68**	**28.69**	**6.39**
Total MW	**14.49**	**10.38**	**8.65**	**12.41**	**13.03**	**8.61**	**7.66**	**14.49**
0%	196.88	161.62	161.69	162.92	124.00	139.84	112.94	113.20
50%	98.44	80.81	80.84	81.46	62.00	69.92	56.47	56.60
90%	19.69	16.16	16.17	16.29	12.40	13.98	11.29	11.32
95%	9.84	8.08	8.08	8.15	6.20	6.99	5.65	5.66
98%	**3.94**	**3.23**	**3.23**	**3.26**	**2.48**	**2.80**	**2.26**	**2.26**
99%	1.97	1.62	1.62	1.63	1.24	1.40	1.13	1.13

Table 5-12 CRM assessment for all grey seal avoidance rates for maximum number (and MW) of each type of device for collision risk of 0.7 or less bottlenose dolphin (number of individuals / year)

Tidal device category	1	2a	2b	4	5a	5b	6a	6b
Number	**5.62**	**7.95**	**7.95**	**19.77**	**6.82**	**39.77**	**13.26**	**5.62**
Total MW	**11.24**	**11.93**	**9.94**	**19.77**	**10.23**	**11.93**	**15.91**	**11.24**
0%	177.45	156.82	156.82	154.96	119.56	133.06	109.83	109.86
50%	88.72	78.41	78.41	77.48	59.78	66.53	54.91	54.93
90%	17.74	15.68	15.68	15.50	11.96	13.31	10.98	10.99
95%	8.87	7.84	7.84	7.75	5.98	6.65	5.49	5.49
98%	**3.55**	**3.14**	**3.14**	**3.10**	**2.39**	**2.66**	**2.20**	**2.20**
99%	1.77	1.57	1.57	1.55	1.20	1.33	1.10	1.10

5.7 Harbour seal avoidance rates

Table 5-13 ERM assessment for all harbour seal avoidance rates for maximum number (and MW) of each type of device for collision risk of 0.7 or less bottlenose dolphin (number of individuals / year)

Tidal device category	1	2a	2b	4	5a	5b	6a	6b
Number	**7.25**	**6.917**	**6.92**	**9.59**	**12.41**	**8.68**	**28.69**	**6.39**
Total MW	**14.49**	**10.38**	**8.65**	**12.41**	**13.03**	**8.61**	**7.66**	**14.49**
0%	0.53	0.52	0.48	0.61	0.54	0.48	0.57	0.29
50%	0.26	0.26	0.24	0.30	0.27	0.24	0.28	0.14
90%	0.05	0.05	0.05	0.06	0.05	0.05	0.06	0.03
95%	0.03	0.03	0.02	0.03	0.03	0.02	0.03	0.01
98%	**0.011**	**0.010**	**0.010**	**0.012**	**0.011**	**0.010**	**0.011**	**0.006**
99%	0.01	0.01	0.00	0.01	0.01	0.00	0.01	0.00

Table 5-14 CRM assessment for all harbour seal avoidance rates for maximum number (and MW) of each type of device for collision risk of 0.7 or less bottlenose dolphin (number of individuals / year)

Tidal device category	1	2a	2b	4	5a	5b	6a	6b
Number	**5.62**	**7.95**	**7.95**	**19.77**	**6.82**	**39.77**	**13.26**	**5.62**
Total MW	**11.24**	**11.93**	**9.94**	**19.77**	**10.23**	**11.93**	**15.91**	**11.24**
0%	0.43	0.49	0.45	0.55	0.50	0.44	0.55	0.28
50%	0.22	0.25	0.23	0.28	0.25	0.22	0.27	0.14
90%	0.04	0.05	0.05	0.06	0.05	0.04	0.05	0.03
95%	0.02	0.02	0.02	0.03	0.03	0.02	0.03	0.01
98%	**0.009**	**0.010**	**0.009**	**0.0111**	**0.010**	**0.009**	**0.0109**	**0.006**
99%	0.00	0.00	0.00	0.01	0.01	0.00	0.01	0.00

5.8 Summary of all avoidance rates

Table 5-15 Number of individuals for all avoidance rates that could be at risk of collision with operational tidal devices at Morlais (based on scenarios for less than 0.7 bottlenose dolphin), with values rounded up to the nearest whole animal

Species	Predicted mortality per year with 0% avoidance	Predicted mortality per year with 50% avoidance	Predicted mortality per year with 90% avoidance	Predicted mortality per year with 95% avoidance	Predicted mortality per year with 98% avoidance	Predicted mortality per year with 99% avoidance
Bottlenose dolphin	35	18	4	2	**0.7**	0.35
Harbour porpoise	116-1245	60-623	12-125	6-63	**3-25**	1-13
Risso's dolphin	50-51	25-26	5-6	2.5-3	**1**	0.5
Common dolphin	245-303	133-152	27-31	14-16	**6**	3
Minke whale	61-117	30-59	6-12	3-6	**1-3**	0.6-2
Grey seal	110-197	55-99	11-20	5.5-10	**2-4**	1-2
Harbour seal	0.3-0.6	0.1-0.3	0.03-0.06	0.01-0.03	**0.006-0.012**	0-0.01