

MONA OFFSHORE WIND PROJECT

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MONA OFFSHORE WIND PROJECT

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Prepared by:

RPS

Prepared for:

Mona Offshore Wind Ltd.

Contents

5	OFFSHORE ORNITHOLOGY	1
5.1	Introduction	1
5.1.1	Overview	1
5.1.2	Purpose of chapter	1
5.1.3	National Policy Statements	2
5.1.4	The Welsh National Marine Plan and its relevance to offshore ornithology	7
5.1.5	North West Inshore and North West Offshore Coast Marine Plans	8
5.2	Consultation	9
5.2.1	Overview	9
5.2.2	Evidence Plan process	10
5.3	Baseline methodology	21
5.3.1	Relevant guidance	21
5.3.2	Scope of the assessment	21
5.3.3	Methodology to inform baseline	22
5.3.4	Study areas	23
5.3.5	Desktop study	25
5.3.6	Identification of designated sites	25
5.3.7	Baseline environment	26
5.3.8	Designated sites	28
5.3.9	Important Ecological Features (IEFs)	33
5.3.10	Future baseline scenario	43
5.3.11	Data limitations	43
5.4	Impact assessment methodology	44
5.4.1	Overview	44
5.4.2	Impact assessment criteria	45
5.4.3	Designated sites	48
5.5	Key parameters for assessment	48
5.5.1	Maximum design scenario	48
5.6	Measures adopted as part of the Mona Offshore Wind Project	54
5.7	Assessment of significant effects	55
5.7.1	Overview	55
5.7.2	Disturbance and displacement from airborne noise, underwater sound, and presence of vessels and infrastructure	55
5.7.3	Indirect impacts from underwater sound affecting prey species	78
5.7.4	Temporary habitat loss/disturbance and increased suspended sediment concentrations (SSCs)	81
5.7.5	Collision risk	83
5.7.6	Combined displacement and collision risk	99
5.7.7	Barrier to movement	102
5.7.8	Future monitoring	103
5.8	Cumulative effects assessment methodology	103
5.8.1	Methodology	103
5.9	Cumulative effects assessment	121
5.9.1	Overview	121
5.9.2	Disturbance and displacement from airborne noise, underwater sound, and presence of vessels and infrastructure	121
5.9.3	Collision risk	193
5.9.4	Combined displacement and collision risk	241
5.10	Transboundary effects	244
5.11	Inter-related effects	244
5.12	Summary of impacts, mitigation measures and monitoring	245
5.13	References	252
5	OFFSHORE ORNITHOLOGY	1

MONA OFFSHORE WIND PROJECT

5.1	Introduction	1
5.1.1	Overview	1
5.1.2	Purpose of chapter	1
5.1.3	National Policy Statements	2
5.1.4	The Welsh National Marine Plan and its relevance to offshore ornithology	7
5.1.5	North West Inshore and North West Offshore Coast Marine Plans	8
5.2	Consultation	9
5.2.1	Overview	9
5.2.2	Evidence Plan process	10
5.3	Baseline methodology	21
5.3.1	Relevant guidance	21
5.3.2	Scope of the assessment	21
5.3.3	Methodology to inform baseline	22
5.3.4	Study areas	23
5.3.5	Desktop study	25
5.3.6	Identification of designated sites	25
5.3.7	Baseline environment	26
5.3.8	Designated sites	28
5.3.9	Important Ecological Features (IEFs)	33
5.3.10	Future baseline scenario	43
5.3.11	Data limitations	43
5.4	Impact assessment methodology	44
5.4.1	Overview	44
5.4.2	Impact assessment criteria	45
5.4.3	Designated sites	48
5.5	Key parameters for assessment	48
5.5.1	Maximum design scenario	48
5.6	Measures adopted as part of the Mona Offshore Wind Project	54
5.7	Assessment of significant effects	55
5.7.1	Overview	55
5.7.2	Disturbance and displacement from airborne noise, underwater sound, and presence of vessels and infrastructure	55
5.7.3	Indirect impacts from underwater sound affecting prey species	78
5.7.4	Temporary habitat loss/disturbance and increased suspended sediment concentrations (SSCs)	81
5.7.5	Collision risk	83
5.7.6	Combined displacement and collision risk	99
5.7.7	Barrier to movement	102
5.7.8	Future monitoring	103
5.8	Cumulative effects assessment methodology	103
5.8.1	Methodology	103
5.9	Cumulative effects assessment	121
5.9.1	Overview	121
5.9.2	Disturbance and displacement from airborne noise, underwater sound, and presence of vessels and infrastructure	121
5.9.3	Collision risk	193
5.9.4	Combined displacement and collision risk	241
5.10	Transboundary effects	245
5.11	Inter-related effects	245
5.12	Summary of impacts, mitigation measures and monitoring	246
5.13	References	253

MONA OFFSHORE WIND PROJECT

Tables

Table 5.1: Summary of the NPS EN-1 and NPS EN-3 provisions relevant to offshore ornithology.....	2
Table 5.2: Summary of NPS EN-1 and NPS EN-3 policy on decision making relevant to offshore ornithology.....	6
Table 5.3: Welsh National Marine Plan and its relevance to offshore ornithology.....	7
Table 5.4: North West Inshore and North West Offshore Marine Plan policies of relevant to offshore ornithology.....	8
Table 5.5: Summary of key topics and issues raised during consultation activities undertaken for the Mona Offshore Wind Project relevant to offshore ornithology.....	11
Table 5.6: Issues considered within this assessment.....	21
Table 5.7: Impacts scoped out of the assessment for offshore ornithology.....	22
Table 5.8: Summary of key desktop reports reviewed to inform baseline.....	25
Table 5.9: Summary of site-specific survey data.....	26
Table 5.10: Designated sites and relevant qualifying interests for the offshore ornithology assessment.....	28
Table 5.11: Nationally designated sites and relevant qualifying interests for the offshore ornithology assessment.....	31
Table 5.12: Evaluation of IEFs showing species assessed for significance of effect from the Mona Offshore Wind Project.....	34
Table 5.13: Seasonal definitions as the basis for assessment, from Furness (2015).....	37
Table 5.14: Bio-seasons, monthly breakdown and population sizes used within the assessment.....	39
Table 5.15: Demographic rates from JNCC/BTO (SMP, 2023) and Horswill and Robinson (2015) and population age ratios calculated from population models used to estimate average mortality for use in impact assessment.....	41
Table 5.16: Definition of terms relating to the magnitude of an impact.....	45
Table 5.17: Definition of recoverability of the receptor.....	46
Table 5.18: Definition of conservation importance of the receptor.....	46
Table 5.19: Definition of sensitivity of the receptor.....	47
Table 5.20: Matrix used for the assessment of the significance of the effect.....	47
Table 5.21: Maximum design scenario considered for the assessment of potential impacts on offshore ornithology.....	49
Table 5.22: Measures adopted as part of the Mona Offshore Wind Project.....	54
Table 5.23: Common guillemot bio-season and annual displacement estimates for Mona during construction.....	62
Table 5.24: Razorbill bio-season and annual displacement estimates for the Mona Array Area plus 2 km buffer during construction.....	63
Table 5.25: Atlantic puffin bio-season and annual displacement estimates for the Mona Array Area plus 2 km buffer during construction.....	64
Table 5.26: Northern gannet bio-season and annual displacement estimates for the Mona Array Area plus 2 km buffer during construction.....	64
Table 5.27: Black-legged kittiwake bio-season and annual displacement estimates for the Mona Array Area plus 2 km buffer during construction.....	65
Table 5.28: Manx shearwater bio-season and annual displacement estimates for the Mona Array Area plus 2 km buffer during construction.....	66
Table 5.29: Table summarising the significance of effect during construction.....	69
Table 5.30: Common guillemot bio-seasons and annual displacement estimates for the Mona Array Area plus 2 km buffer during the operations and maintenance phase.....	71
Table 5.31: Razorbill bio-seasons and annual displacement estimates for the Mona Array Area plus 2 km buffer during the operations and maintenance phase.....	72
Table 5.32: Atlantic puffin bio-seasons and annual displacement estimates for the Mona Array Area plus 2 km buffer during the operations and maintenance phase.....	73
Table 5.33: Northern gannet bio-seasons and annual displacement estimates for the Mona Array Area plus 2 km buffer during the operations and maintenance phase.....	73
Table 5.34: Black-legged kittiwake bio-seasons and annual displacement estimates for the Mona Array Area plus 2 km buffer during the operations and maintenance phase.....	74

MONA OFFSHORE WIND PROJECT

Table 5.35: Manx shearwater bio-seasons and annual displacement estimates for the Mona Array Area plus 2 km buffer during the operations and maintenance phase.	75
Table 5.36: Table summarising the significance of effect during the operations and maintenance phase.	78
Table 5.37: Species considered for assessment of underwater sound affecting prey species based on habitat specialisation score (Wade <i>et al.</i> , 2016).	79
Table 5.38: Black-legged kittiwake expected collision mortality across bio-seasons.	85
Table 5.39: Great black-backed gull expected additional mortality due to collisions with turbines across bio-seasons.	86
Table 5.40: European herring gull expected additional mortality due to collisions with turbines across bio-seasons.	87
Table 5.41: Lesser black-backed gull expected additional mortality due to collisions with turbines across bio-seasons.	87
Table 5.42: Northern gannet expected additional mortality due to collisions with turbines across bio-seasons, assuming no displacement.	88
Table 5.43: Northern gannet expected additional mortality due to collisions with turbines across bio-seasons, assuming 70% displacement.	89
Table 5.44: Northern fulmar expected additional mortality due to collisions with turbines across bio-seasons.	89
Table 5.45: Manx shearwater expected additional mortality due to collisions with turbines across bio-seasons.	90
Table 5.46: Summary of collision risk assessment on migratory birds at the Mona Offshore Wind Project.	92
Table 5.47: Table summarising the significance of effect of collision from the Mona Offshore Wind Project impacts during the operations and maintenance phase.	99
Table 5.48: Combined displacement and collision cumulative impacts.	100
Table 5.49: List of other projects, plans and activities considered within the offshore ornithology CEA.	106
Table 5.50: Maximum design scenario considered for the assessment of potential cumulative effects on offshore ornithology.	116
Table 5.51: Common guillemot cumulative abundances for potential overlapping construction phase offshore wind projects for disturbance and displacement assessment.	122
Table 5.52: Construction phase cumulative common guillemot mortality following displacement from offshore wind farms in the breeding season.	123
Table 5.53: Construction phase cumulative common guillemot mortality following displacement from offshore wind farms in the non-breeding season.	124
Table 5.54: Construction phase cumulative common guillemot mortality following displacement from offshore wind farms annually.	124
Table 5.55: Razorbill cumulative abundances for overlapping construction phase offshore wind projects for disturbance and displacement assessment.	126
Table 5.56: Construction phase cumulative razorbill mortality following displacement from offshore wind farms in the pre-breeding season.	127
Table 5.57: Construction phase cumulative razorbill mortality following displacement from offshore wind farms in the breeding season.	127
Table 5.58: Construction phase cumulative razorbill mortality following displacement from offshore wind farms in the post-breeding season.	128
Table 5.59: Construction phase cumulative razorbill mortality following displacement from offshore wind farms in the non-breeding season.	128
Table 5.60: Construction phase cumulative razorbill mortality following displacement from offshore wind farms annually.	129
Table 5.61: Atlantic puffin cumulative abundances for overlapping construction phase offshore wind projects for disturbance and displacement assessment.	130
Table 5.62: Construction phase cumulative Atlantic puffin mortality following displacement from offshore wind farms in the breeding season.	131
Table 5.63: Construction phase cumulative Atlantic puffin mortality following displacement from offshore wind farms in the non-breeding season.	131
Table 5.64: Construction phase cumulative Atlantic puffin mortality following displacement from offshore wind farms annually.	132

MONA OFFSHORE WIND PROJECT

Table 5.65: Northern gannet cumulative abundances for overlapping construction phase offshore wind projects for disturbance and displacement assessment.....	133
Table 5.66: Construction phase cumulative northern gannet mortality following displacement from offshore wind farms in the pre-breeding season.....	134
Table 5.67: Construction phase cumulative northern gannet mortality following displacement from offshore wind farms in the breeding season.....	134
Table 5.68: Construction phase cumulative northern gannet mortality following displacement from offshore wind farms in the post-breeding season.....	135
Table 5.69: Construction phase cumulative northern gannet mortality following displacement from offshore wind farms annually.....	135
Table 5.70: Black-legged kittiwake cumulative abundances for overlapping construction phase offshore wind projects for disturbance and displacement assessment.....	136
Table 5.71: Construction phase cumulative black-legged kittiwake mortality following displacement from offshore wind farms in the pre-breeding season.....	137
Table 5.72: Construction phase cumulative black-legged kittiwake mortality following displacement from offshore wind farms in the breeding season.....	138
Table 5.73: Construction phase cumulative black-legged kittiwake mortality following displacement from offshore wind farms in the post-breeding season.....	138
Table 5.74: Construction phase cumulative black-legged kittiwake mortality following displacement from offshore wind farms annually.....	139
Table 5.75: Manx shearwater cumulative abundances for overlapping construction phase offshore wind projects for disturbance and displacement assessment.....	140
Table 5.76: Construction phase cumulative Manx shearwater mortality following displacement from offshore wind farms in the pre-breeding season.....	141
Table 5.77: Construction phase cumulative Manx shearwater mortality following displacement from offshore wind farms in the breeding season.....	141
Table 5.78: Construction phase cumulative Manx shearwater mortality following displacement from offshore wind farms in the post-breeding season.....	142
Table 5.79: Construction phase cumulative Manx shearwater mortality following displacement from offshore wind farms annually.....	142
Table 5.80: Table summarising the cumulative significance of effect during construction.....	144
Table 5.81: Guillemot cumulative abundances for offshore wind projects for disturbance and displacement assessment during the operations and maintenance phase.....	145
Table 5.82: Operations and maintenance phase cumulative guillemot mortality following displacement from offshore wind farms in the breeding season.....	146
Table 5.83: Operations and maintenance phase cumulative guillemot mortality following displacement from offshore wind farms in the non-breeding season.....	147
Table 5.84: Operations and maintenance phase cumulative guillemot mortality following displacement from offshore wind farms annually.....	147
Table 5.85: Qualitative assessment of projects considered cumulatively with the Mona Offshore Wind Project for which quantitative consideration of displacement impacts was not undertaken in project specific documentation for guillemot.....	148
Table 5.86: Razorbill cumulative abundances for offshore wind projects for disturbance and displacement assessment during the operations and maintenance phase.....	152
Table 5.87: Operations and maintenance phase cumulative razorbill mortality following displacement from offshore wind farms in the pre-breeding season.....	154
Table 5.88: Operations and maintenance phase cumulative razorbill mortality following displacement from offshore wind farms in the breeding season.....	154
Table 5.89: Operations and maintenance phase cumulative razorbill mortality following displacement from offshore wind farms in the post-breeding season.....	155
Table 5.90: Operations and maintenance phase cumulative razorbill mortality following displacement from offshore wind farms in the non-breeding season.....	155
Table 5.91: Operations and maintenance phase cumulative razorbill mortality following displacement from offshore wind farms annually.....	156

MONA OFFSHORE WIND PROJECT

Table 5.92: Qualitative assessment of projects considered cumulatively with the Mona Offshore Wind Project for which quantitative consideration of displacement impacts was not undertaken in project-specific documentation for razorbill.	157
Table 5.93: Atlantic puffin cumulative abundances for offshore wind projects for disturbance and displacement assessment during the operations and maintenance phase.	161
Table 5.94: Operations and maintenance phase cumulative Atlantic puffin mortality following displacement from offshore wind farms in the breeding season.	162
Table 5.95: Operations and maintenance phase cumulative Atlantic puffin mortality following displacement from offshore wind farms in the non-breeding season.	163
Table 5.96: Operations and maintenance phase cumulative Atlantic puffin mortality following displacement from offshore wind farms annually.	163
Table 5.97: Qualitative assessment of projects considered cumulatively with the Mona Offshore Wind Project for which quantitative consideration of displacement impacts was not undertaken in project-specific documentation for Atlantic puffin.	164
Table 5.98: Northern gannet cumulative abundances for offshore wind projects for disturbance and displacement assessment during the operations and maintenance phase.	166
Table 5.99: Operations and maintenance phase cumulative northern gannet mortality following displacement from offshore wind farms in the pre-breeding season.	168
Table 5.100: Operations and maintenance phase cumulative northern gannet mortality following displacement from offshore wind farms in the breeding season.	169
Table 5.101: Operations and maintenance phase cumulative northern gannet mortality following displacement from offshore wind farms in the post-breeding season.	169
Table 5.102: Operations and maintenance phase cumulative northern gannet mortality following displacement from offshore wind farms annually.	170
Table 5.103: Qualitative assessment of projects considered cumulatively with the Mona Offshore Wind Project for which quantitative consideration of displacement impacts was not undertaken in project-specific documentation for northern gannet.	171
Table 5.104: Black-legged kittiwake cumulative abundances for offshore wind projects for disturbance and displacement assessment during the operations and maintenance phase.	176
Table 5.105: Operations and maintenance phase cumulative black-legged kittiwake mortality following displacement from offshore wind farms in the pre-breeding season.	177
Table 5.106: Operations and maintenance phase cumulative black-legged kittiwake mortality following displacement from offshore wind farms in the breeding season.	178
Table 5.107: Operations and maintenance phase cumulative black-legged kittiwake mortality following displacement from offshore wind farms in the post-breeding season.	178
Table 5.108: Operations and maintenance phase cumulative black-legged kittiwake mortality following displacement from offshore wind farms annually.	179
Table 5.109: Qualitative assessment of projects considered cumulatively with the Mona Offshore Wind Project for which quantitative consideration of displacement impacts was not undertaken in project-specific documentation for black-legged kittiwake.	180
Table 5.110: Manx shearwater cumulative abundances for offshore wind projects for disturbance and displacement assessment during the operations and maintenance phase.	184
Table 5.111: Operations and maintenance phase cumulative Manx shearwater mortality following displacement from offshore wind farms in the pre-breeding season.	185
Table 5.112: Operations and maintenance phase cumulative Manx shearwater mortality following displacement from offshore wind farms in the breeding season.	186
Table 5.113: Operations and maintenance phase cumulative Manx shearwater mortality following displacement from offshore wind farms in the post-breeding season.	186
Table 5.114: Operations and maintenance phase cumulative Manx shearwater mortality following displacement from offshore wind farms annually.	187
Table 5.115: Qualitative assessment of projects considered cumulatively with the Mona Offshore Wind Project for which quantitative consideration of displacement impacts was not undertaken in project-specific documentation for manx shearwater.	188
Table 5.116: Table summarising the cumulative significance of effect during operation.	192

MONA OFFSHORE WIND PROJECT

Table 5.117: Expected annual collision mortality across relevant offshore wind farms for black-legged kittiwake (avoidance rate 99.28).....	194
Table 5.118: Qualitative assessment of projects considered cumulatively with the Mona Offshore Wind Project for which quantitative consideration of collision risk was not undertaken in project-specific documentation for kittiwake.....	196
Table 5.119: Expected annual collision mortality across relevant offshore wind farms for great black-backed gull (avoidance rate 99.39).....	199
Table 5.120: Expected annual collision mortality across relevant offshore wind farms for great black-backed gull (avoidance rate 99.91).....	200
Table 5.121: Qualitative assessment of projects considered cumulatively with the Mona Offshore Wind Project for which quantitative consideration of collision risk was not undertaken in project-specific documentation for great black-backed gull.....	202
Table 5.122: Expected annual collision mortality across relevant offshore wind farms for herring gull (avoidance rate 99.39).....	207
Table 5.123: Expected annual collision mortality across relevant offshore wind farms for herring gull (avoidance rate 99.52).....	208
Table 5.124: Qualitative assessment of projects considered cumulatively with the Mona Offshore Wind Project for which quantitative consideration of collision risk was not undertaken in project-specific documentation for herring gull.....	210
Table 5.125: Expected annual collision mortality across relevant offshore wind farms for lesser black-backed gull (avoidance rate 99.39).....	215
Table 5.126: Expected annual collision mortality across relevant offshore wind farms for lesser black-backed gull (avoidance rate 99.54).....	217
Table 5.127: Qualitative assessment of projects considered cumulatively with the Mona Offshore Wind Project for which quantitative consideration of collision risk was not undertaken in project-specific documentation for lesser black-backed gull.....	219
Table 5.128: Expected annual collision mortality across relevant offshore wind farms for northern gannet (avoidance rate 99.28).....	220
Table 5.129: Qualitative assessment of projects considered cumulatively with the Mona Offshore Wind Project for which quantitative consideration of collision risk was not undertaken in project-specific documentation for northern gannet.....	222
Table 5.130: Expected annual collision mortality across relevant offshore wind farms for all migratory bird species assessed for collision risk.....	226
Table 5.131: Expected annual collision mortality across relevant offshore wind farms for all migratory bird species assessed for collision risk.....	228
Table 5.132: Expected annual collision mortality across relevant offshore wind farms for all migratory bird species assessed for collision risk.....	230
Table 5.133: Expected annual collision mortality across relevant offshore wind farms for all migratory bird species assessed for collision risk.....	232
Table 5.134: Expected annual collision mortality across relevant offshore wind farms for all migratory bird species assessed for collision risk.....	234
Table 5.135: Expected annual collision mortality across relevant offshore wind farms for all migratory bird species assessed for collision risk.....	237
Table 5.136: Table summarising the significance of effect of collision from cumulative impacts during the operations and maintenance phase.....	241
Table 5.137: Black-legged kittiwake combined displacement and collision cumulative impacts.....	242
Table 5.138: Northern gannet combined displacement and collision cumulative impacts.....	243
Table 5.139: Summary of potential environmental effects, mitigation and monitoring.....	246
Table 5.140: Summary of potential cumulative environmental effects, mitigation and monitoring.....	250
Table 5.1: Summary of the NPS EN-1 and NPS EN-3 provisions relevant to offshore ornithology.....	2
Table 5.2: Summary of NPS EN-1 and NPS EN-3 policy on decision making relevant to offshore ornithology.....	6
Table 5.3: Welsh National Marine Plan and its relevance to offshore ornithology.....	7
Table 5.4: North West Inshore and North West Offshore Marine Plan policies of relevant to offshore ornithology.....	8

MONA OFFSHORE WIND PROJECT

Table 5.5: Summary of key topics and issues raised during consultation activities undertaken for the Mona Offshore Wind Project relevant to offshore ornithology.....	11
Table 5.6: Issues considered within this assessment.....	21
Table 5.7: Impacts scoped out of the assessment for offshore ornithology.....	22
Table 5.8: Summary of key desktop reports reviewed to inform baseline.....	25
Table 5.9: Summary of site-specific survey data.....	26
Table 5.10: Designated sites and relevant qualifying interests for the offshore ornithology assessment.....	28
Table 5.11: Nationally designated sites and relevant qualifying interests for the offshore ornithology assessment.....	31
Table 5.12: Evaluation of IEFs showing species assessed for significance of effect from the Mona Offshore Wind Project.....	34
Table 5.13: Seasonal definitions as the basis for assessment, from Furness (2015).....	37
Table 5.14: Bio-seasons, monthly breakdown and population sizes used within the assessment.....	39
Table 5.15: Demographic rates from JNCC/BTO (SMP, 2023) and Horswill and Robinson (2015) and population age ratios calculated from population models used to estimate average mortality for use in impact assessment.....	41
Table 5.16: Definition of terms relating to the magnitude of an impact.....	45
Table 5.17: Definition of recoverability of the receptor.....	46
Table 5.18: Definition of conservation importance of the receptor.....	46
Table 5.19: Definition of sensitivity of the receptor.....	47
Table 5.20: Matrix used for the assessment of the significance of the effect.....	47
Table 5.21: Maximum design scenario considered for the assessment of potential impacts on offshore ornithology.....	49
Table 5.22: Measures adopted as part of the Mona Offshore Wind Project.....	54
Table 5.23: Common guillemot bio-season and annual displacement estimates for Mona during construction.....	62
Table 5.24: Razorbill bio-season and annual displacement estimates for the Mona Array Area plus 2 km buffer during construction.....	63
Table 5.25: Atlantic puffin bio-season and annual displacement estimates for the Mona Array Area plus 2 km buffer during construction.....	64
Table 5.26: Northern gannet bio-season and annual displacement estimates for the Mona Array Area plus 2 km buffer during construction.....	64
Table 5.27: Black-legged kittiwake bio-season and annual displacement estimates for the Mona Array Area plus 2 km buffer during construction.....	65
Table 5.28: Manx shearwater bio-season and annual displacement estimates for the Mona Array Area plus 2 km buffer during construction.....	66
Table 5.29: Table summarising the significance of effect during construction.....	69
Table 5.30: Common guillemot bio-seasons and annual displacement estimates for the Mona Array Area plus 2 km buffer during the operations and maintenance phase.....	71
Table 5.31: Razorbill bio-seasons and annual displacement estimates for the Mona Array Area plus 2 km buffer during the operations and maintenance phase.....	72
Table 5.32: Atlantic puffin bio-seasons and annual displacement estimates for the Mona Array Area plus 2 km buffer during the operations and maintenance phase.....	73
Table 5.33: Northern gannet bio-seasons and annual displacement estimates for the Mona Array Area plus 2 km buffer during the operations and maintenance phase.....	73
Table 5.34: Black-legged kittiwake bio-seasons and annual displacement estimates for the Mona Array Area plus 2 km buffer during the operations and maintenance phase.....	74
Table 5.35: Manx shearwater bio-seasons and annual displacement estimates for the Mona Array Area plus 2 km buffer during the operations and maintenance phase.....	75
Table 5.36: Table summarising the significance of effect during the operations and maintenance phase.....	78
Table 5.37: Species considered for assessment of underwater sound affecting prey species based on habitat specialisation score (Wade <i>et al.</i>, 2016).....	79
Table 5.38: Black-legged kittiwake expected collision mortality across bio-seasons.....	85
Table 5.39: Great black-backed gull expected additional mortality due to collisions with turbines across bio-seasons.....	86

MONA OFFSHORE WIND PROJECT

Table 5.40: European herring gull expected additional mortality due to collisions with turbines across bio-seasons.	87
Table 5.41: Lesser black-backed gull expected additional mortality due to collisions with turbines across bio-seasons.	87
Table 5.42: Northern gannet expected additional mortality due to collisions with turbines across bio-seasons, assuming no displacement.....	88
Table 5.43: Northern gannet expected additional mortality due to collisions with turbines across bio-seasons, assuming 70% displacement.	89
Table 5.44: Northern fulmar expected additional mortality due to collisions with turbines across bio-seasons.	89
Table 5.45: Manx shearwater expected additional mortality due to collisions with turbines across bio-seasons.	90
Table 5.46: Summary of collision risk assessment on migratory birds at the Mona Offshore Wind Project. .	92
Table 5.47: Table summarising the significance of effect of collision from the Mona Offshore Wind Project impacts during the operations and maintenance phase.	99
Table 5.48: Combined displacement and collision cumulative impacts.	100
Table 5.49: List of other projects, plans and activities considered within the offshore ornithology CEA.	106
Table 5.50: Maximum design scenario considered for the assessment of potential cumulative effects on offshore ornithology.	116
Table 5.51: Common guillemot cumulative abundances for potential overlapping construction phase offshore wind projects for disturbance and displacement assessment.	122
Table 5.52: Construction phase cumulative common guillemot mortality following displacement from offshore wind farms in the breeding season.....	123
Table 5.53: Construction phase cumulative common guillemot mortality following displacement from offshore wind farms in the non-breeding season.	124
Table 5.54: Construction phase cumulative common guillemot mortality following displacement from offshore wind farms annually.	124
Table 5.55: Razorbill cumulative abundances for overlapping construction phase offshore wind projects for disturbance and displacement assessment.	126
Table 5.56: Construction phase cumulative razorbill mortality following displacement from offshore wind farms in the pre-breeding season.	127
Table 5.57: Construction phase cumulative razorbill mortality following displacement from offshore wind farms in the breeding season.	127
Table 5.58: Construction phase cumulative razorbill mortality following displacement from offshore wind farms in the post-breeding season.	128
Table 5.59: Construction phase cumulative razorbill mortality following displacement from offshore wind farms in the non-breeding season.	128
Table 5.60: Construction phase cumulative razorbill mortality following displacement from offshore wind farms annually.	129
Table 5.61: Atlantic puffin cumulative abundances for overlapping construction phase offshore wind projects for disturbance and displacement assessment.....	130
Table 5.62: Construction phase cumulative Atlantic puffin mortality following displacement from offshore wind farms in the breeding season.	131
Table 5.63: Construction phase cumulative Atlantic puffin mortality following displacement from offshore wind farms in the non-breeding season.	131
Table 5.64: Construction phase cumulative Atlantic puffin mortality following displacement from offshore wind farms annually.	132
Table 5.65: Northern gannet cumulative abundances for overlapping construction phase offshore wind projects for disturbance and displacement assessment.....	133
Table 5.66: Construction phase cumulative northern gannet mortality following displacement from offshore wind farms in the pre-breeding season.	134
Table 5.67: Construction phase cumulative northern gannet mortality following displacement from offshore wind farms in the breeding season.....	134
Table 5.68: Construction phase cumulative northern gannet mortality following displacement from offshore wind farms in the post-breeding season.....	135

MONA OFFSHORE WIND PROJECT

Table 5.69: Construction phase cumulative northern gannet mortality following displacement from offshore wind farms annually.	135
Table 5.70: Black-legged kittiwake cumulative abundances for overlapping construction phase offshore wind projects for disturbance and displacement assessment.	136
Table 5.71: Construction phase cumulative black-legged kittiwake mortality following displacement from offshore wind farms in the pre-breeding season.	137
Table 5.72: Construction phase cumulative black-legged kittiwake mortality following displacement from offshore wind farms in the breeding season.	138
Table 5.73: Construction phase cumulative black-legged kittiwake mortality following displacement from offshore wind farms in the post-breeding season.	138
Table 5.74: Construction phase cumulative black-legged kittiwake mortality following displacement from offshore wind farms annually.	139
Table 5.75: Manx shearwater cumulative abundances for overlapping construction phase offshore wind projects for disturbance and displacement assessment.	140
Table 5.76: Construction phase cumulative Manx shearwater mortality following displacement from offshore wind farms in the pre-breeding season.	141
Table 5.77: Construction phase cumulative Manx shearwater mortality following displacement from offshore wind farms in the breeding season.	141
Table 5.78: Construction phase cumulative Manx shearwater mortality following displacement from offshore wind farms in the post-breeding season.	142
Table 5.79: Construction phase cumulative Manx shearwater mortality following displacement from offshore wind farms annually.	142
Table 5.80: Table summarising the cumulative significance of effect during construction.	144
Table 5.81: Guillemot cumulative abundances for offshore wind projects for disturbance and displacement assessment during the operations and maintenance phase.	145
Table 5.82: Operations and maintenance phase cumulative guillemot mortality following displacement from offshore wind farms in the breeding season.	146
Table 5.83: Operations and maintenance phase cumulative guillemot mortality following displacement from offshore wind farms in the non-breeding season.	147
Table 5.84: Operations and maintenance phase cumulative guillemot mortality following displacement from offshore wind farms annually.	147
Table 5.85: Qualitative assessment of projects considered cumulatively with the Mona Offshore Wind Project for which quantitative consideration of displacement impacts was not undertaken in project-specific documentation for guillemot.	148
Table 5.86: Razorbill cumulative abundances for offshore wind projects for disturbance and displacement assessment during the operations and maintenance phase.	152
Table 5.87: Operations and maintenance phase cumulative razorbill mortality following displacement from offshore wind farms in the pre-breeding season.	154
Table 5.88: Operations and maintenance phase cumulative razorbill mortality following displacement from offshore wind farms in the breeding season.	154
Table 5.89: Operations and maintenance phase cumulative razorbill mortality following displacement from offshore wind farms in the post-breeding season.	155
Table 5.90: Operations and maintenance phase cumulative razorbill mortality following displacement from offshore wind farms in the non-breeding season.	155
Table 5.91: Operations and maintenance phase cumulative razorbill mortality following displacement from offshore wind farms annually.	156
Table 5.92: Qualitative assessment of projects considered cumulatively with the Mona Offshore Wind Project for which quantitative consideration of displacement impacts was not undertaken in project-specific documentation for razorbill.	157
Table 5.93: Atlantic puffin cumulative abundances for offshore wind projects for disturbance and displacement assessment during the operations and maintenance phase.	161
Table 5.94: Operations and maintenance phase cumulative Atlantic puffin mortality following displacement from offshore wind farms in the breeding season.	162
Table 5.95: Operations and maintenance phase cumulative Atlantic puffin mortality following displacement from offshore wind farms in the non-breeding season.	163

MONA OFFSHORE WIND PROJECT

Table 5.96: Operations and maintenance phase cumulative Atlantic puffin mortality following displacement from offshore wind farms annually.	163
Table 5.97: Qualitative assessment of projects considered cumulatively with the Mona Offshore Wind Project for which quantitative consideration of displacement impacts was not undertaken in project-specific documentation for Atlantic puffin.	164
Table 5.98: Northern gannet cumulative abundances for offshore wind projects for disturbance and displacement assessment during the operations and maintenance phase.	166
Table 5.99: Operations and maintenance phase cumulative northern gannet mortality following displacement from offshore wind farms in the pre-breeding season.	168
Table 5.100: Operations and maintenance phase cumulative northern gannet mortality following displacement from offshore wind farms in the breeding season.	169
Table 5.101: Operations and maintenance phase cumulative northern gannet mortality following displacement from offshore wind farms in the post-breeding season.	169
Table 5.102: Operations and maintenance phase cumulative northern gannet mortality following displacement from offshore wind farms annually.	170
Table 5.103: Qualitative assessment of projects considered cumulatively with the Mona Offshore Wind Project for which quantitative consideration of displacement impacts was not undertaken in project-specific documentation for northern gannet.	171
Table 5.104: Black-legged kittiwake cumulative abundances for offshore wind projects for disturbance and displacement assessment during the operations and maintenance phase.	176
Table 5.105: Operations and maintenance phase cumulative black-legged kittiwake mortality following displacement from offshore wind farms in the pre-breeding season.	177
Table 5.106: Operations and maintenance phase cumulative black-legged kittiwake mortality following displacement from offshore wind farms in the breeding season.	178
Table 5.107: Operations and maintenance phase cumulative black-legged kittiwake mortality following displacement from offshore wind farms in the post-breeding season.	178
Table 5.108: Operations and maintenance phase cumulative black-legged kittiwake mortality following displacement from offshore wind farms annually.	179
Table 5.109: Qualitative assessment of projects considered cumulatively with the Mona Offshore Wind Project for which quantitative consideration of displacement impacts was not undertaken in project-specific documentation for black-legged kittiwake.	180
Table 5.110: Manx shearwater cumulative abundances for offshore wind projects for disturbance and displacement assessment during the operations and maintenance phase.	184
Table 5.111: Operations and maintenance phase cumulative Manx shearwater mortality following displacement from offshore wind farms in the pre-breeding season.	185
Table 5.112: Operations and maintenance phase cumulative Manx shearwater mortality following displacement from offshore wind farms in the breeding season.	186
Table 5.113: Operations and maintenance phase cumulative Manx shearwater mortality following displacement from offshore wind farms in the post-breeding season.	186
Table 5.114: Operations and maintenance phase cumulative Manx shearwater mortality following displacement from offshore wind farms annually.	187
Table 5.115: Qualitative assessment of projects considered cumulatively with the Mona Offshore Wind Project for which quantitative consideration of displacement impacts was not undertaken in project-specific documentation for manx shearwater.	188
Table 5.116: Table summarising the cumulative significance of effect during operation.	192
Table 5.117: Expected annual collision mortality across relevant offshore wind farms for black-legged kittiwake (avoidance rate 99.28).	194
Table 5.118: Qualitative assessment of projects considered cumulatively with the Mona Offshore Wind Project for which quantitative consideration of collision risk was not undertaken in project-specific documentation for kittiwake.	196
Table 5.119: Expected annual collision mortality across relevant offshore wind farms for great black-backed gull (avoidance rate 99.39).	199
Table 5.120: Expected annual collision mortality across relevant offshore wind farms for great black-backed gull (avoidance rate 99.91).	200

MONA OFFSHORE WIND PROJECT

<u>Table 5.121: Qualitative assessment of projects considered cumulatively with the Mona Offshore Wind Project for which quantitative consideration of collision risk was not undertaken in project-specific documentation for great black-backed gull.....</u>	202
<u>Table 5.122: Expected annual collision mortality across relevant offshore wind farms for herring gull (avoidance rate 99.39).....</u>	207
<u>Table 5.123: Expected annual collision mortality across relevant offshore wind farms for herring gull (avoidance rate 99.52).....</u>	208
<u>Table 5.124: Qualitative assessment of projects considered cumulatively with the Mona Offshore Wind Project for which quantitative consideration of collision risk was not undertaken in project-specific documentation for herring gull.....</u>	210
<u>Table 5.125: Expected annual collision mortality across relevant offshore wind farms for lesser black-backed gull (avoidance rate 99.39).....</u>	215
<u>Table 5.126: Expected annual collision mortality across relevant offshore wind farms for lesser black-backed gull (avoidance rate 99.54).....</u>	217
<u>Table 5.127: Qualitative assessment of projects considered cumulatively with the Mona Offshore Wind Project for which quantitative consideration of collision risk was not undertaken in project-specific documentation for lesser black-backed gull.....</u>	219
<u>Table 5.128: Expected annual collision mortality across relevant offshore wind farms for northern gannet (avoidance rate 99.28).....</u>	220
<u>Table 5.129: Qualitative assessment of projects considered cumulatively with the Mona Offshore Wind Project for which quantitative consideration of collision risk was not undertaken in project-specific documentation for northern gannet.....</u>	222
<u>Table 5.130: Expected annual collision mortality across relevant offshore wind farms for all migratory bird species assessed for collision risk.....</u>	226
<u>Table 5.131: Expected annual collision mortality across relevant offshore wind farms for all migratory bird species assessed for collision risk.....</u>	228
<u>Table 5.132: Expected annual collision mortality across relevant offshore wind farms for all migratory bird species assessed for collision risk.....</u>	230
<u>Table 5.133: Expected annual collision mortality across relevant offshore wind farms for all migratory bird species assessed for collision risk.....</u>	232
<u>Table 5.134: Expected annual collision mortality across relevant offshore wind farms for all migratory bird species assessed for collision risk.....</u>	234
<u>Table 5.135: Expected annual collision mortality across relevant offshore wind farms for all migratory bird species assessed for collision risk.....</u>	237
<u>Table 5.136: Table summarising the significance of effect of collision from cumulative impacts during the operations and maintenance phase.....</u>	241
<u>Table 5.137: Black-legged kittiwake combined displacement and collision cumulative impacts.....</u>	242
<u>Table 5.138: Northern gannet combined displacement and collision cumulative impacts.....</u>	244
<u>Table 5.139: Summary of potential environmental effects, mitigation and monitoring.....</u>	247
<u>Table 5.140: Summary of potential cumulative environmental effects, mitigation and monitoring.....</u>	251

Figures

<u>Figure 5.1: The Mona Offshore Ornithology Array Area study area and the Mona Offshore Ornithology Offshore Cable Corridor study area.....</u>	24
<u>Figure 5.2: Other projects, plans and activities screened into the cumulative effects assessment.....</u>	114
<u>Figure 5.1: The Mona Offshore Ornithology Array Area study area and the Mona Offshore Ornithology Offshore Cable Corridor study area.....</u>	24
<u>Figure 5.2: Other projects, plans and activities screened into the cumulative effects assessment.....</u>	114

Annexes

Volume 6, Annex 5.1: Offshore ornithology baseline characterisation of the Environmental Statement
Volume 6; Annex 5.2: Offshore ornithology displacement technical report of the Environmental Statement

MONA OFFSHORE WIND PROJECT

Volume 6, Annex 5.3: Offshore ornithology collision risk modelling technical report of the Environmental Statement
Volume 6, Annex 5.4: Offshore ornithology migratory bird collision risk modelling technical report of the Environmental Statement
Volume 6, Annex 5.5: Offshore ornithology apportioning technical report of the Environmental Statement
Volume 6, Annex 5.6: Offshore ornithology population viability analysis technical report of the Environmental Statement

Glossary

Term	Meaning
Avoidance	Probability that a bird takes successful evasive action to avoid collision with a wind turbine.
Air draught	Distance between sea level and lowest blade tip.
Bio-season	Bird behaviour and abundance is recognised to differ across a calendar year, with particular months recognised as being part of different seasons. The biologically defined minimum population scales (BDMPS) bio-seasons used in this report are based on those in Furness (2015), hereafter referred to as bio-seasons. Separate bio-seasons are recognised in this chapter in order to establish the level of importance any seabird species has within the study area during any particular period of time.
Biologically Defined Minimum Population Scales	Seasonal subdivision of bird population size. The rationale behind these subdivisions is that the likely origin of a bird in a particular location depends on the time of year.
Collision risk	Risk of a bird lethally colliding with a wind turbine within a wind farm.
Collision risk model (CRM)	A model that calculates collision risk for a species within a wind farm based on a set of wind farm and bird species specific parameters. Collision risk models can be run deterministically or stochastically.
Confidence Interval	A confidence interval displays the probability that a parameter will fall between a pair of values around the mean.
Design-based Abundance Estimates	An estimated total abundance of birds within a given area. The design-based method is based on the premise that the portion of the study area that is surveyed is representative of the remainder of the study area.
Disturbance sensitivity	Disturbance by wind farm structures, ship and helicopter traffic factor used scores from 1 (limited escape behaviour and a very short flight distance when approached), to 5 (strong escape behaviour, at a large response distance).
Habitat specialisation	The habitat specialisation factor represents the range of habitats species are able to use and whether they use these as specialists or generalists. Species habitat specialisation scores used in this Technical Report have been compiled by Bradbury <i>et al.</i> (2014). This score classifies species into categories from 1 (tend to forage over large marine areas with little known association with particular marine features) to 5 (tend to feed on very specific habitat features, such as shallow banks with bivalve communities, or kelp beds).
Light Detection and Ranging (LiDAR)	A remote sensing method using pulsed lasers to measure distances to the earth.
Lowest Astronomical Tide (LAT)	The lowest level of the sea surface with respect to the land.
Maximum Design Scenario (MDS)	The wind farm design scenario that is considered the worst case from the perspective of collision risk.
MRSea	Statistical package to model spatial count data and predict spatial abundances. Package has been developed by the Centre for Research into Ecological and Environmental Modelling (CREEM) specifically for dealing with data collected for offshore wind farm projects.
Ornithology	Ornithology is a branch of zoology that concerns the study of birds.

MONA OFFSHORE WIND PROJECT

Term	Meaning
Parameter	Parameters are the input elements of a model that together affect the output of a model. In collision risk models, examples of parameters are the number of wind turbines and the length of the bird.
Section 42 of the Planning Act (2008)	Under Section 42 of the Planning Act, the applicant is required to undertake formal and statutory consultation with a prescribed list of bodies, local authorities and those people with an interest in the land, or whose properties may potentially be affected by the operation of the proposed Project.
Significant effect	The significance of an effect is determined by considering the overall importance of the receptor and the magnitude of the effect using a matrix-based approach and applying professional judgement as to whether the integrity of an SPA feature will be affected.
Stochastic model	Model where the input parameters that go into the model are allowed to vary, leading to a range of output.

Acronyms

Acronym	Description
BDMPS	Biologically Defined Minimum Population Scales
BoCC	Birds of Conservation Concern
BTO	British Trust for Ornithology
CEA	Cumulative Effects Assessment
CRM	Collision Risk Modelling
DAS	Digital Aerial Surveys
DCO	Development Consent Order
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EWG	Expert Working Group
HPAI	Highly Pathogenic Avian Influenza
HRA	Habitat Regulations Assessment
IEF	Important ecological features
IEMA	The Institute of Environmental Management and Assessment
ISAA	Information to Support Appropriate Assessment
JNCC	Joint Nature Conservation Committee
LAT	Lowest Astronomical Tide
LiDAR	Light Detection and Ranging
LSE	Likely Significant Effects
MPCP	Marine Pollution Contingency Plan
MDS	Maximum Design Scenario
MLWS	Mean Low Water Springs

MONA OFFSHORE WIND PROJECT

Acronym	Description
MNR	Marine Nature Reserves
MPA	Marine Protected Area
MRSea	Marine Renewables Strategic Environmental Assessment
NPS	National Policy Statements
NRW	Natural Resources Wales
OSP	Offshore Substation Platform
PEIR	Preliminary Environmental Information Report
PVA	Population Viability Analysis
RSPB	Royal Society for the Protection of Birds
SAC	Special Areas of Conservation
sCRM	Stochastic Collision Risk Model
SD	Standard Deviation
SMP	Seabird Monitoring Programme
SNCB	Statutory Nature Conservation Body
SOSSMAT	Strategic Ornithological Support Services Migration Assessment Tool
SPAs	Special Protection Areas
SSCs	Suspended Sediment Concentrations
SSSI	Site of Special Scientific Interest
TWT	The Wildlife Trusts
UK	United Kingdom
ZOI	Zone of Influence

Units

Unit	Description
%	Percentage
kJ	Kilojoules
km ²	Square kilometres
km	Kilometres
m	Metres
MW	Megawatts
nm	Nautical mile

5 Offshore ornithology

5.1 Introduction

5.1.1 Overview

5.1.1.1 This chapter of the Environmental Statement presents the assessment of the potential impact of the Mona Offshore Wind Project on offshore ornithology. Specifically, this chapter considers the potential impact of the Mona Offshore Wind Project seaward of Mean Low Water Springs (MLWS) during the construction, operations and maintenance, and decommissioning phases. Those impacts of the Mona Offshore Wind Project landward of MLWS are addressed in Volume 3, Chapter 4: Onshore and intertidal ornithology of the Environmental Statement.

5.1.1.2 The assessment presented is informed by the following technical reports:

- Volume 6, Annex 5.1: Offshore ornithology baseline characterisation of the Environmental Statement (Document reference F6.5.1)
- Volume 6; Annex 5.2: Offshore ornithology displacement technical report of the Environmental Statement (Document reference F6.5.2)
- Volume 6, Annex 5.3: Offshore ornithology collision risk modelling technical report of the Environmental Statement (Document reference F6.5.3)
- Volume 6 Annex 5.4: Offshore ornithology migratory bird collision risk modelling technical report of the Environmental Statement (Document reference F6.5.4)
- Volume 6, Annex 5.5: Offshore ornithology apportioning technical report of the Environmental Statement (Document Reference F6.5.5)
- Volume 6, Annex 5.6: Offshore ornithology population viability analysis technical report of the Environmental Statement (Document Reference F6.5.6)

5.1.1.3 The offshore ornithology chapter (Document reference F2.5) considers any seabirds that are present at some point in their life cycle in the study areas and non-seabird species using the study areas during migratory flights. The overarching term 'seabird' is used to refer to species that depend on the marine environment for survival at some point in their life cycle. Therefore, in addition to the true seabirds, seaducks, divers and grebes are also included because of their additional reliance on marine areas, especially in the non-breeding season. The study areas are defined in section 5.3.4.

5.1.2 Purpose of chapter

5.1.2.1 The primary purpose of the Environmental Statement is outlined in Volume 1, Chapter 1: Introduction of the Environmental Statement (Document reference F1.1). In summary, the primary purpose of an Environmental Statement is to support the Development Consent Order (DCO) application for Mona Offshore Wind Project under the Planning Act 2008 (the 2008 Act). The Environmental Impact Assessment (EIA) has been finalised following completion of pre-application consultation and the Environmental Statement will accompany the application to the Secretary of State for Development Consent.

5.1.2.2 In particular, this Environmental Statement chapter:

1. Presents the existing environmental baseline established from desk studies, site-specific surveys and consultation

MONA OFFSHORE WIND PROJECT

2. Identifies any assumptions and limitations encountered in compiling the environmental information
3. Presents the potential environmental effects on offshore ornithology arising from the Mona Offshore Wind Project, based on the information gathered and the analysis and assessments undertaken
4. Highlights any necessary monitoring and/or mitigation measures which could prevent, minimise, reduce or offset the possible environmental effects of the Mona Offshore Wind Project on offshore ornithology.

5.1.3 National Policy Statements

5.1.3.1 There are currently six energy National Policy Statements (NPSs), two of which contain policy relevant to offshore wind development and the Mona Offshore Wind Project, specifically:

- NPS for Energy (NPS EN-1) which sets out the United Kingdom (UK) Government’s policy for the delivery of major energy infrastructure (Department for Energy Security & Net Zero, 2024a)
- NPS for Renewable Energy Infrastructure (NPS EN-3) (Department for Energy Security & Net Zero, 2024b).

5.1.3.2 NPS EN-1 and NPS EN-3 include guidance on what matters are to be considered in the assessment. These are summarised in Table 5.1. NPS EN-1 and NPS EN-3 also highlight a number of factors relating to the determination of an application and in relation to mitigation. These are summarised in Table 5.2.

Table 5.1: Summary of the NPS EN-1 and NPS EN-3 provisions relevant to offshore ornithology.

Summary of NPS EN-1 and EN-3 provision	How and where considered in the Environmental Statement
<p>NPS-EN1</p> <p>All proposals for projects that are subject to the Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 (the EIA Regulations) must be accompanied by an Environmental Statement (ES) describing the aspects of the environment likely to be significantly affected by the project. (NPS EN1 paragraph 4.3.1).</p> <p>The Regulations require an assessment of the Likely Significant Effects (LSE) of the proposed project on the environment, covering the direct effects and any indirect, secondary, cumulative, transboundary, short, medium, and long-term, permanent and temporary, positive and negative effects at all stages of the project, and also of the measures envisaged for avoiding or mitigating significant adverse effects. (NPS EN1 paragraph 4.3.3).</p>	<p>Assessment of the potential effects of the Mona Offshore Wind Project relevant to offshore ornithology is considered in section 5.7. The approach to mitigation is discussed in section 5.6.</p>

MONA OFFSHORE WIND PROJECT

Summary of NPS EN-1 and EN-3 provision	How and where considered in the Environmental Statement
<p>For the purposes of this NPS and the technology specific NPSs the ES should cover the environmental, social and economic effects arising from pre-construction, construction, operation and decommissioning of the project.</p> <p>(NPS EN-1 paragraph 4.3.5)</p>	<p>Construction, operations and maintenance and decommissioning effects of the Mona Offshore Wind Project relevant to offshore ornithology are assessed in section 5.7.</p>
<p>Where some details are still to be finalised, the ES should, to the best of the applicant's knowledge, assess the likely worst-case environmental, social and economic effects of the proposed development to ensure that the impacts of the project as it may be constructed have been properly assessed.</p> <p>(NPS EN-1 paragraph 4.3.12)</p>	<p>The maximum design scenario (MDS) is shown in Table 5.21. The MDS has been selected as those scenarios having the potential to result in the greatest effect on an identified receptor or receptor group. The assessment of effects is contained in section 5.7.</p>
<p>The highest level of biodiversity protection is afforded to sites identified through international conventions. The Habitats Regulations set out sites for which a Habitat Regulations Assessment (HRA) will assess the implications of a plan or project, including Special Areas of Conservation (SAC) and Special Protection Areas (SPA).</p> <p>(NPS EN-1 paragraph 5.4.4)</p>	<p>Internationally designated sites are identified in Table 5.10 and Table 5.11, and are described in Volume 6, Annex 5.1: Offshore ornithology baseline characterisation of the Environmental Statement (Document reference F6.5.1).</p>
<p>As a matter of policy, the following should be given the same protection as sites covered by the Habitats Regulations and an HRA will also be required:</p> <ul style="list-style-type: none"> (a) potential SPA and possible SAC; (b) listed or proposed Ramsar sites; and (c) sites identified, or required, as compensatory measures for adverse effects on any of the other sites covered by this paragraph. <p>(NPS EN-1, paragraph 5.4.5)</p>	<p>Internationally designated sites are identified in Table 5.10 described in Volume 6, Annex 5.1: Offshore ornithology baseline characterisation of the Environmental Statement (Document reference F6.5.1).</p> <p>The findings of the HRA process are reported in an Information to Support Appropriate Assessment (ISAA) report (Document Reference E1.1 – E1.3), which assesses the impact specifically on all European sites and is submitted alongside the Environmental Statement.</p>
<p>Many Sites of Special Scientific Interest (SSSIs) are also designated as sites of international importance and will be protected accordingly. Those that are not, or those features of SSSIs not covered by an international designation, should be given a high degree of protection. Most National Nature Reserves are notified as SSSIs.</p> <p>(NPS EN-1 paragraph 5.4.7)</p>	<p>All relevant SSSIs are identified in Table 5.11 and described in Volume 6, Annex 5.1: Offshore ornithology baseline characterisation of the Environmental Statement (Document reference F6.5.1). The assessment of impacts takes account all impacts on all designated sites (including SSSIs) within the Mona offshore ornithology study areas as defined in section 5.3.4.</p>
<p>Many individual species receive statutory protection under a range of legislative provisions. Other species and habitats have been identified as being of principal importance for the conservation of biodiversity in England and Wales, as well as for their continued benefit for climate mitigation and adaptation and thereby requiring conservation action.</p> <p>(NPS EN-1 paragraph 5.4.16)</p>	<p>Assessment of the potential effects of the Mona Offshore Wind Project relevant to offshore ornithology are considered in section 5.7. The approach to mitigation is discussed in section 5.6.</p>

MONA OFFSHORE WIND PROJECT

Summary of NPS EN-1 and EN-3 provision	How and where considered in the Environmental Statement
<p>Where the development is subject to EIA, the applicant should ensure that the ES clearly sets out any effects on internationally, nationally, and locally designated sites of ecological or geological conservation importance (including those outside England), on protected species and on habitats and other species identified as being of principal importance for the conservation of biodiversity, including irreplaceable habitats.</p> <p>(NPS EN-1 paragraph, 5.4.17)</p>	<p>The baseline ornithological environment is described in section 5.4.</p> <p>As part of this chapter, the process of identifying designated sites has been undertaken and results are presented in Table 5.9 and Table 5.10.</p> <p>The specific bird species that may be impacted by the potential effects of the Mona Offshore Wind Project are identified in Table 5.11 and an assessment of the potential effects for these specific species are identified and considered in section 5.7.</p>
<p>Applicants should include appropriate avoidance, mitigation, compensation and enhancement measures as an integral part of the proposed development. In particular, the applicant should demonstrate that:</p> <ul style="list-style-type: none"> • During construction, they will seek to ensure that activities will be confined to the minimum areas required for the works • The timing of construction has been planned to avoid or limit disturbance • During construction and operation best practice will be followed to ensure that risk of disturbance or damage to species or habitats is minimised, including as a consequence of transport access arrangements • Habitats will, where practicable, be restored after construction works have finished • Opportunities will be taken to enhance existing habitats rather than replace them, and where practicable, create new habitats of value within the site landscaping proposals. Where habitat creation is required as mitigation, compensation, or enhancement, the location and quality will be of key importance. In this regard habitat creation should be focused on areas where the most ecological and ecosystems benefits can be realised • Mitigations required as a result of legal protection of habitats or species will be complied with. <p>(NPS EN-1 paragraph 5.4.35)</p>	<p>The approach taken to mitigation is described in section 5.6.</p>
<p>NPS-EN3</p>	
<p>As part of the Offshore Wind Environmental Improvement Package set out in the British Energy Security Strategy, government committed to establishing Offshore Wind Environmental Standards (OWES; previously referred to as Nature Based Design Standards) to accelerate deployment whilst offering greater protection of the marine environment. OWES aim to support developers to take a more consistent approach to avoiding, reducing, and mitigating the impacts of an offshore wind farm and/or offshore transmission infrastructure. The measures could apply to the design, construction, operation and decommissioning of offshore wind farms and offshore transmission (as defined in EN-5 at section 2.12).</p>	<p>The project is aware of the requirements in NPS EN3 to apply the guidance on Environmental Standards once the final guidance is issued. The project will review the guidance once available and determine how the project complies with the guidance, and where, if relevant, the project departs from them.</p>

MONA OFFSHORE WIND PROJECT

Summary of NPS EN-1 and EN-3 provision	How and where considered in the Environmental Statement
<p>Defra will consult on a series of OWES before drafting clear OWES Guidance, which sets out where and how Defra expects each measure to be applied to a development. Once the OWES Guidance is issued, the Secretary of State will expect applicants to have applied the relevant measures to their applications.</p> <p>Applicants should explain how their proposals comply with the guidance or, alternatively, the grounds on which a departure from them is justified. Any reasons for departure from the OWES should be fully detailed within the application documents, with details of any agreements made with statutory consultees.</p> <p>(NPS EN-3 paragraphs 2.8.90 to 2.8.92)</p>	
<p>Applicants should consult at an early stage of pre-application with relevant statutory consultees and energy not-for profit organisations/non governmental organisations as appropriate, on the assessment methodologies, baseline data collection, and potential avoidance, mitigation and compensation options which should be undertaken.</p> <p>(NPS EN-3 paragraph 2.8.104)</p>	<p>Throughout the Mona Offshore Wind Project consultations with relevant statutory and non-statutory stakeholders have been carried out (e.g. via the Evidence Plan Process Expert Working Groups (EWG)) and are presented in section 0. A Scoping Report was submitted to the Planning Inspectorate and a Scoping Opinion was received, discussed in section 5.2. Furthermore, Section S42 responses from the relevant statutory and non-statutory stakeholders were received following submission of the Preliminary Environmental Information Report (PEIR) technical annexes and chapter. All the responses provided, and changes suggested by the stakeholders are presented in the consultation report (Document reference E.3).</p>
<p>Offshore wind farms have the potential to impact on birds through:</p> <ul style="list-style-type: none"> • Collisions with rotating blades • Direct habitat loss • Disturbance from construction activities such as the movement of construction/decommissioning/maintenance vessels and piling • Displacement during the operational phase, resulting in loss of foraging/roosting area • Impacts on bird flight lines (i.e. barrier effect) and associated increased energy use by birds for commuting flights between roosting and foraging areas • Impacts upon prey species and prey habitat; and • Impacts on protected sites. <p>(NPS EN-3 paragraph 2.8.136)</p>	<p>Assessment of the potential effects of the Mona Offshore Wind Project relevant to offshore ornithology are discussed in section 5.7.</p>

MONA OFFSHORE WIND PROJECT

Summary of NPS EN-1 and EN-3 provision	How and where considered in the Environmental Statement
<p>Applicants should discuss the scope, effort and methods required for ornithological surveys with the relevant statutory advisor, taking into consideration baseline and monitoring data from operational windfarms. (NPS EN-3 paragraph 2.8.143)</p>	<p>Baseline survey methods have been discussed with Natural Resources Wales (NRW), Natural England, the Joint Nature Conservation Committee (JNCC) and the Royal Society for the Protection of Birds (RSPB) through the Evidence Plan Process EWG.</p> <p>Relevant data from other operational offshore wind farms has been considered to inform the assessment of potential significant effects of the Mona Offshore Wind Project and the Cumulative Effects Assessment (CEA) in section 5.9.</p>
<p>Applicants must undertake collision risk modelling (CRM), as well as displacement and population viability assessments for certain species of birds. Applicants are expected to seek advice from Statutory Nature Conservation Bodies (SNCBs). (NPS EN-3 paragraph 2.8.144)</p>	<p>CRM, displacement assessment, population viability assessment has been undertaken for birds using parameters that have been agreed with SNCBs through the Evidence Plan process EWG. Potential effects from collision risk and displacement are presented and assessed in section 5.7.</p>
<p>The assessment should be undertaken for all stages of the lifespan of the proposed wind farm in accordance with the appropriate policy and guidance for offshore wind farm EIAs. (NPS EN-3 paragraph 2.8.198)</p>	<p>The construction, operations and maintenance and decommissioning phases of Mona Offshore Wind Project have been assessed in section 5.7.</p>
<p>The Secretary of State should consider the effects of a proposed development on marine ecology and biodiversity, considering all relevant information made available by the applicant. (NPS EN-3 paragraph 2.8.302)</p>	<p>Section 5.7 presents the assessment of effects of the Mona Offshore Wind Project on offshore ornithology receptors.</p>

Table 5.2: Summary of NPS EN-1 and NPS EN-3 policy on decision making relevant to offshore ornithology.

Summary of NPS EN-1 and EN-3 provision	How and where considered in the Environmental Statement
NPS EN-1	
<p>In the 25 Year Environment Plan, the government set out its vision for a quarter-of-a-century action to help the natural world regain and retain good health. A commitment to review the plan every 5 years was set into law in the Environment Act 2021. The Environmental Improvement Plan was published in 2023, which reinforces the intent of the 25 Year Environment Plan and sets out a plan to deliver on its framework and vision. The government's policy for biodiversity in England is set out in the Environmental Improvement Plan 2023, the National Pollinator Strategy and the UK Marine Strategy. The aim is to halt overall biodiversity loss in England by 2030 and then reverse loss by 2042, support healthy well-functioning ecosystems and establish coherent ecological networks, with more and better places for nature for the benefit of wildlife and people. This aim needs to be viewed in the context of the challenge presented by climate change. Healthy, naturally functioning ecosystems and coherent ecological networks will be more resilient and adaptable</p>	<p>Assessment of the potential effects of the Mona Offshore Wind Project and associated mitigation for specific species are identified and discussed in section 5.7 and 5.6 respectively.</p>

MONA OFFSHORE WIND PROJECT

Summary of NPS EN-1 and EN-3 provision	How and where considered in the Environmental Statement
<p>to climate change effects. Failure to address this challenge will result in significant adverse impact on biodiversity and the ecosystem services it provides. (NPS EN-1 paragraph 5.4.2).</p>	

5.1.4 The Welsh National Marine Plan and its relevance to offshore ornithology

- 5.1.4.1 The assessment of potential changes to offshore ornithology has also been made with consideration to the specific policies set out in the Welsh National Marine Plan (Welsh Government, 2019).
- 5.1.4.2 The Welsh National Marine Plan was published on 12 November 2019 and sets out the policy for the next 20 years for the sustainable use of Welsh seas. It includes sector objectives for renewable energy to support the decarbonisation of the Welsh economy and the use of marine renewable energy, including offshore wind farms.
- 5.1.4.3 Key provisions are set out in Table 5.3 along with details as to how these have been addressed within the assessment.

Table 5.3: Welsh National Marine Plan and its relevance to offshore ornithology.

Policy	Key provisions	How and where considered in the Environmental Statement
ENV_01: Resilient marine ecosystems	<p>Proposals should demonstrate how potential impacts on marine ecosystems have been taken into consideration and should, in order of preference:</p> <ul style="list-style-type: none"> • Avoid adverse impacts; and/or • Minimise impacts where they cannot be avoided; and/or • Mitigate impacts where they cannot be minimised. If significant adverse impacts cannot be avoided, minimised or mitigated, proposals must present a clear and convincing case for proceeding. <p>Proposals that contribute to the protection, restoration and/or enhancement of marine ecosystems are encouraged.</p>	<p>The potential impacts on Important Ecological Features (IEFs) have been assessed in section 5.7 and measures adopted as part of the Mona Offshore Wind Project are summarised in section 5.6.</p>
ENV_02: Marine Protected Areas (MPA)	<p>Proposals should demonstrate how they:</p> <ul style="list-style-type: none"> • Avoid adverse impacts on individual MPAs and the coherence of the network as a whole • Have regard to the measures to manage MPAs; and • Avoid adverse impacts on designated sites that are not part of the MPA network. 	<p>Designated sites supporting IEFs that have been identified as appropriate are outlined in section 5.3.8, and any potential impacts to features and the site network will be assessed in the Habitats Regulations Assessment Stage 2 Information to Support an Appropriate Assessment (ISAA) – Part Three: Special Protection Areas and Ramsar sites (Document reference E1.3).</p>

MONA OFFSHORE WIND PROJECT

Policy	Key provisions	How and where considered in the Environmental Statement
ENV_05: Underwater sound.	<p>Proposals should demonstrate that they have considered man-made noise impacts on the marine environment and, in order of preference:</p> <ul style="list-style-type: none"> • Avoid adverse impacts; and/or • Minimise impacts where they cannot be avoided; and/or • Mitigate impacts where they cannot be minimised. <p>If significant adverse impacts cannot be avoided, minimised or mitigated, proposals must present a clear and convincing case for proceeding.</p>	<p>Section 5.7 assesses the impact of underwater and airborne sound on seabirds.</p>
ENV_07: Fish species and Habitats	<p>Proposals potentially affecting important feeding, breeding (including spawning and nursery) and migration areas or habitats for key fish and shellfish species of commercial or ecological importance should demonstrate how they, in order of preference:</p> <ul style="list-style-type: none"> • Avoid adverse impacts on those areas; and/or • Minimise adverse impacts where they cannot be avoided; and/or • Mitigate adverse impacts where they cannot be minimised. <p>If significant adverse impacts cannot be avoided, minimised or mitigated, proposals must present a clear and convincing case for proceeding.</p>	<p>The potential effects on fish species and their habitats have been assessed in full in Volume 2, Chapter 3: Fish and shellfish ecology of the Environmental Statement (Document reference F2.3).</p> <p>Section 5.7 of this chapter assesses the potential effects on seabirds in the context of how seabird prey species may be impacted.</p>

5.1.5 North West Inshore and North West Offshore Coast Marine Plans

5.1.5.1 The assessment of potential changes to offshore ornithology has also been made with consideration to the specific policies set out in the North West Inshore and North West Offshore Coast Marine Plans (MMO, 2021). Key provisions are set out in Table 5.4 along with details as to how these have been addressed within the assessment.

Table 5.4: North West Inshore and North West Offshore Marine Plan policies of relevant to offshore ornithology.

Policy	Key provisions	How and where considered in the Environmental Statement
NW-SCP-1	<p>Proposals within or relatively close to nationally designated areas should have regard to the specific statutory purposes of the designated area. Great weight should be given to conserving and enhancing landscape and scenic beauty in National Parks and Areas of Outstanding Natural Beauty.</p>	<p>As part of this chapter (as well as Volume 6, Annex 5.1: Offshore ornithology baseline characterisation of the Environmental Statement (Document reference F6.5.1)), designated sites with mobile features connected to the Mona Offshore Wind Project have been identified. This is to ensure that all features and species of conservation importance were considered, where relevant, in this assessment.</p> <p>The HRA Stage 1 Screening Report (Document reference E1.4) considers the direct or indirect effects on features of relevant SPA sites, and</p>

MONA OFFSHORE WIND PROJECT

Policy	Key provisions	How and where considered in the Environmental Statement
		where relevant will be included in the ISAA (Document reference E1.3).
NW-MPA-1	Proposals that support the objectives of MPAs and the ecological coherence of the MPA network will be supported.	As part of this chapter (as well as Volume 6, Annex 5.1: Offshore ornithology baseline characterisation of the Environmental Statement (Document reference F6.5.1)), designated sites with mobile features connected to the Mona Offshore Wind Project have been identified (section 5.3.8). This is to ensure that all features and species of conservation importance were considered, where relevant, in this assessment. The HRA Stage 1 Screening Report (Document reference E1.4) considers the direct or indirect effects on features of relevant SPA sites, and where relevant will be included in the ISAA (Document reference E1.3).
NW-BIO-1	NW-BIO-1 encourages and supports proposals that enhance the distribution of priority habitats and priority species.	The Mona Offshore Wind Project will aim to conserve habitats and species as far as reasonably practicable through a number of measures adopted to reduce the impact of the Mona Offshore Wind Project (section 5.6).
NW-BIO-2	NW-BIO-2 requires proposals to manage negative effects which may significantly adversely impact the functioning of healthy, resilient and adaptable marine ecosystems.	In addition to measures adopted as part of the Mona Offshore Wind Project and sensitive project design, secondary mitigation will be considered if an impact is considered to be significant in EIA terms in section 5.7.
NW-CE-1	Proposals which may have adverse cumulative effects with other existing, authorised, or reasonably foreseeable proposals must demonstrate that they will avoid, minimise and mitigate.	Cumulative effects have been quantified and their significance assessed in section 5.9.

5.2 Consultation

5.2.1 Overview

5.2.1.1 A summary of the key issues raised during consultation activities undertaken to date specific to offshore ornithology is presented in Table 5.5 below, together with how these issues have been considered in the production of this Environmental Statement chapter. Further detail is presented in the following Annexes:

- Volume 6, Annex 5.1: Offshore ornithology baseline characterisation of the Environmental Statement (Document reference F6.5.1)
- Volume 6; Annex 5.2: Offshore ornithology displacement technical report of the Environmental Statement (Document reference F6.5.2)
- Volume 6, Annex 5.3: Offshore ornithology collision risk modelling technical report of the Environmental Statement (Document reference F6.5.3)
- Volume 6, Annex 5.4: Offshore ornithology migratory bird collision risk modelling technical report of the Environmental Statement (Document reference F6.5.4)

MONA OFFSHORE WIND PROJECT

- Volume 6, Annex 5.5: Offshore ornithology apportioning technical report of the Environmental Statement (Document reference F6.5.5)
- Volume 6, Annex 5.6: Offshore ornithology population viability analysis technical report of the Environmental Statement (Document reference F6.5.6).

5.2.2 Evidence Plan process

- 5.2.2.1 The purpose of the Evidence Plan process is to agree the information the Mona Offshore Wind Project needs to supply to the Secretary of State, as part of a DCO application for the Mona Offshore Wind Project. The Evidence Plan seeks to ensure compliance with the HRA and EIA Regulations. The development and monitoring of the Evidence Plan and its subsequent progress is being undertaken by the Steering Group. The Steering Group is comprised of the Planning Inspectorate, the Applicant, NRW, Natural England, JNCC and the MMO as the key regulatory and SNCBs. To inform the EIA and HRA process during the pre-application stage of the Mona Offshore Wind Project, EWGs were also set up to discuss and agree topic specific issues with the relevant stakeholders. Consultation was undertaken via the Offshore Ornithology EWG, with meetings held in February 2022, July 2022, November 2022, February 2023, June 2023, October 2023 and December 2023 (Table 5.5).
- 5.2.2.2 The responses provided and changes suggested by the stakeholders through the EWG are summarised in Table 5.5 together with changes implemented in the chapter of the Environmental Statement.

MONA OFFSHORE WIND PROJECT

Table 5.5: Summary of key topics and issues raised during consultation activities undertaken for the Mona Offshore Wind Project relevant to offshore ornithology.

Date	Consultee and type of response	Topics and issues raised	Response to issue raised and/or where considered in this chapter
February 2022	<p>Offshore Ornithology Expert Working Group 1</p> <p>Attended by:</p> <p>Natural England, JNCC, The Wildlife Trusts (TWT), MMO, RSPB (apologies given by NRW)</p>	<p>The EWG agreed on broad approach to baseline characterisation (including digital aerial survey) and characterisation for the Mona Offshore Cable Corridor using desktop data sources only.</p>	<p>Methodology presenting the approach to baseline using site-specific surveys and desktop studies is summarised and presented in section 5.3 of this chapter.</p>
	<p>Scoping Opinion</p> <p>IOM Department of Infrastructure</p>	<p>The Isle of Man Department of Infrastructure noted that Manx shearwater <i>Puffinus puffinus</i>, common guillemot <i>Uria aalge</i>, razorbill <i>Alca torda</i> and black-legged kittiwake <i>Rissa tridactyla</i> were numerous in previous surveys of the generation assets study area. These are all within foraging range of their Isle of Man breeding colonies.</p> <p>The Isle of Man government requested that the national bird statuses and conservation concerns of the Isle of Man are taken into account by reference to the recently published Manx Birds of Conservation Concern and had a current concern regarding severe declines in many seabird populations on the Isle of Man (See Hill <i>et al.</i>, 2019). Schedule 1 of the Wildlife Act 1990 lists the specially protected birds. Both of these are relevant to the status of these species in the vicinity of this development and in particular, the considerations of potential impacts on Manx populations.</p>	<p>Abundance at breeding colonies on the Isle of Man (using the Seabird Monitoring Programme (SMP) database (JNCC (2023))) are considered in section 5.3 this chapter</p> <p>The conservation value of Isle of Man birds has been included in section 5.3 of this chapter.</p>

MONA OFFSHORE WIND PROJECT

Date	Consultee and type of response	Topics and issues raised	Response to issue raised and/or where considered in this chapter
June 2022	Scoping Opinion The Planning Inspectorate	Where possible, the Applicant should seek to agree the magnitude of impact or sensitivity of receptors with relevant consultees through the PEIR and pre-application process. Where differences in opinion remain, these should be identified within the Environmental Statement with justification given for the Applicant's choice.	The description of the magnitude of each impact and sensitivity of each receptor, or each receptor group considered in the EIA (see sections 5.7 to 5.12 of this chapter). Comments note that where differences in opinion remain, these will be identified, and justification given for the Applicant's choice.
		The Environmental Statement should define what a 'reasonable timescale' or 'short time period' would be within which recovery could occur so that an impact would be reversible/not permanent.	For each impact where recovery is considered, the timescales for recovery has been stated in section 5.4 of this chapter
		A number of mitigation plans have been referred to in aspect chapters. Where plans are relied upon to avoid significant environmental effects, outline or in-principle plans should be submitted as part of the DCO application.	Where a significant environmental effect has been identified, further mitigation has been proposed in section 5.6 of this chapter.
		The Applicant proposed to assess the effects of underwater sound on marine life due to jacket or monopile cutting and removal during decommissioning. The Scoping Report does not propose to assess this potential impact within the fish and shellfish ecology, marine mammals or offshore ornithology Environmental Statement chapters. The outcomes of this assessment should be presented within the relevant chapters.	The indirect impact of underwater sound on prey species relevant to ornithological receptors has been assessed for the construction, operations and maintenance, and decommissioning phases, as detailed in section 5.7.3 of this chapter.
		Direct disturbance and displacement impacts from underwater sound during the operations and maintenance and decommissioning phases.	Disturbance and displacement from airborne noise, underwater sound, and presence of vessels and infrastructure has been assessed in-combination across all phases, as detailed in section 5.7 of this chapter.

MONA OFFSHORE WIND PROJECT

Date	Consultee and type of response	Topics and issues raised	Response to issue raised and/or where considered in this chapter
		<p>The Inspectorate agreed that collision risk to birds from the offshore booster station structures is unlikely and is therefore content to scope this matter from the Environmental Statement.</p>	<p>The Offshore Booster Substation is no longer in the design for the Mona Offshore Wind Project and is therefore not included in the impact assessments presented in section 5.7 of this chapter.</p>
		<p>The Planning Inspectorate proposes a range (4 km to 10 km) within the study area proposed for the offshore ornithology aspect chapter. The Environmental Statement should clearly state and provide justification for the final study area adopted in the impact assessment. It should also be supported by a figure(s) clearly presenting the extent of the buffer and where these buffer distances differ. The study area should be based on the Zone of Influence (ZOI) for the Proposed Development.</p> <p>The Applicant's attention is directed to the recent issue of the 'Joint SNCB1 Interim Advice on the treatment of displacement for red-throated diver (2022)' with regards to revised guidance for red-throated diver displacement. The Inspectorate advises that the marine ornithology study area should include the array area and a minimum 10 km buffer. Where the buffer does not consistently reach 10 km, the Environmental Statement should clearly justify the approach.</p>	<p>There are three study areas adopted for the offshore ornithology assessment presented in section 5.3.4 of this chapter, with justifications.</p>
		<p>The Environmental Statement should consider those birds listed on Schedule 1 of the Wildlife Act 1990 (Isle of Man) and refer to the Manx Birds of Conservation Concern (2021) when considering conservation status of Manx birds (where relevant).</p>	<p>The conservation value of Isle of Man birds has been included in section 5.3 of this chapter.</p>
		<p>The Applicant's attention is directed to the response of the Isle of Man Government at Appendix 2 to this Opinion with regards to designated sites and in particular the Calf of Man National Bird Observatory.</p>	<p>The importance of the National Bird Observatory for monitoring, research and recreational activities is acknowledge (see Table 5.11 in section 5.3.8 of this chapter). However, the status of the Bird Observatory is of limited relevance to the assessment of ornithological receptors.</p>

MONA OFFSHORE WIND PROJECT

Date	Consultee and type of response	Topics and issues raised	Response to issue raised and/or where considered in this chapter
		<p>The Scoping Report proposes to determine connectivity between breeding seabird colonies at designated sites and the Proposed Development through the application of the metric ‘mean maximum (plus one standard deviation)’. Until the site-specific surveys are complete, and the data analysis finalised, it may be prudent to scope in all SPAs, Ramsar sites, and SSSIs with marine or estuarine bird qualifying features to the impact assessment. The Applicant should seek to agree the appropriate metric with relevant consultation bodies, including NRW and Natural England.</p>	<p>Best practice (i.e. using the mean-max + 1 standard deviation (SD) foraging range from Woodward <i>et al.</i>, (2019)) guidelines were followed to determine connectivity between sites and the ZOI of the Mona Offshore Wind Project. Designated sites connected to the Mona Offshore Wind Project are presented in 5.3.8 of this chapter.</p>
		<p>The Scoping Report states that the displacement matrix approach for the transmission assets may be modified (in terms of the appropriate displacement and mortality rates) to assess the potential temporary impact of disturbance during installation of the offshore export cables. If fundamental disagreements remain regarding the assessment methods and modelling for assessing effects from displacement and collision-related mortality, the Environmental Statement should include assessments based on the Applicant’s preferred method and those advocated by NRW and Natural England. The Applicant is advised to agree the detailed assessment methodologies with relevant stakeholders represented on the ornithology EWG.</p>	<p>The Mona Offshore Cable Corridor assessment has been agreed with the Offshore Ornithology EWG and the findings are presented in section 5.7 of this chapter.</p>
	<p>Scoping Opinion JNCC</p>	<p>Clarity is required as to how impacts from operational developments will be included within a cumulative assessment. If built and operational projects are classed as part of the baseline conditions, then the project alone assessment needs to consider whether it brings ‘baseline mortality’ (including the mortality contributed from baseline projects) above a level that is unacceptable. Mortality that can be attributed to projects that were built and operational at the time that survey data were collected do need to be considered alongside predicted mortality from the Mona proposal. We would suggest that, given the difficulties in assessing ‘actual’ mortality or population consequences for mobile species such as marine birds, from existing built and operational infrastructure (such as windfarms), then in practice this means that the assessment is based on a combined ‘predicted’ mortality across built, operational, under construction, consented and otherwise identified infrastructure projects.</p> <p>The Scoping Report appears to suggest that operational project/plans will be included within a cumulative assessment, which contracts with the list of developments in stated elsewhere in the document. Please clarify whether and how the impact operational developments will be incorporated in a cumulative assessment.</p>	<p>The impact of operational developments has been included in the cumulative assessment (section 5.9 of this chapter). The approach to assessing cumulative impact is based on obtaining collision risk estimates where available. If unavailable for historic projects, a qualitative assessment of collision will be undertaken. For displacement, the approach follows standard methodology obtaining, where possible, abundance data from each project (or using Marine Ecosystem Research Programme (MERP)</p>

MONA OFFSHORE WIND PROJECT

Date	Consultee and type of response	Topics and issues raised	Response to issue raised and/or where considered in this chapter
	<p>Scoping Opinion Natural England</p>	<p>Identification of receptors and the sensitivity of receptors to impact scale definitions should be discussed and agreed as part of the Evidence Plan process with the relevant EWG. These definitions should be set out within the Environmental Statement.</p>	<p>data if unavailable) and scaling this to relevant areas/seasons. The definition of sensitivity for receptors and receptor groups is included in section 5.3.11 of this chapter.</p>
<p>A matrix for assessment of significance is provided as an example, demonstrating how the sensitivity of receptor against magnitude of impact can determine the significance of effect. As with above comments, sensitivity of receptor, magnitude of impact and the matrix of significance of effect should be discussed and agreed through the Evidence Planning process. Discuss and agree with the relevant EWGs and definitions should be provided in the Environmental Statement.</p>		<p>The matrix for assessment of significance has been included in section 5.3.11 of this chapter.</p>	
<p>We understand that at the current stage this is a high-level definition, however, all definitions will require refining. Discussion and agreement should be sought through the Evidence Plan process with the relevant EWG.</p>		<p>The definition if significance levels will be included in section 5.3.11 of this chapter.</p>	
<p>Consideration of climate change impacts over the operational period of Mona offshore wind farm should be considered. These impacts will become important if they cause an alteration in the baseline conditions and become detectable above natural inter-annual variations.</p>		<p>An assessment of the future baseline scenario including the impact of climate change is presented in section 5.1.1 of this chapter.</p>	

MONA OFFSHORE WIND PROJECT

Date	Consultee and type of response	Topics and issues raised	Response to issue raised and/or where considered in this chapter
February 2022	<p>Offshore Ornithology Expert Working Group 1</p> <p>– Attended by:</p> <p>Natural England, JNCC, NRW, TWT,</p>	<p>Agreed on ways of working document, including timescales. Agreed on broad approach to digital aerial surveys (DAS). Agreed on broad approach to characterisation for the Mona Offshore Cable Corridor using desktop data sources only.</p>	<p>The Mona digital aerial area includes a buffer of 7-16 km from the Mona Array Area. The Mona digital aerial survey area does not extend fully to 10 km in all directions around the Mona Array Area, as this area was refined following commencement of the DAS. The uneven buffer around the Mona Array Area is a result of the surveys being designed on the basis of an array area that differed to the final boundary. The use of Light Detection and Ranging (LiDAR) as a method for collecting flight height data to parameterise collision risk models was not endorsed by Natural England; as such it has not been progressed and flight heights are based on existing literature.</p> <p>The approach to characterisation of the Mona Offshore Cable Corridor is to rely on available desktop data for the Mona Offshore Cable Corridor. This approach is standard for offshore wind farm transmission assets</p>

MONA OFFSHORE WIND PROJECT

Date	Consultee and type of response	Topics and issues raised	Response to issue raised and/or where considered in this chapter
13 July 2022	<p>Offshore Ornithology Expert Working Group 2</p> <p>Attended by: Natural England, JNCC, NRW, RSPB, TWT, MMO</p>	<p>The second EWG meeting provided an update on the approach used to characterise the baseline conditions and assess the effects on ornithological receptors.</p> <ul style="list-style-type: none"> JNCC advised that the assessment of displacement during construction and decommissioning should include for 50% of the displacement during operation. 	<p>The EWG agreed on the approach to baseline characterisation as summarised and presented in section 5 of this chapter. A summary of the methodology presenting the approach to baseline using site-specific surveys and desktop studies is presented in section 5.3.1.</p> <p>Assessment during construction and decommissioning is presented in section 5.7 of the Environmental Statement chapter</p>
November 2022	<p>Offshore Ornithology Expert Working Group 3</p> <p>Attended by: Natural England, JNCC, NRW, RSPB TWT, MMO, Isle of Man Government</p>	<p>The third EWG meeting provided an update on the results of the baseline characterisation, displacement assessment, migratory and non-migratory collision assessment, apportioning and approach to LSE screening under for the Preliminary Environmental Information Report (PEIR).</p> <ul style="list-style-type: none"> NRW and JNCC advised on displacements rates and mortality rates to be used for Manx shearwater Request for sabbaticals to be included as adult birds. 	<p>As recommended, auk species displacement and mortality rates have been used in the assessment of effect presented in section of the 5.7 of the Environmental Statement chapter. Sabbaticals are included in adult impacts in the assessment of effect presented in section of the 5.7 of this chapter.</p>
February 2023	<p>Offshore Ornithology Expert Working Group 4</p> <p>Attended by: Natural England, JNCC, NRW, RSPB TWT, MMO</p>	<p>The fourth EWG meeting provided an update on the Highly Pathogenic Avian Influenza (HPAI) and discuss the result of the assessment for the Mona Offshore Cable Corridor on seabirds and divers, overview of the new conservation advice package for Liverpool Bay SPA, and approach to LSE screening.</p> <ul style="list-style-type: none"> NRW/JNCC/Natural England suggested timing restrictions during cable laying across the Liverpool Bay SPA to avoid disturbance and displacement impacts on red-throated divers and common scoter. 	<p>Timing restrictions of work will be followed and implemented during cable laying across the Liverpool Bay SPA. Mitigation measures adopted are presented in section 5.6 of this chapter.</p>

MONA OFFSHORE WIND PROJECT

Date	Consultee and type of response	Topics and issues raised	Response to issue raised and/or where considered in this chapter
June 2023	Offshore Ornithology Expert Working Group 5 Attended by: Natural England, JNCC, NRW, RSPB TWT, Isle of Man Government, MMO, Niras	Presentation of Power Analysis results and discussion of Section 42 comments. The fifth EWG meeting (June 2023) discussed Section 42 responses and provided an update on the power analysis carried out to demonstrate the adequacy of the survey design and sampling regime.	A summary of the key Section 42 responses with changes implemented in the Environmental Statement chapter are presented in this table below.
June 2023	S42 Consultation NRW, JNCC, Natural England	Consultees do not agree with the use of stable age structures for age-class apportioning or the removal of sabbaticals from impacts in the PEIR.	Sabbaticals are included in adult impacts in the assessment of effect presented in section of the 5.7 of Volume 2, Chapter 5: Offshore ornithology of the Environmental Statement (Document reference F2.5).
	S42 Consultation NRW, JNCC, Natural England	Consultees do not consider it appropriate to base the cumulative (and hence also in-combination) assessments on so many unknowns for impacts from many of the relevant other projects. Whilst these historic projects may not have undertaken quantitative assessments, or assessments using current approaches, estimates will need to be generated for these unknown projects in order to undertake meaningful assessments.	The impact of historic projects for which collision and assessment were unknown have been included in the cumulative assessment (section 5.9 of this chapter). In the absence of quantitative assessment for historical projects, qualitative assessment has been presented where the information was available.
	S42 Consultation NRW and Natural England	Consultees query why Manx shearwater has not been assessed for cumulative displacement impacts both during construction and operation/maintenance, as we consider this should be assessed.	Cumulative and in-combination assessments have been undertaken for Manx shearwater and the results are presented in this chapter.
	S42 Consultation NRW and Natural England	Consultees suggest that cumulative collision assessments of migrant species are also undertaken.	Cumulative collision assessment of migrant species is included in the CEA presented in this chapter.

MONA OFFSHORE WIND PROJECT

Date	Consultee and type of response	Topics and issues raised	Response to issue raised and/or where considered in this chapter
	<p>S42 Consultation NRW, JNCC, Natural England</p>	<p>The combined impact of displacement plus collision risk for the Mona project alone should be undertaken for black-legged kittiwake and northern gannet.</p>	<p>The combined cumulative displacement and collision for northern gannet and black-legged kittiwake for the Mona project alone is included in the CEA presented in this chapter.</p>
	<p>S42 Consultation Orsted</p>	<p>To assess the impacts of project alone and cumulative projects on Whooper swan.</p>	<p>Project alone and cumulative collision assessment of Whooper swan is included in the CEA presented in this chapter.</p>
<p>October 2023</p>	<p>Offshore Ornithology Expert Working Group 6 Attended by: Natural England, JNCC, NRW, RSPB TWT, Isle of Man Government, MMO, Niras</p>	<p>Project updates that affect the assessment were presented to the EWG (e.g., a reduction in the array area and no. of turbines). The EWG were asked to agree whether or not up to 8 vessel movements at the landfall would not be subject to seasonal restrictions. The EWG were notified that due to a number of project changes the baseline characterisation presented in the ES will differ slightly from that of the PEIR and that the regional population estimates used had been revised. It was also noted that precautionary regional breeding estimates as explored with the EWG would be used for assessment. It was noted that the impacts assessed in the ES will be the same as those assessed in the PEIR.</p>	<p>The SNCBs disagreed with the approach taken surrounding the revision of population estimates and the inclusion of immatures within the breeding population and suggested that the discussion would need more clarification. Following the EWG meeting, a technical note detailing the approach to calculating the reference breeding population for project alone and cumulative effect assessment has been circulated to the SNCBs. Agreement on approach detailed under the December EWG meeting below,</p>

MONA OFFSHORE WIND PROJECT

Date	Consultee and type of response	Topics and issues raised	Response to issue raised and/or where considered in this chapter
December 2023	<p>Offshore Ornithology Expert Working Group 7</p> <p>Attended by:</p> <p>Natural England, JNCC, NRW, RSPB, TWT, Isle of Man Government, MMO, Niras</p>	<p>Methodology updates that affect the assessment were presented to the EWG (e.g., project alone and CEA breeding regional population approach and avoidance rates for gull species).</p> <p>Following presentation of the Applicant's approach to calculating regional breeding population against NRW approach (as agreed with JNCC and NE), NRW/JNCC/NE requested that the impacts in the context of the smallest regional breeding population for project alone should also be presented.</p> <p>Following discussion on data sources on avoidance rates, NRW/JNCC/NE requested that the Natural England avoidance rates should be used when assessing collision risk to gull species.</p> <p>The applicant presented an update to the Mona HRA outlining method of screening SPAs for LSE and concluded that there are likely no adverse effects on integrity of any SPAs and a derogation case would likely not be required.</p>	<p>Following discussion with SNCBs, the applicant has presented for project alone the impacts in the context of the smallest regional breeding population. The NRW approach (as agreed with JNCC and Natural England) shows a smaller regional population for northern gannet and Manx shearwater and the Applicant has u presented these values alongside the foraging range populations. The impacts are presented in section 5.7.</p>

5.3 Baseline methodology

5.3.1 Relevant guidance

5.3.1.1 The baseline characterisation has followed methodologies and approaches set out in the following guidance documents:

- Offshore Wind Marine Environmental Assessments: Best Practice Advice for Evidence and Data Standards. Phase I: Expectations for pre-application baseline data for designated nature conservation and landscape receptors to support offshore wind applications (Natural England, 2022a)
- Offshore Wind Marine Environmental Assessments: Best Practice Advice for Evidence and Data Standards. Phase II: Expectations for pre-application engagement and best practice guidance for the evidence plan process (Natural England, 2022b)
- Offshore Wind Marine Environmental Assessments: Best Practice Advice for Evidence and Data Standards. Phase III: Expectations for data analysis and presentation at examination for offshore wind applications (Natural England, 2022c).

5.3.2 Scope of the assessment

5.3.2.1 The scope of this Environmental Statement has been developed in consultation with relevant statutory and non-statutory consultees as detailed in Table 5.5

5.3.2.2 Taking into account the scoping and consultation process, Table 5.6 summarises the issues considered as part of this assessment.

Table 5.6: Issues considered within this assessment.

Activity	Potential effects scoped into the assessment
Construction phase	
	<ul style="list-style-type: none"> • Disturbance and displacement from airborne noise, underwater sound, and presence of vessels and infrastructure • Indirect impacts from underwater sound affecting prey species • Temporary habitat loss/disturbance and increased suspended sediment concentrations (SSCs).
Operation and maintenance	
	<ul style="list-style-type: none"> • Disturbance and displacement from airborne noise, underwater sound, and presence of vessels and infrastructure • Temporary habitat loss/disturbance and increased SSCs • Presence of operational wind turbines may lead to collision risk. Additional mortality may cause a decrease in seabird populations • Presence of operational wind turbines may result in additional energy expenditure as migrating or commuting birds fly longer distances around the offshore wind farm.

MONA OFFSHORE WIND PROJECT

Activity	Potential effects scoped into the assessment
Decommissioning	<ul style="list-style-type: none"> • Disturbance and displacement from airborne noise, underwater sound, and presence of vessels and infrastructure • Indirect impacts from underwater sound affecting prey species • Temporary habitat loss/disturbance and increased SSCs.

5.3.2.3 On the basis of the baseline environment and the description of development outlined in Volume 1, Chapter 3: Project description of the Environmental Statement, a number of impacts have been scoped out of the assessment at the scoping stage for offshore ornithology. These impacts are outlined, together with a justification for scoping them out, in Table 5.7.

Table 5.7: Impacts scoped out of the assessment for offshore ornithology.

Potential impact	Justification
Direct disturbance and displacement impacts from underwater sound during the operations and maintenance phase.	Underwater sound as a result of operation of the wind turbines is extremely unlikely to result in sound levels that would harm birds. In the unlikely event that such low levels of sound emission result in displacement of birds away from wind turbines, this impact would already be accounted for by the above-water operational displacement assessment.
Accidental pollution during all phases of the Mona Offshore Wind Project.	Pollution impacts (accidental oil/fuel spills) during all phases of the Mona Offshore Wind Project relating to the generation assets are scoped out on the basis that the implementation of a Marine Pollution Contingency Plan (MPCP) will avoid the risk of significant pollution events. Consequently, seabirds and shorebirds are extremely unlikely to be significantly affected by any such pollution impacts.
Indirect impact from underwater sound from wind turbine operation on prey fish species during the operations and maintenance phase.	Sound generated by operational wind turbines is of a very low frequency and low sound pressure level (Andersson, 2011). Studies have found that sound levels are only high enough to possibly cause a behavioural reaction within metres from a wind turbine (Sigray and Andersson, 2011) and therefore such levels are not considered to have potentially significant effects on fish. The Marine Management Organisation (MMO, 2014) review of post-consent monitoring at offshore wind farms found that available data on the operational wind turbine sound, from the UK and abroad, in general showed that sound levels from operational wind turbines are low and the spatial extent of the potential impact of the operational sound is low. This is supported by project specific modelling which indicated that effects on fish (e.g., injury or behavioural effects) are unlikely to occur for the modelled operations wind turbines. See Volume 5, Annex 3.1: Underwater sound technical report of the Environmental Statement (Document reference F5.3.1) for further details.

5.3.3 Methodology to inform baseline

5.3.3.1 In order to inform the Environmental Statement, 24 months of DAS were undertaken between March 2020 and February 2022. The DAS aim to characterise the distribution

MONA OFFSHORE WIND PROJECT

and abundance of seabirds within the Mona Offshore Ornithology Array Area study area (Figure 5.1).

5.3.3.2 Furthermore, information on offshore ornithology within the Mona Offshore Ornithology Array Area study area and the Mona Offshore Ornithology Offshore Cable Corridor study area was collected through a detailed desktop review of existing studies and datasets.

5.3.3.3 The full details of both the site-specific surveys and desktop review methodology are presented in Volume 6, Annex 5.1: Offshore ornithology baseline characterisation technical report of the Environmental Statement (Document reference F6.5.1).

5.3.4 Study areas

5.3.4.1 There are three study areas for the Mona Offshore Ornithology EIA. These are:

- The Mona Offshore Ornithology Array Area study area: this includes the Mona Array Area plus a buffer extending between 7 km and 16.5 km (Figure 5.1). This area was defined by the extent of the digital aerial bird surveys. Due to the changes in the proposed Mona Array Area since the design of the digital aerial survey in spring 2020, the Mona Offshore Ornithology Array Area study area does not extend equally in all directions around the Mona Array Area assessed in this Environmental Statement
- The Mona Offshore Ornithology Offshore Cable Corridor study area: this encompasses the Mona Offshore Cable Corridor and Access Areas running between the landfall area on the Welsh Coast and the Mona Array Area, plus a 4 km buffer (Figure 5.1). Part of the Mona Offshore Ornithology Offshore Cable Corridor study area has been covered by the digital aerial bird surveys. The areas outside the digital bird surveys are covered by the regional studies of Liverpool Bay (Bradbury *et al.*, 2014, Lawson *et al.*, 2016 and HiDef Aerial Surveying Limited., 2023)
- The Cumulative Mona Offshore Ornithology study area: this was identified by consideration of the foraging ranges of seabird species recorded within the Mona Offshore Ornithology Array Area study area and the relevant Biologically Defined Minimum Population Scales (BDMPS) region (Furness, 2015). The Cumulative Mona Offshore Ornithology study correlates to the relevant BDMPS (e.g. 'UK Western Waters'). The Cumulative Mona Offshore Ornithology study area varies dependent upon different species foraging ranges (See Volume 6, Annex 5.1: Offshore ornithology baseline characterisation technical report of the Environmental Statement (Document reference F6.5.1) for a list of mean maximum foraging ranges plus one standard definition as reported by Woodward, *et al.* (2019)).

MONA OFFSHORE WIND PROJECT

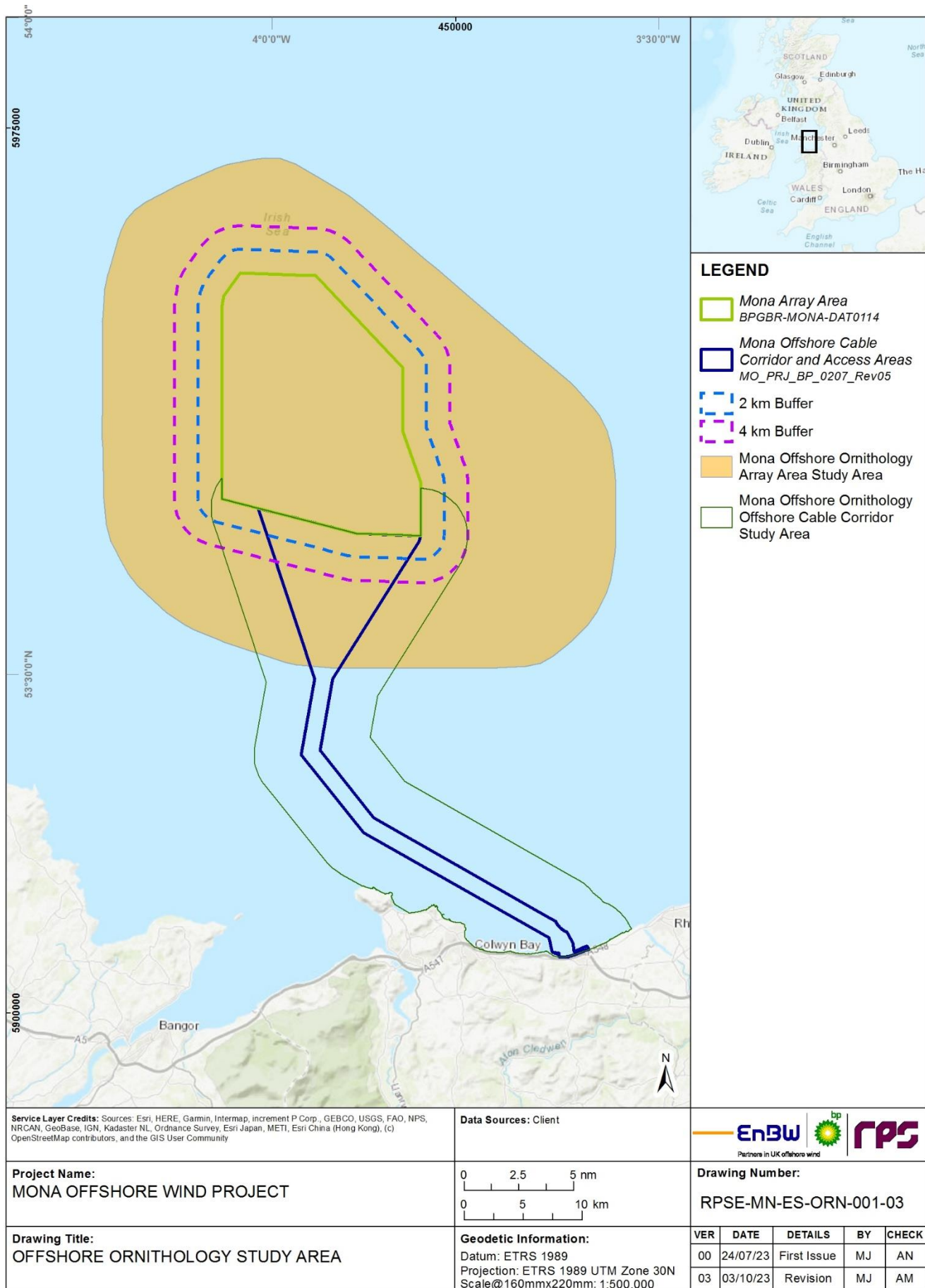


Figure 5.1: The Mona Offshore Ornithology Array Area study area and the Mona Offshore Ornithology Offshore Cable Corridor study area.

MONA OFFSHORE WIND PROJECT

5.3.5 Desktop study

5.3.5.1 Information on offshore ornithology within the Mona Offshore Ornithology Array Area study area and the Mona Offshore Ornithology Offshore Cable Corridor study area was collected through a detailed desktop review of existing studies and datasets. These are summarised in Table 5.8 with full details presented in Volume 6, Annex 5.1: Offshore ornithology baseline characterisation technical report of the Environmental Statement (Document reference F6.5.1).

Table 5.8: Summary of key desktop reports reviewed to inform baseline.

Title	Reference
Identifying important at-sea areas for seabirds using species distribution models and hotspot mapping.	Cleasby <i>et al.</i> , 2020
Distribution maps of cetacean and seabird populations in the northeast Atlantic.	Waggitt <i>et al.</i> , 2020
Mapping seabird sensitivity to offshore wind farms.	Bradbury <i>et al.</i> , 2014
Non-breeding season populations of seabirds in UK waters: Population sizes for Biologically Defined Minimum Population Scales (BDMPS).	Furness, 2015
All Wales Common Scoter survey: report on 2002/03 work programme.	Cranswick <i>et al.</i> , 2004
An assessment of the numbers and distributions of inshore aggregations of waterbirds using Liverpool Bay during the non-breeding season in support of possible SPA identification.	Webb <i>et al.</i> , 2006
An assessment of the numbers and distribution of wintering waterbirds and seabirds in Liverpool Bay/Bae Lerpwl area of search.	Lawson <i>et al.</i> , 2016
SEA678 Data Report for Offshore Seabird Populations.	Mackey and Giménez, 2006
Seabird Tracking Database.	BirdLife International, 2022
Morgan Offshore Wind Project Preliminary Environmental Information Report (Volume 2, Chapter 10: Offshore Ornithology)	Morgan Offshore Wind Ltd, 2023
Morecambe Offshore Wind Project Preliminary Environmental Information Report (Volume 1, Chapter 12: Offshore Ornithology)	Morecambe Offshore Wind Ltd, 2023
Densities of qualifying species within Liverpool Bay Bae Lerpwl SPA: 2015 to 2020	HiDef Aerial Surveying Limited, 2023

5.3.6 Identification of designated sites

5.3.6.1 All designated sites within the three study areas with qualifying interest features that could be affected by the construction, operations and maintenance and decommissioning phases of the Mona Offshore Wind Project were identified.

5.3.6.2 All designated sites of international (e.g. SPAs or Ramsar sites) and national (e.g. SSSIs or Marine Nature Reserves (MNR) within the Isle of Man) importance which directly overlap one of the three study areas or have features which connect to the study areas were identified. The main sources for identifying these sites were the

MONA OFFSHORE WIND PROJECT

JNCC's online resource on the SPAs network (JNCC, 2022), the Ramsar Sites Information Service (RSIS, n.d.) and the Isle of Man's website (The Official Isle of Man Government Website, 2023).

5.3.6.3 Connectivity was established during the breeding season if a site (for which a species is a qualifying feature) is within foraging range of one of the study areas (using mean maximum + 1 SD (Woodward *et al.*, 2019).

5.3.6.4 Additional designated sites are included within the HRA for the non-breeding period (migration and winter) but are not specifically mentioned within the chapter. Impacts to populations are felt more profoundly during the breeding season due to its significance in life cycles and therefore to reduce the length of baseline description within this Environmental Statement chapter, only sites connected to the Mona Offshore Wind Project during the breeding season are described in section 5.3.8. During the non-breeding season, species are no longer spatially restricted and undertake much larger movements than during the breeding season (Furness, 2015).

Site-specific surveys

5.3.6.5 In order to inform the Environmental Statement, site-specific surveys were undertaken as agreed with the statutory bodies. A summary of the surveys undertaken to inform the offshore ornithology impact assessment is outlined in Table 5.9.

Table 5.9: Summary of site-specific survey data.

Title	Extent of survey	Overview of survey	Survey contractor	Date	Reference to further information
DAS	Mona Array Area with buffer extending 7 km to 16.5 km	DAS to characterise the distribution and abundance of seabirds within the Mona Offshore Ornithology Array Area study area.	APEM	March 2020 to February 2022 (24 months)	Volume 6, Annex 5.1: Offshore ornithology baseline characterisation technical report of the Environmental Statement (Document reference F6.5.1).

5.3.7 Baseline environment

Desktop study findings

5.3.7.1 The Mona Array Area is situated in the central part of the Irish Sea. The Irish Sea separates the islands of Ireland and Great Britain and is linked to the Celtic Sea in the south by St George's Channel, and to the Inner Seas off the West Coast of Scotland in the north by the North Channel (also known as the Straits of Moyle).

5.3.7.2 21 species of seabird have been reported as regularly nesting on beaches or cliffs around the Irish Sea (Mitchell *et al.*, 2004).

5.3.7.3 A large proportion of the Manx shearwater biogeographic population is found breeding on offshore islands around the Irish Sea. Most of the world's Manx shearwater population is found in the UK and over 90% of the UK population is found on the Islands of Rum, Eigg (Scotland), Skomer and Skokholm (Wales) (Mitchell *et al.*, 2004; JNCC, 2020).

5.3.7.4 During the non-breeding season, large populations of common scoter *Melanitta nigra* and red-throated diver use the shallow waters of Liverpool Bay (Lawson *et al.*, 2016).

MONA OFFSHORE WIND PROJECT

- 5.3.7.5 For the most widespread and abundant seabirds of the central Irish Sea, namely northern gannet, common guillemot, European herring gull *Larus argentatus*, black-legged kittiwake, lesser black-backed gull *Larus fuscus*, Manx shearwater and razorbill, there are a number of breeding colonies within the species-specific foraging ranges (mean-maximum foraging ranges compiled by Woodward *et al.* (2019)) from the Mona Array Area.
- 5.3.7.6 During the desktop study a review of boat-based and aerial survey data analysed by Waggitt *et al.* (2020) and Bradbury *et al.* (2014) revealed key patterns of temporal and spatial use in the Mona Offshore Ornithology Array Area study area. These are summarised below with full details presented in Volume 6, Annex 5.1: Offshore ornithology baseline characterisation of the Environmental Statement (Document reference F6.5.1).
- 5.3.7.7 Both studies showed that black-legged kittiwake have a patchy seasonal distribution, an overall lower abundance during the breeding season (March to August) and relative low densities in the Mona Offshore Ornithology Array Area study area. It is also apparent from both studies that the Mona Array Area did not overlap with hotspots of abundance of common guillemot and razorbill, which were located further inshore or offshore during the non-breeding and breeding seasons respectively. It is also evident from Waggitt *et al.* (2020) and Bradbury *et al.* (2014) that lesser black-backed gull and European herring gull have a very restricted coastal distribution during the breeding season (April to August) owing to their small foraging range (Woodward *et al.*, 2019).
- 5.3.7.8 Both Bradbury *et al.* (2014) and Waggitt *et al.* (2020) showed densities of Manx shearwater to be relatively low during the breeding season (April to August) with less than one bird per km² in the Mona Offshore Ornithology Array Area study area. The work by Waggitt *et al.* (2020), based on aerial and boat-based survey data collected between 1980 to 2018, also indicated that northern gannet were found in the highest densities to the west of the Mona Offshore Ornithology Array Area study area during the breeding season (March to September) whilst Bradbury *et al.* (2014) found the highest densities to be southeast of the Mona Offshore Ornithology Array Area study area during the breeding season.

Site-specific survey findings

- 5.3.7.9 Design-based abundance estimates of all species are presented in Volume 6, Annex 5.1: Offshore ornithology baseline characterisation technical report of the Environmental Statement (Document reference F6.5.1), alongside model-based abundance (using the Marine Renewables Strategic Environmental Assessment (MRSea) package) for the most abundant seabird species. MRSea modelling is unable to calculate estimated abundance for species with low counts.
- 5.3.7.10 Common guillemot was the most abundant seabird species recorded during the DAS, with most birds found on the sea. Common guillemot distribution was heterogeneous depending on year and month. Within the Mona Array Area study area plus 2 km, the highest MRSea modelled estimates were recorded in March 2020 and February 2021, with 5,739 and 4,415 individuals, respectively.
- 5.3.7.11 Black-legged kittiwake were most abundant in March at the start of the breeding season. Thereafter, the predicted abundance varied greatly for the rest of the breeding season (April to August) and the predicted distribution within the Mona Array Area appeared to be variable, with high inter-month variability recorded. Black-legged kittiwake were also present in moderate numbers throughout the non-breeding season. MRSea modelled estimates for monthly black-legged kittiwake numbers in the Mona Array Area plus 2 km peaked at 540 individuals in March 2021.

MONA OFFSHORE WIND PROJECT

- 5.3.7.12 Within the Mona Array Area plus 2 km, the highest MRSea estimate of Manx shearwater was recorded in June 2021, with an estimated 1,209 individuals. The presence of Manx shearwater in July suggested that these birds might be associated with the Welsh colonies and thus forage within the Mona Offshore Ornithology Array Area study area.
- 5.3.7.13 Razorbill was recorded in the highest MRsea estimates in February 2021 with 2,305 individuals in the Mona Array Area plus 2 km. At this time of the year, the species starts gathering at sea in the vicinity of breeding colonies. Outside the pre-breeding period (February to March), population estimates were very low.
- 5.3.7.14 The distribution of northern gannet during the breeding months was patchy, and the highest densities were found outside the Mona Array Area. In Year 1, the highest MRSea estimate in the Mona Array Area plus 2 km was recorded in July and August, with 209 and 144 individuals respectively. In contrast the highest MRSea estimate was recorded at the end of the breeding season in Year 2 with 293 individuals (in September 2022). The low abundances and high inter-annual variability during the breeding season suggests that the Mona Array Area is not favoured by foraging northern gannet.

5.3.8 Designated sites

International sites (European sites and Ramsar sites)

- 5.3.8.1 Internationally designated sites identified for the offshore ornithology assessment are described in Table 5.10. Sites are ordered according to distance from the Mona Array Area within two broad categories of site; marine SPAs and breeding seabird colony SPAs.

Table 5.10: Designated sites and relevant qualifying interests for the offshore ornithology assessment.

Designated site	Closest distance to the Mona Array Area (km)	Closest distance to the Mona Offshore Cable Corridor and Access Areas (km)	Relevant qualifying interest (i.e. the site is within connectivity distance (mean max foraging range + 1 SD) to the Mona Array Area or Cable Corridor and Access Areas)
Marine SPAs (designated for aggregations of seabirds within the marine environment)			
Liverpool Bay SPA	10.0	0.0	Red-throated diver
			Little gull
			Common scoter
			Little tern <i>Sternula albifrons</i>
			Common tern
			Waterbird assemblage
Mersey Narrows and North Wirral Foreshore SPA/Ramsar	44.9	26.2	Little gull
Irish Seafront SPA	57.2	61.4	Manx shearwater
Breeding seabird colony SPAs (designated for breeding seabirds)			
Dee Estuary SPA/Ramsar	39.2	13.1	Common tern
			Sandwich tern

MONA OFFSHORE WIND PROJECT

Designated site	Closest distance to the Mona Array Area (km)	Closest distance to the Mona Offshore Cable Corridor and Access Areas (km)	Relevant qualifying interest (i.e. the site is within connectivity distance (mean max foraging range + 1 SD) to the Mona Array Area or Cable Corridor and Access Areas)
			Cormorant
Ribble and Alt Estuaries SPA/Ramsar	37.2	39.3	Lesser black-backed gull
Morecambe Bay and Duddon Estuary SPA/Ramsar	47.0	58.7	Lesser black-backed gull
			European herring gull
			Sandwich tern
Bowland Fells SPA	76.2	80.1	Lesser-black backed gull
Aberdaron Coast and Bardsey Island SPA	98.9	83.0	Manx shearwater
Lambay Island SPA	128.9	132.5	Lesser black-backed gull
			European herring gull
			Black-legged kittiwake
			Razorbill
			Northern fulmar
			Atlantic puffin
Howth Head Coast SPA	134.4	137.7	Black-legged kittiwake
Ireland's Eye SPA	134.7	138.0	Black-legged kittiwake
Copeland Islands SPA	136.1	152.1	Manx shearwater
Wicklow Head SPA	148.8	146.2	Black-legged kittiwake
Ailsa Craig SPA	166.9	193.0	Northern gannet
			Black-legged kittiwake
			Lesser black-backed gull
Rathlin Island SPA	207.7	230.3	Black-legged kittiwake
			Seabird assemblage (breeding) including the components: Atlantic puffin Lesser black-backed gull
Skomer, Skokholm and the Seas off Pembrokeshire SPA	220.6	201.1	European storm-petrel <i>Hydrobates pelagicus</i>
			Manx shearwater
			Lesser black-backed gull
			Atlantic puffin
			Seabird assemblage (breeding) including the components: Black-legged kittiwake Common guillemot Razorbill
Grassholm SPA	229.4	211.4	Northern gannet
			Northern fulmar
Saltee Islands SPA	236.8	228.2	Northern gannet

MONA OFFSHORE WIND PROJECT

Designated site	Closest distance to the Mona Array Area (km)	Closest distance to the Mona Offshore Cable Corridor and Access Areas (km)	Relevant qualifying interest (i.e. the site is within connectivity distance (mean max foraging range + 1 SD) to the Mona Array Area or Cable Corridor and Access Areas)
			Lesser black-backed gull
			Black-legged kittiwake
			Northern fulmar
			Atlantic puffin
North Colonsay and Western Cliffs SPA	281.7	307.0	Black-legged kittiwake
Helvick Head to Ballyquin SPA	292.4	286.6	Black-legged kittiwake
Rum SPA	365.5	391.8	Black-legged kittiwake
Old Head of Kinsale SPA	377.7	371.9	Black-legged kittiwake
Canna and Sanday SPA	384.5	410.7	Black-legged kittiwake
Cruagh Island SPA	407.31	410.7	Manx shearwater
Isles of Scilly SPA/Ramsar	433.3	411.1	Great-black backed gull
			Lesser black-backed gull
Blasket Islands SPA	465.5	465.9	Manx shearwater
Deenish Island and Scariff Island SPA	466.5	464.6	Northern fulmar
			Manx shearwater
Shiant Isles SPA	467.5	494.3	Seabird assemblage including the components: Northern fulmar
Puffin Island SPA	472.6	471.5	Northern fulmar
Skelligs SPA	481.9	480.5	Northern gannet
Handa SPA	505.1	532.5	Seabird assemblage including the components: Northern fulmar
St Kilda SPA	514.2	538.9	Northern gannet
			Northern fulmar
Cape Wrath SPA	527.1	554.6	Northern fulmar
Flannan Isles SPA	535.5	561.6	Northern fulmar

National sites (SSSI and MNRs)

5.3.8.2 Nationally designated sites (seabird colonies within SSSI and MNR sites) identified for the offshore ornithology assessment are described in Table 5.11. Sites are ordered according to distance from the Mona Array Area within each category of site.

MONA OFFSHORE WIND PROJECT

Table 5.11: Nationally designated sites and relevant qualifying interests for the offshore ornithology assessment.

Designated Site	Closest Distance to the Mona Array Area (km)	Closest Distance to the Mona Offshore Cable Corridor and Access Areas (km)	Relevant Qualifying Interest
SSSI (seabird colonies)			
Creigiau Rhiwledyn/Little Orme's Head SSSI	31.3	2.3	Common guillemot
			Razorbill
			Black-legged kittiwake
			Great cormorant
Pen y Gogarth/Great Orme's Head SSSI	29.8	3.3	Common guillemot
			Razorbill
			Black-legged kittiwake
			Great cormorant
Arfordir Gogleddol Penmon SSSI	34.7	13.8	Northern fulmar
Penrhynoedd Llangadwaladr SSSI	57.3	43.5	Lesser black-backed gull
			Herring gull
Ribble Estuary SSSI	58.7	48.3	Black-headed gull
			Common tern
St. Bees Head SSSI	77.8	97.3	Common guillemot
			Northern fulmar
			Black-legged kittiwake
			Razorbill
Abbey Burn Foot to Balcary Point SSSI	108.0	127.9	Herring gull
			Northern fulmar
			Black-legged kittiwake
Sanda Islands SSSI	191.2	209.5	Razorbill
			Northern fulmar
St. Margaret's Island SSSI	226.0	197.6	Black-legged kittiwake
			Atlantic puffin
			Lesser black-backed gull
Grassholm / Ynys Gwales SSSI	232.6	213.6	Northern gannet
MNRs			
Langness MNR	40.9	56.6	Northern fulmar
			Herring gull

MONA OFFSHORE WIND PROJECT

Designated Site	Closest Distance to the Mona Array Area (km)	Closest Distance to the Mona Offshore Cable Corridor and Access Areas (km)	Relevant Qualifying Interest
			Lesser black-backed gull
Little Ness MNR	44.6	62.2	Northern fulmar Lesser black-backed gull
Laxey Bay MNR	48.8	67.8	Herring gull Lesser black-backed gull Northern fulmar
Baie ny Carrickey MNR	49.9	64.7	Razorbill Common guillemot Northern fulmar Black-legged kittiwake Atlantic puffin
Calf of Man and Wart Bank MNR	53.2	66.6	Lesser black-backed gull Herring gull Manx shearwater Atlantic puffin Black-legged kittiwake
Port Erin Bay MNR	56.5	70.8	Northern fulmar Northern gannet Herring gull
Ramsey Bay MNR	57.0	76.7	Northern fulmar Northern gannet Atlantic puffin Black-legged kittiwake Herring gull
Niarbyl Bay MNR	57.5	72.2	Northern fulmar Lesser black-backed gull
West Coast MNR	60.7	76.4	Black-legged kittiwake Northern fulmar Common guillemot Atlantic puffin Razorbill Manx shearwater Lesser black-backed gull

MONA OFFSHORE WIND PROJECT

Designated Site	Closest Distance to the Mona Array Area (km)	Closest Distance to the Mona Offshore Cable Corridor and Access Areas (km)	Relevant Qualifying Interest
			Herring gull

5.3.9 Important Ecological Features (IEFs)

- 5.3.9.1 The IEFs included within the assessment are those species recorded during the site-specific surveys and identified in the desktop study that could be potentially affected by the Mona Offshore Wind Project during the construction, operations and maintenance or decommissioning phases. In addition, statutory consultees requested additional species also be included within the assessment (highlighted within Table 5.12).
- 5.3.9.2 The offshore ornithology IEFs have been selected (Table 5.12) based on the conservation status of the ornithological receptor, their sensitivity to impact (for each impact which has been scoped in for the assessment) and known abundance from site specific surveys and desktop studies (Volume 6, Annex 5.1: Offshore ornithology baseline characterisation of the Environmental Statement (Document reference F6.5.1)).
- 5.3.9.3 For each IEF identified, it has been stated in Table 5.12 whether the identified species are listed on Annex I of the European Commission ('EC') Directive 2009/147/EC (codified version of 79/409/EC) on the Conservation of Wild Birds (the 'Birds Directive'). Within the UK, the Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019 (known as the 'Habitats Regulations') provide amendments to the 2017 Habitats Regulations. The 2017 Habitats Regulations transpose aspects of the Birds Directive into national law, covering all environments out to 12 nm.
- 5.3.9.4 The level of conservation concern is presented from the Birds of Conservation Concern 5 (BoCC) (Stanbury *et al.*, 2021), which uses quantitative assessments against standardised criteria to allocate species to red, amber, or green lists depending on their level of conservation concern.
- 5.3.9.5 Furthermore, species of principal importance for the conservation of biodiversity in England (priority species) were included in the assessment as listed under Section 41 of the Natural Environment and Rural Communities Act 2006. A number of species of conservation importance, i.e., BoCC (Stanbury *et al.*, 2021) and Section 41 (Natural England, 2022d), are also interest features of UK SSSI sites and MNR on the Isle of Man.
- 5.3.9.6 Following the evaluation, the IEFs identified in Table 5.12 were taken forward for consideration in the impact assessment. Species that were recorded in very low numbers or very infrequently during the site-specific surveys and the desktop study are excluded because a population-level effect would be undetectable and thus negligible.

MONA OFFSHORE WIND PROJECT

Table 5.12: Evaluation of IEFs showing species assessed for significance of effect from the Mona Offshore Wind Project.

Important ecological features	Conservation status	Observed within the Mona Array Area plus 2 km buffer (or 4 km buffer if appropriate for the species)	Vulnerable to disturbance and displacement	Vulnerable to collision risk	Assessed for significance of effects for the Mona Offshore Wind Project
Arctic skua	Red list	Yes – peak abundance of 11 birds during one survey.	Very low	High	Yes for collision, the species risk of collision was considered during the migration periods using the WWT Consulting and MacArthur Green (2014) approach for migratory species. However, as Arctic skua are assumed to migrate within a band of no more than 20 km from shore, there was no risk of collision during the migration period using the WWT Consulting and MacArthur Green (2014) approach.
Arctic tern	Annex 1, Amber list	No	Low	Moderate	No, no birds were present within array area
Atlantic puffin	Red list	Yes – peak abundance of 44 birds during one survey.	Moderate	Very low	Yes, for disturbance and displacement
Black-headed gull	Amber list	Yes – peak abundance of 7 birds during one survey.	Low	Moderate	Yes, for migratory collision risk
Black-legged kittiwake	Red list	Yes – peak abundance of 907 birds during one survey.	Low	High	Yes, for disturbance and displacement, and collision risk
Common guillemot	Red list	Yes – peak abundance of 5,739 birds during one survey.	Moderate	Very low	Yes, for disturbance and displacement
Common gull	Amber list	Yes – peak abundance of 20 birds during one survey.	Low	High	Yes for collision during migration periods, the species risk of collision was considered using the WWT Consulting and MacArthur Green (2014) approach for migratory species. However, as common gull are assumed to migrate within a band of no more than 20 km from shore, there was no risk of collision during the migration period using the WWT Consulting and MacArthur Green (2014) approach.

MONA OFFSHORE WIND PROJECT

Important ecological features	Conservation status	Observed within the Mona Array Area plus 2 km buffer (or 4 km buffer if appropriate for the species)	Vulnerable to disturbance and displacement	Vulnerable to collision risk	Assessed for significance of effects for the Mona Offshore Wind Project
Common scoter	Red list, Section 41 species	No	High	Very low	Yes, for disturbance and displacement due to higher abundances within the Cable Corridor and Access Areas.
Common tern	Annex 1, Amber list	Yes – peak abundance of 7 birds during one survey.	Low	Moderate	No, for collision during breeding season, the species was not considered as the Mona Array Area is beyond the mean maximum plus one standard deviation for foraging common tern at breeding colonies. Yes, for collision during migration periods, the species risk of collision was considered using the WWT Consulting and MacArthur Green (2014) approach for migratory species. However, as common tern are assumed to migrate within a band of no more than 20 km from shore, there was no risk of collision during the migration period using the WWT Consulting and MacArthur Green (2014) approach.
European shag	Red list	No	Moderate	Moderate	No, no birds were present within the Mona Array Area
Great black-backed gull	Amber list	Yes – peak abundance of 174 birds during one survey.	Low	Very high	Yes, for collision risk
Great cormorant	Green list	Yes – peak abundance of 6 birds during one survey.	High	Low	No, the species is of low conservation status and low numbers of birds were present and therefore, the risk of collision and displacement was not considered.
Great skua	Amber list	Yes – peak abundance of 7 birds during one survey.	Very Low	Moderate	Yes, for migratory collision risk
Herring gull	Red list, Section 41 species	Yes – peak abundance of 68 birds during one survey.	Low	Very high	Yes, for collision risk
Lesser black-backed gull	Amber list	Yes – peak abundance of 27 birds during one survey.	Low	Very high	Yes, for collision risk

MONA OFFSHORE WIND PROJECT

Important ecological features	Conservation status	Observed within the Mona Array Area plus 2 km buffer (or 4 km buffer if appropriate for the species)	Vulnerable to disturbance and displacement	Vulnerable to collision risk	Assessed for significance of effects for the Mona Offshore Wind Project
Little gull	Annex 1, Green list	Yes – peak abundance of 14 birds during one survey.	Low	Low	No, species is of low risk to displacement and/or collision risk. In addition, low numbers of birds were present compared to regional populations and therefore, the species was not assessed.
Manx shearwater	Amber list	Yes – peak abundance of 2,173 birds during one survey.	Very Low	Very low	Yes, for disturbance and displacement and collision risk. Requested by the EWG even though the species is very low vulnerability.
Northern fulmar	Amber list	Yes – peak abundance of 149 birds during one survey.	Very Low	Very low	Yes, for collision risk. Requested by the EWG even though the species is very low vulnerability.
Northern gannet	Amber list	Yes – peak abundance of 293 birds during one survey.	Low	High	Yes, for disturbance and displacement, and collision risk.
Razorbill	Amber list	Yes – peak abundance of 2,305 birds during one survey.	Moderate	Very low	Yes, for disturbance and displacement.
Red-throated diver	Annex 1, Green list	No	High	Moderate	Yes, for disturbance and displacement. Requested by the EWG even though the species was not recorded during the Array Area surveys.
Sandwich tern	Annex 1, Amber list	Yes – peak abundance of 15 birds during one survey.	Moderate	Moderate	No, for disturbance and displacement during breeding season, the species was not considered as the Mona Array Area is beyond the mean maximum plus one standard deviation for foraging common tern at breeding colonies. Yes for collision, the species risk of collision was considered during the migration periods using the WWT Consulting and MacArthur Green (2014) approach for migratory species. However, sandwich tern are assumed to migrate within a band of no more than 20 km from shore, there was no risk of collision during the migration period using the WWT Consulting and MacArthur Green (2014) approach.

MONA OFFSHORE WIND PROJECT

Seasonality

- 5.3.9.7 The behaviour and abundance of bird populations vary throughout the calendar year, contingent on the biological seasons relevant to different seabird species. The IEFs included in the assessment showed seasonality in their distribution and abundance during the site-specific surveys, which reflected the timing of the breeding and non-breeding seasons and migratory periods (i.e. pre- and post-breeding). These distinct biological seasons (bio-seasons) are acknowledged in order to assess the significance of each bird species within the Mona Offshore Wind Project during each specific time period. The BDMPS seasons used within the assessment are based on those in Furness (2015).
- 5.3.9.8 The seasonal definitions in Furness (2015) include overlapping months in some instances due to variation in the timing of migration for birds which breed at different latitudes (i.e. individuals from breeding sites in the north of the species' range may still be on spring migration when individuals farther south have already commenced breeding).
- 5.3.9.9 Bio-seasons used within the assessment were defined according to the breeding, non-breeding and migratory periods (autumn and spring migration) from Furness (2015) are shown in Table 5.13. Common Scoter was not included within Furness (2015) and so was based on Cramp and Simmons (1983). The Migration-free breeding season was not used in the assessment as advised by JNCC in the second EWG (held on 13/07/2022).

Table 5.13: Seasonal definitions as the basis for assessment, from Furness (2015).

Species	Pre-breeding season/spring migration	Migration-free breeding season	Full breeding Season	Post breeding Season/autumn migration	Migration-free non-breeding/winter season
Red-throated diver	February to April	May to August	March to August	September to November	December to January
Common Scoter	N/A	N/A	May to August	N/A	September to April
Common guillemot	December to February	March to June	March to July	July to October	November
Razorbill	January to March	April to June	April to July	August to October	November to December
Atlantic puffin	March to April	May to June	April to early August	Late July to August	September to February
Northern fulmar	December to March	April to August	January to August	September to October	November
Northern gannet	December to March	April to August	March to September	September to November	N/A
Manx shearwater	Late March to May	June to July	April to August	August to early October	November to February
Black-legged kittiwake	January to April	May to July	March to August	August to December	N/A
European herring gull	January to April	May to July	March to August	August to November	December

MONA OFFSHORE WIND PROJECT

Species	Pre-breeding season/spring migration	Migration-free breeding season	Full breeding Season	Post breeding Season/autumn migration	Migration-free non-breeding/winter season
Lesser black-backed gull	March to April	May to July	April to August	August to October	November to February
Great black-backed gull	January to April	May to July	Late March to August	August to November	December

Reference populations

- 5.3.9.10 Regional population estimates for the non-breeding, wintering and autumn and spring migration periods have been defined and calculated using the BDMPS relevant for each species (Furness, 2015). Population estimates for the breeding population were based on SPA and non-SPA sites (including SSSIs and MNR sites) located within the species' mean-maximum plus one standard deviation foraging range (using Woodward *et al.*, 2019) of the Mona Offshore Wind Project. Regional breeding colony counts were extracted from the SMP online database (JNCC, 2023), with the most recent colony count for each colony utilised (up to the year 2023)
- 5.3.9.11 In addition to breeding adult birds associated with the breeding colonies, there will be immature and juvenile seabirds present within the region. Population counts therefore must be adjusted to account for these seabirds.
- 5.3.9.12 As outlined in Volume 6, Annex 5.1 Offshore ornithology baseline characterisation technical report of the Environmental Statement (Document reference F6.5.1), calculation of the total regional breeding population was explored collaboratively with the Offshore Ornithology EWG due to their being little evidence to support the calculation of the number of juveniles, immatures and non-breeding birds that remain in their wintering areas into the breeding season. During the seventh EWG meeting (held 08 December 2023), it was agreed that for the project alone assessment, foraging range populations could be used, however if the foraging range population is greater than the regional seas populations (BDMPS from Furness, 2015) then impacts would also be assessed against this population. This specifically occurs for northern gannet and Manx shearwater. For precaution, the lowest breeding season population is presented in assessment.
- 5.3.9.13 In the non-breeding season, seabirds are not constrained by colony location and can, depending on individual species, range widely within UK seas and beyond. The ZOI for seabird species where an assessment in the non-breeding season and migratory periods is deemed to be required is based on either the 'UK Western Waters', 'UK Western Waters and Channel' or 'UK south-west and Channel waters' depending on the species (Furness, 2015). The total regional breeding population (adult plus juveniles and immatures) are presented in Table 5.14 alongside the non-breeding and migration periods BDMPS. Non-breeding populations for common scoter and red-throated diver were derived from HiDef Aerial Surveying Limited (2023).
- 5.3.9.14 As shown in Table 5.14, only certain seasons have been taken forward to the assessment. Furness (2015) provides under each species account the appropriate seasons to be used within assessments and hence why not all seasons in Table 5.13 have been utilised. These seasons were agreed with the EWG during the second meeting.

MONA OFFSHORE WIND PROJECT

Table 5.14: Bio-seasons, monthly breakdown and population sizes used within the assessment.

Bio-season population sizes of species taken from Furness, 2015.

¹HiDef. (2023) – Latest population for the Liverpool Bay/Lerpwl Bae Area of Search.

Species	Pre-Breeding Season/Spring Migration	Foraging Range Breeding Season	Regional Seas Breeding Season	Post Breeding Season/Autumn Migration	Non-breeding/Winter Season
Red-throated diver	February to April (4,373)	N/A	N/A	September to November (4,373)	December to January (2,073) ¹
Common scoter	N/A	N/A	N/A	N/A	September to April (95,931) ¹
Common guillemot	N/A	March to July (136,680)	March to July (1,145,528)	N/A	August to February (1,139,220)
Razorbill	January to March (606,914)	April to July (18,345)	April to July (198,969)	August to October (606,914)	November to December (341,422)
Atlantic puffin	N/A	April to August (203,302)	April to August (1,482,791)	N/A	September to March (304,557)
Northern fulmar	December (828,194)	January to August (54,403)	January to August (629,594)	September to October (828,194)	November (556,367)
Northern gannet	December to February (661,888)	March to September (682,989)	March to September (522,888)	October to November (545,954)	N/A
Manx shearwater	March (1,580,895)	April to August (2,372,485)	April to August (1,821,544)	September to October (1,580,895)	N/A
Black-legged kittiwake	January to February (691,526)	March to August (156,679)	March to August (245,234)	September to December (911,586)	N/A
European herring gull	N/A	March to August (31,214)	March to August (217,167)	N/A	September to February (173,299)
Lesser black-backed gull	March (163,304)	April to August (109,785)	April to August (240,750)	September to October (163,304)	November to February (41,159)
Great black-backed gull	N/A	March to August (1,496)	March to August (44,753)	N/A	September to February (17,742)

Baseline mortality rates

5.3.9.15 The impact of additional mortality due to offshore wind farm effects is assessed in terms of the change in the baseline mortality rate which could result. It has been assumed that all age classes are equally at risk of effects, with each age class affected in proportion to its presence in the population. Therefore, a weighted average baseline

MONA OFFSHORE WIND PROJECT

mortality rate has been calculated which is appropriate for all age classes for use in assessments, calculated for those species screened in for assessment.

- 5.3.9.16 Age specific survival rates for each species from Horswill and Robinson (2015) were entered into a matrix population model. Updated productivity values were provided by JNCC/British Trust for Ornithology (BTO) (SMP, 2023), with the UK average over the course of 2010 to 2019 calculated and used. Not all species and colonies had updated counts after 2014, and so the national average from Horswill and Robinson (2015) was used if no updated rates from JNCC/BTO were made available. Productivity values were used to calculate the expected proportions in each age class. Each age class survival rate was multiplied by its proportion and the total for all ages summed to give the average survival rate for all ages. The average mortality rate was subsequently calculated by subtracting the survival rate from 1. The demographic rates, age class proportions and average mortality rates calculated are presented in Table 5.15.

MONA OFFSHORE WIND PROJECT

Table 5.15: Demographic rates from JNCC/BTO (SMP, 2023) and Horswill and Robinson (2015) and population age ratios calculated from population models used to estimate average mortality for use in impact assessment.

Species	Parameter	Age Class						Adult	Productivity	Average mortality
		0 to 1	1 to 2	2 to 3	3 to 4	4 to 5	5 to 6			
Red-throated diver	Survival	0.600	0.620	N/A	N/A	N/A	N/A	0.840	0.571	0.233
	Proportion in population	0.196	0.118	N/A	N/A	N/A	N/A	0.686	N/A	N/A
Common scoter	Survival	0.749	0.749	N/A	N/A	N/A	N/A	0.783	1.838	0.238
	Proportion in population	0.352	0.264	N/A	N/A	N/A	N/A	0.384	N/A	N/A
Common guillemot	Survival	0.560	0.792	0.917	0.939	0.939	N/A	0.939	0.583	0.133
	Proportion in population	0.153	0.084	0.065	0.058	0.053	N/A	0.587	N/A	N/A
Razorbill	Survival	0.630	0.630	0.895	0.895	N/A	N/A	0.895	0.532	0.172
	Proportion in population	0.155	0.099	0.064	0.059	N/A	N/A	0.623	N/A	N/A
Atlantic puffin	Survival	0.709	0.709	0.709	0.760	0.805	N/A	0.906	0.555	0.176
	Proportion in population	0.155	0.113	0.082	0.060	0.046	N/A	0.544	N/A	N/A
Northern fulmar	Survival	0.260	N/A	N/A	N/A	N/A	N/A	0.936	0.410	0.221
	Proportion in population	0.233	N/A	N/A	N/A	N/A	N/A	0.767	N/A	N/A
Manx shearwater	Survival	0.870	0.870	0.870	0.870	0.870	N/A	0.870	0.600	0.130
	Proportion in population	0.140	0.120	0.103	0.089	0.077	N/A	0.471	N/A	N/A
Northern gannet	Survival	0.424	0.829	0.891	0.895	0.895	N/A	0.919	0.766	0.193
	Proportion in population	0.201	0.084	0.069	0.061	0.054	N/A	0.531	N/A	N/A
Black-legged kittiwake	Survival	0.790	0.854	0.854	0.854	N/A	N/A	0.854	0.619	0.156
	Proportion in population	0.160	0.126	0.107	0.090	N/A	N/A	0.517	N/A	N/A

MONA OFFSHORE WIND PROJECT

Species	Parameter	Age Class						Adult	Productivity	Average mortality
		0 to 1	1 to 2	2 to 3	3 to 4	4 to 5	5 to 6			
European herring gull	Survival	0.798	0.834	0.834	0.834	0.834	N/A	0.834	0.498	0.171
	Proportion in population	0.132	0.110	0.096	0.084	0.073	N/A	0.505	N/A	N/A
Lesser black-backed gull	Survival	0.820	0.885	0.885	0.885	0.885	N/A	0.885	0.438	0.121
	Proportion in population	0.120	0.099	0.088	0.079	0.069	N/A	0.547	N/A	N/A
Great black-backed gull	Survival	0.798	0.930	0.930	0.930	0.930	N/A	0.930	1.061	0.095
	Proportion in population	0.188	0.134	0.112	0.094	0.078	N/A	0.394	N/A	N/A

MONA OFFSHORE WIND PROJECT

5.3.10 Future baseline scenario

- 5.3.10.1 The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 requires that *"an outline of the likely evolution thereof without implementation of the development as far as natural changes from the baseline scenario can be assessed with reasonable effort on the basis of the availability of environmental information and scientific knowledge"* is included within the Environmental Statement. In the event that the Mona Offshore Wind Project does not come forward, an assessment of the future baseline conditions has been carried out and is described within this section.
- 5.3.10.2 The UK holds internationally important populations of seabirds (Mitchell *et al.*, 2004). UK seabird populations have shown a marked decline over the last two decades (JNCC, 2020; Mitchell *et al.*, 2020) with over a third of species experiencing declines in breeding abundance of up to 30% or more since the early 1990s (Mitchell *et al.*, 2020).
- 5.3.10.3 A recent study suggests that, in terms of number of species affected and the average impact, the key three threats to seabird populations globally are invasive species (165 species across all the most threatened groups), bycatch in fisheries (100 species but with the greatest average impact) and climate change (96 species affected) (Dias *et al.*, 2019; Mitchell *et al.*, 2020).
- 5.3.10.4 Most seabird species in the UK are at the southern limit of their range in the northeast Atlantic and therefore an increase in global temperatures could result in a shift in species' range with the potential for overall declines in population size (Frederiksen *et al.*, 2007, 2013 and Mitchell *et al.*, 2020). In the UK and Ireland, climate change is considered to be the likely primary cause of decline in seabird populations in the future, with anticipated depletion of breeding conditions for most species either indirectly, through changes in prey abundance, or directly during extreme weather events (Mitchell *et al.*, 2020). On current predictions it is anticipated that sea surface temperatures will continue to rise (see Volume 4, Chapter 2: Climate Change of the Environmental Statement (Document reference F4.2)).
- 5.3.10.5 Fisheries management will also likely impact on future seabird populations in the UK and Ireland. For many years, seabird species have benefitted from bycatch and fisheries discards; for scavenging species such as European herring gull, black-legged kittiwake, great skua and fulmar, population levels may already be above those that naturally occurring food sources would sustain (Votier *et al.*, 2004 and Frederiksen *et al.*, 2013), however the introduction between 2015 and 2019 of the Common Fisheries Policy Landings Obligation ('discard ban') will likely reduce the discard available and ultimately put more pressure on scavenging species.

5.3.11 Data limitations

- 5.3.11.1 Baseline characterisation of the Mona Offshore Ornithology Array Area study area and resulting assessments of significance use site-specific data (DAS) conducted over a period of 24 months (March 2020 to February 2022). As sampling is undertaken once a month for a period of 24 months, it may be considered to represent a snapshot of each month. Indeed, seabird numbers may fluctuate both spatially and temporally in response to environmental conditions. However, the sampling regime adopted at the Mona Offshore Wind Project is identical to other baseline characterisation surveys at offshore wind farms projects which have been previously agreed by SNCBs as suitable for baseline characterisation.
- 5.3.11.2 The level of precision of the abundance estimates is crucial as reliable abundance underpins the robustness of the predictions and the assessment of the effects on the

MONA OFFSHORE WIND PROJECT

IEFs. To characterise the baseline conditions, model-based estimates using the MRSea) package were produced in order to predict numbers across the survey area alongside 95% confidence intervals to provide a level of uncertainty. Design based estimates for bird numbers and densities in each month were also generated and compared to the MRSea estimates to provide additional validation of the MRSea outputs and provide estimates for months where low raw abundances prevented the use of the MRSea model. Flight heights for the Stochastic Collision Risk Model (sCRM) were derived from the published literature rather than site-specific data. Generic flight height distributions published by Johnston *et al.* (2014a, 2014b) were therefore used in sCRM for this assessment. The application of site-specific flight height data collected by LiDAR survey was considered during the survey programme but was not undertaken following consultation with the EWG in 2021. At the time of consultation, the EWG did not endorse the use of LiDAR as a method for collecting flight height data to parameterise CRMs due to the lack of an established body of scientific evidence. Other methods to collect site-specific flight height data (e.g. derived from aerial imagery) were not currently considered to be sufficiently robust or precise in their estimates and have associated issues with the application of appropriate avoidance rates. The use of generic flight heights conforms to current best practice and has been agreed through the Evidence Plan Process EWG as presented in section 0.

5.3.11.3 The impact of the short, medium and long-term effects of the 2022 HPAI outbreak on seabird colony abundance and vital rates (productivity and survival) on UK breeding colonies is unclear. It is also unclear yet how the distribution and abundance of seabirds at sea was affected during the 2022 summer outbreak. The disease has affected 61 bird species, including species such as northern gannet, razorbill, common guillemot, Atlantic puffin, Manx shearwater, northern fulmar and small and large gull species (Pearce-Higgins *et al.*, 2022). The impact has affected northern gannet and great skua colonies profoundly, with both species now facing increased risk of global extinction (Pearce-Higgins *et al.*, 2022) (the UK supports 55.6% of the global northern gannet population and 60% of the global great skua population; JNCC, 2021). However, as determined by recent Natural England guidance on HPAI in relation to baseline characterisation of offshore renewable projects (Natural England, 2022d), as the baseline data for the Mona Offshore Ornithology Array Area study area were all collected prior to summer 2022 (surveys commenced in March 2020 and were completed in February 2022), the assessments within this report remain a valid representation of typical seabird distribution and density.

5.4 Impact assessment methodology

5.4.1 Overview

5.4.1.1 The offshore ornithology impact assessment has followed the methodology set out in Volume 1, Chapter 5: EIA methodology of the Environmental Statement (Document reference F1.5). Specific to the offshore ornithology impact assessment, the following guidance documents have been considered:

- Offshore Wind Marine Environmental Assessments: Best Practice Advice for Evidence and Data Standards. Phase I: Expectations for pre-application baseline data for designated nature conservation and landscape receptors to support offshore wind applications (Natural England, 2022a)
- Offshore Wind Marine Environmental Assessments: Best Practice Advice for Evidence and Data Standards. Phase II: Expectations for pre-application

MONA OFFSHORE WIND PROJECT

engagement and best practice guidance for the evidence plan process (Natural England, 2022b)

- Offshore Wind Marine Environmental Assessments: Best Practice Advice for Evidence and Data Standards. Phase III: Expectations for data analysis and presentation at examination for offshore wind applications (Natural England, 2022c)
- Chartered Institute of Ecology and Environmental Management (CIEEM) (2018) Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine
- EIA for Offshore Renewable Energy projects (British Standards Institute (BSI) (2015); and
- UK Planning Inspectorate Advice Note Twelve: Transboundary Impacts (PINS, 2015); and Advice Note Seventeen: Cumulative Effects Assessment (PINS, 2019).

5.4.1.2 In addition, the offshore ornithology impact assessment has considered the legislative framework as defined by:

- The Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019 and the 2017 Habitats Regulations
- European Commission ('EC') Directive 2009/147/EC (codified version of 79/409/EC) on the Conservation of Wild Birds (the 'Birds Directive')
- Ramsar Convention on Wetlands of International Importance 1971
- Wildlife and Countryside Act 1981 (as amended).

5.4.2 Impact assessment criteria

5.4.2.1 Determination of significance of effects is a two-stage process that involves defining the magnitude of the impacts and the sensitivity of the receptors. This section describes the criteria applied in this chapter to assign values to the magnitude of potential impacts and the sensitivity of the receptors. The terms used to define magnitude and sensitivity are based on those which are described in further detail in Volume 1, Chapter 5: EIA methodology of the Environmental Statement (Document reference F1.5).

5.4.2.2 The criteria for defining magnitude in this chapter are outlined in Table 5.16 below. This set of definitions has been determined on the basis of changes to bird populations.

Table 5.16: Definition of terms relating to the magnitude of an impact.

Magnitude of impact	Definition
High	A change in the size or extent of distribution of the relevant biogeographic population or the population that is the interest feature of a specific protected site that is predicted to irreversibly alter the population in the short to long term and to alter the long-term viability of the population and/or the integrity of the protected site. Impacts felt long-term. Impacts predicted to be reversed in the long-term (i.e. more than five years) following cessation of the project activity.
Medium	A change in the size or extent of distribution of the relevant biogeographic population or the population that is the interest feature of a specific protected site that occurs in the short and long-term, but which is not predicted to alter the long-term viability of the population and/or the integrity of the protected site. Impacts felt medium to long-term. Impacts predicted to be reversed in the medium-term (i.e. no more than five years) following cessation of the project activity.

MONA OFFSHORE WIND PROJECT

Magnitude of impact	Definition
Low	A change in the size or extent of distribution of the relevant biogeographic population or the population that is the interest feature of a specific protected site that is sufficiently small-scale or of short duration to cause no long-term harm to the feature/population. Impacts present for a short to medium duration. Impacts predicted to be reversed in the short-term (i.e. no more than one year) following cessation of the project activity.
Negligible	Very slight or no change from the size or extent of distribution of the relevant biogeographic population or the population that is the interest feature of a specific protected site. Impacts present for a short duration. Impacts predicted to be reversed rapidly (i.e. no more than circa six months) following cessation of the project related activity.

5.4.2.3 The criteria for defining recoverability and sensitivity in this chapter are outlined in Table 5.17 below.

Table 5.17: Definition of recoverability of the receptor.

Recoverability	Definition
High	A species with a low to medium reproductive success and a stable or increasing UK trend in breeding abundance and productivity.
Medium	A species with a low reproductive success and a stable or increasing UK long-term trend in breeding abundance and productivity.
Low	A species with a low reproductive success and a declining UK long-term trend in breeding abundance and productivity or uncertainty regarding the long-term trend (due to data availability).

5.4.2.4 The conservation value of ornithological receptors is based on the population from which individuals are predicted to be drawn. This reflects current understanding of the movements of species, with site-based protection (e.g. SPAs) generally limited to specific periods of the year (e.g. the breeding season). Therefore, conservation value can vary through the year depending on the relative sizes of the number of individuals predicted to be at risk of impact and the population from which they are estimated to be drawn. Conservation value therefore corresponds to the degree of connectivity which is predicted between the offshore wind farm site and protected populations. Using this approach, the conservation importance of a species seen at different times of year may fall into any of the defined categories (Table 5.18).

Table 5.18: Definition of conservation importance of the receptor.

Conservation Importance	Definition
High	A species for which individuals at risk can be clearly connected to a particular SPA and is listed as a qualifying feature of a designated site
Medium	A species for which individuals at risk are probably drawn from particular SPA populations, although other colonies (both SPA and non-SPA) may also contribute to individuals observed on the Mona Offshore Wind Project. The species is listed as a feature of a national designated site (e.g. SSSI)
Low	A species for which it is not possible to identify the SPAs from which individuals on the Mona Offshore Wind Project have been drawn, or for which no SPAs are designated (includes SPAs, Ramsar sites and SSSIs).

MONA OFFSHORE WIND PROJECT

5.4.2.5 The definition of sensitivity considers the vulnerability and recoverability of a receptor as well as taking into account the conservation importance of each receptor (outlined in Table 5.18).

5.4.2.6 It should be noted that high vulnerability and/or low recoverability are not necessarily linked with high conservation value within a particular impact. A receptor could be categorised as being of high conservation value (e.g. an interest feature of a SPA) but have a low or negligible physical/ecological vulnerability to an effect and vice versa. Determination of sensitivity takes these differing aspects into consideration.

Table 5.19: Definition of sensitivity of the receptor.

Sensitivity	Definition
Very High	Bird species has high conservation value, very high vulnerability to impact and has no ability to recover
High	Bird species has high conservation value, medium vulnerability to impact and has low recoverability
	Bird species has medium conservation value, high vulnerability to impact and has low recoverability
Medium	Bird species has high conservation value, low vulnerability to impact and has medium recoverability
	Bird species has high conservation value, low vulnerability to impact and has low recoverability
	Bird species has medium conservation value, high vulnerability to impact and has medium recoverability
	Bird species has medium conservation value, medium vulnerability to impact and has medium recoverability
	Bird species has medium conservation value, low vulnerability to impact and has medium recoverability
Low	Bird species has medium conservation value, medium vulnerability to impact and high recoverability
	Bird species has low conservation value, medium to high vulnerability to impact and medium to high recoverability
Negligible	Bird species has low conservation value, low vulnerability to impact and medium to high recoverability
	Bird species is not vulnerable to impacts.

5.4.2.7 The significance of the effect upon offshore ornithology is determined by correlating the magnitude of the impact and the sensitivity of the receptor. The method employed for this assessment is presented in Table 5.20. Where a range of significance of effect is presented in section 5.7, the final assessment for each effect is based upon expert judgement and a precautionary approach.

5.4.2.8 For the purposes of this assessment, any effects with a significance level of 'moderate' or 'major' have been concluded to be significant in terms of The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017.

Table 5.20: Matrix used for the assessment of the significance of the effect.

Sensitivity of Receptor	Magnitude of Impact			
	Negligible	Low	Medium	High
Negligible	Negligible	Negligible or Minor	Negligible or Minor	Minor
Low	Negligible or Minor	Negligible or Minor	Minor	Minor or Moderate

MONA OFFSHORE WIND PROJECT

Sensitivity of Receptor	Magnitude of Impact			
	Negligible	Low	Medium	High
Medium	Negligible or Minor	Minor	Moderate	Moderate or Major
High	Minor	Minor or Moderate	Moderate or Major	Major
Very High	Minor	Moderate or Major	Major	Major

5.4.3 Designated sites

5.4.3.1 Where National Site Network sites (i.e. internationally designated sites) are considered, this chapter summarises the assessments made on the interest features of internationally designated sites as described within section 5.3.8 of this chapter (with the assessment on the site itself deferred to the ISAA (Document reference E.1.1 – E1.3)). With respect to nationally and locally designated sites, where these sites fall within the boundaries of an internationally designated site (e.g. SSSIs which have not been assessed within the ISAA (Document reference E.1.1 – E1.3)), only the international site has been taken forward for assessment. This is because potential effects on the integrity and conservation status of the nationally designated site are assumed to be inherent within the assessment of the internationally designated site (i.e. a separate assessment for the national site is not undertaken).

5.4.3.2 The ISAA (Document reference E.1.1 – E1.3) has been prepared in accordance with Advice Note Ten: Habitats Regulations Assessment Relevant to Nationally Significant Infrastructure Projects (Planning Inspectorate, 2022) and has been submitted alongside the Environmental Statement.

5.5 Key parameters for assessment

5.5.1 Maximum design scenario

5.5.1.1 The MDS identified in Table 5.21 have been selected as those having the potential to result in the greatest effect on an identified receptor or receptor group. These scenarios have been selected from the Project Design Envelope provided in Volume 1, Chapter 3: Project description of the Environmental Statement (Document reference F1.3). Effects of greater adverse significance are not predicted to arise should any other development scenario, based on details within the Project Design Envelope (e.g. different infrastructure layout), to that assessed here be taken forward in the final design scheme.

MONA OFFSHORE WIND PROJECT

Table 5.21: Maximum design scenario considered for the assessment of potential impacts on offshore ornithology.

^a C=construction, O=operations and maintenance, D=decommissioning

Potential impact	Phase ^a			Maximum Design Scenario	Justification
	C	O	D		
Disturbance and displacement from airborne noise, underwater sound, and presence of vessels and infrastructure	✓	✓	✓	<p>Construction phase</p> <p>Installation of wind turbines, offshore substation platforms (OSPs), inter-array and interconnector cables in the Mona Array Area of up to 300 km², and offshore export cables within the Mona Offshore Cable Corridor and Access Areas.</p> <ul style="list-style-type: none"> - Wind turbines: installation of up to 96 wind turbines - Up to 64 with four-legged jacket foundations. This will require one pile per leg with a maximum diameter of each pile of 3.8 m) installed by impact piling - Up to 32 with gravity base foundations, with up to 10 requiring piling, leading to up to 150 piles, with 15 piles per foundation (maximum diameter of 4 m per pile) - OSPs: installation of up to four OSPs - OSP foundations consisting of up to four-legged jacket foundations, with three piles per leg (48 piles, maximum diameter of 5 m per pile) installed by impact piling - Maximum hammer energy of up to 4,400 kJ - Up to two vessels piling wind turbines concurrently with a maximum hammer energy of 3,000 kJ each (minimum distance 1.4 km, maximum distance 15 km, between piling vessels) - Maximum of up to 4.5 hours of piling for a wind turbine foundation with a cumulative total of up to 1,152 hours, with a maximum of one foundation (four piles) per day. - Consecutive piling to take place over a maximum of 24 hours per foundation. - Up to four piles installed per 24 hours per vessel = up to 159 days (up to 64 four legged jacket foundations for wind turbines, up to 37.5 days for the 10 gravity base foundations that require piling, 12 days for OSP foundation piles) for a single vessel (maximum temporal) or 57 days for two vessels (maximum spatial) - Total piling phase (foundation installation) of up to two years within a four-year construction programme 	<p>Represents the maximum density of wind turbines and structures across the maximum Mona Array Area and the Mona Offshore Cable Corridor and Access Areas that would cause greatest extent of disturbance and displacement to birds or the greatest duration of impact.</p> <p>Represents the maximum underwater sound impacts from impact piling for each of the relevant infrastructure foundation options.</p> <p>Represents the maximum number of vessel and helicopter movements that would cause greatest visual and noise disturbance and displacement to birds from the Mona Array Area and the Mona Offshore Cable Corridor and Access Areas.</p>

MONA OFFSHORE WIND PROJECT

Potential impact	Phase ^a Maximum Design Scenario			Justification
	C	O	D	
			<ul style="list-style-type: none"> - Burial of up to 325 km of inter-array cables, 50 km of interconnector cables and 360 km of export cable via ploughing, trenching and jetting; cable burial and rock dumping • Mona Array Area <ul style="list-style-type: none"> - Up to 1,929 installation vessel movements (return trips) during construction (521 main installation and support vessels, 74 tug/anchor handlers, 56 cable lay installation and support vessels, 50 guard vessel, 31 survey vessels, 19 seabed preparation vessels, 1,135 CTVs, 41 scour protection installation vessels and 2 cable protection installation vessels) - Up to a total of 69 construction vessels on site at any one time - Up to 1,095 helicopter movements with up to 7 helicopters on site at any one time • Mona Offshore Cable Corridor and Access Areas <ul style="list-style-type: none"> - Up to a total of 17 construction vessels on site at any one time including; <ul style="list-style-type: none"> ○ 2 cable lay installation and support vessels ○ 2 trench supporting vessels for export cable route ○ 2 installation support vessels for export cable route ○ 1 guard vessel for export cable route ○ 2 survey vessels for pre or post survey works for export cable route ○ 1 Out of Service cable removal vessel for export cable route ○ 1 boulder clearance vessel for export cable route ○ 1 dredging vessel for export cable route ○ 2 crew transport / installation support vessels ○ 1 rock dumping vessel for export cable route ○ 1 construction support vessel for concrete mattress installation for export cable route - Up to 126 installation vessel movements (return trips) during construction (10 cable lay installation cycles, 10 TSV rotations and 20 ISV rotations (support vessels), 18 guard vessel, 4 survey vessels, 24 seabed preparation vessels, 20 CTVs, and 20 cable protection installation vessels) 	

MONA OFFSHORE WIND PROJECT

Potential impact	Phase ^a Maximum Design Scenario			Justification
	C	O	D	
			<p>Operations and maintenance phase</p> <p>Disturbance and displacement from presence of operational wind turbines and associated operations and maintenance activity, including increased vessel, helicopter and inspection drone activity:</p> <ul style="list-style-type: none"> - Presence of up to 96 operating turbines and up to four OSPs occupying the Mona Array Area of up to 300 km² - Minimum spacing of 1400 m between wind turbines - Up to a total of 21 operations and maintenance vessels on site at any one time <ul style="list-style-type: none"> o Up to 6 crew transfer vessels o Up to 3 Jack-up vessels o Up to 4 cable repair vessels o Up to 4 other vessels o Up to 4 excavator or backhoe dredger o Up to 8 helicopters o Up to 5 inspection drones (operated from vessel). Up to five inspections per wind turbine per year as a maximum. - Up to 849 operations and maintenance vessel movements (return trips) each year <ul style="list-style-type: none"> o Up to 730 crew transfer vessels return trips o Up to 25 Jack-up vessel trips return trips o Up to 8 cable repair vessel return trips o Up to 78 other vessel return trips o Up to 8 excavator or backhoe dredger return trips o Up to 730 helicopter return trips o Up to 214 inspection drone return trips (operated from vessel). - Routine inspections once per year <ul style="list-style-type: none"> o max 2 repairs every 5 years per export cable with max 4 km per repair = 6.4 km per year o estimated 1 reburial event every 5 years with approx 15 km cable length per reburial event - Operational lifetime of up to 35 years. 	

MONA OFFSHORE WIND PROJECT

Potential impact	Phase ^a			Maximum Design Scenario	Justification
	C	O	D		
				Decommissioning phase <ul style="list-style-type: none"> - Vessels used for a range of decommissioning activities such as removal of foundations - Noise from vessels assumed to be as per vessel activity described for the construction phase above. 	
Indirect impacts from underwater sound affecting prey species	✓	✗	✓	Construction phase <ul style="list-style-type: none"> • As described in Volume 2, Chapter 3: Fish and shellfish ecology of the Environmental Statement (Document reference F2.3) for: <ul style="list-style-type: none"> – Underwater sound during the construction phase impacting fish and shellfish receptors. Decommissioning phase <ul style="list-style-type: none"> • As described in Volume 2, Chapter 3: Fish and shellfish ecology of the Environmental Statement (Document reference F2.3) for: <ul style="list-style-type: none"> – Underwater sound during the construction phase impacting fish and shellfish receptors. 	As described in Volume 2, Chapter 3: Fish and shellfish ecology of the Environmental Statement (Document reference F2.3).
Temporary habitat loss/disturbance and increased SSCs	✓	✓	✓	Construction phase <ul style="list-style-type: none"> • As described in Volume 2, Chapter 3: Fish and shellfish ecology of the Environmental Statement (Document reference F2.3) for: <ul style="list-style-type: none"> – Increased SSCs and associated sediment deposition. Operations and maintenance phase <ul style="list-style-type: none"> • As described in Volume 2, Chapter 3: Fish and shellfish ecology of the Environmental Statement (Document reference F2.3) for: <ul style="list-style-type: none"> – Increased SSCs and associated sediment deposition. Decommissioning phase <ul style="list-style-type: none"> • As described in Volume 2, Chapter 3: Fish and shellfish ecology of the Environmental Statement (Document reference F2.3) for: <ul style="list-style-type: none"> – Increased SSCs and associated sediment deposition. 	As described in Volume 2, Chapter 3: Fish and shellfish ecology of the Environmental Statement (Document reference F2.3).

MONA OFFSHORE WIND PROJECT

Potential impact	Phase ^a			Maximum Design Scenario	Justification
	C	O	D		
Collision risk	x	✓	x	Operations and maintenance phase <ul style="list-style-type: none"> • Presence of up to 96 wind turbines within the Mona Array Area • Minimum lower blade tip height of 34 m above Lowest Astronomical Tide (LAT) • Maximum hub height of 168 m above LAT • Maximum blade tip height of 293 m above LAT • Maximum rotor diameter of 250 m • Average blade pitch (in degrees) of 10 • Maximum chord width of 6.8 m • Maximum rotor speed of 8.4 rpm (with maximum average speed of 6.2 rpm) • Proportion of time operational of 94% • Operational lifetime of up to 35 years. 	The potential for collision risk is derived from wind turbine parameters including rotor diameter, chord width, rotor speed and minimum lower blade tip height. The parameters associated with the most numerous wind turbines (96) represents the MDS because it will result in the greatest potential for collision risk. The parameters associated with the most numerous turbine option have been used, these values are based on the MDS parameter values for the worst-case collision risk.
Barrier to movement	x	✓	x	Operations and maintenance phase <ul style="list-style-type: none"> • Presence of up to up to 96 wind turbines, up to four OSPs within the Mona Array Area of 300 km² with a minimum spacing of 1,400 m between rows and within rows. 	Maximum density of wind turbines and structures across the Mona Array Area, which maximises the potential barrier to foraging grounds and migration routes for bird species.

MONA OFFSHORE WIND PROJECT

5.6 Measures adopted as part of the Mona Offshore Wind Project

5.6.1.1 For the purposes of the EIA process, the term 'measures adopted as part of the project' is used to include the following measures (adapted from The Institute of Environmental Management and Assessment (IEMA), 2016):

- Measures included as part of the project design. These include modifications to the location or design envelope of the Mona Offshore Wind Project which are integrated into the application for consent. These measures are secured through the consent itself through the description of the development and the parameters secured in the DCO and/or marine licences (referred to as primary mitigation in IEMA (2016))
- Measures required to meet legislative requirements, or actions that are standard practice used to manage commonly occurring environmental effects and are secured through the DCO requirements and/or the conditions of the marine licences (referred to as tertiary mitigation in IEMA (2016)).

5.6.1.2 A number of measures (primary and tertiary) have been adopted as part of the Mona Offshore Wind Project to reduce the potential for impacts on offshore ornithology. These are outlined in Table 5.22. As there is a secured commitment to implementing these measures for the Mona Offshore Wind Project, they have been considered in the assessment presented in section 5.7 (i.e. the determination of magnitude and therefore significance assumes implementation of these measures).

5.6.1.3 It should be noted that the Applicant has committed to increase the air draught to 34 m above LAT during the project design phase to reduce the impacts from collision. Air draught is a known factor in calculating collision risk and it is assumed that increasing the air draught will decrease the proportion of birds flying at risk height (Band, 2012), and ultimately reduce the number of predicted collisions.

Table 5.22: Measures adopted as part of the Mona Offshore Wind Project.

Measures adopted as part of the Mona Offshore Wind Project	Justification	How the measure will be secured
Primary measures: Measures included as part of the project design		
The Applicant has committed to a minimum lower blade tip height (air draught) of 34 m above LAT.	Air draught is known to be an important factor for collision risk, with typically fewer collisions predicted with increasing air draught.	To be secured as a requirement of the DCO and within the deemed marine licence in Schedule 14 of the draft DCO.
Tertiary measures: Measures required to meet legislative requirements, or adopted standard industry practice		
Offshore Environmental Management Plan (EMP) that will include measures to minimise disturbance to rafting birds from transiting vessels	The development of and adherence to an Offshore EMP which will include measures to minimise disturbance to rafting birds from transiting vessels.	To be secured within the deemed marine licence in Schedule 14 of the draft DCO and expected to be secured within the standalone NRW marine licence.

MONA OFFSHORE WIND PROJECT

Measures adopted as part of the Mona Offshore Wind Project	Justification	How the measure will be secured
The Offshore EMP will include a timing restriction of no offshore export cable installation during the period 1 st November to 31 st March within the Liverpool Bay SPA.	The timing restriction will ensure no installation of offshore export cables during the period of 1 st November to 31 st March within the Mona Offshore Cable Corridor and Access Areas located within the Liverpool Bay SPA in order to minimise disturbance to IEFs within the Mona Offshore Cable Corridor and Access Areas, in particular diver and seaduck species.	To be secured within the deemed marine licence in Schedule 14 of the draft DCO and expected to be secured within the standalone NRW marine licence.
The Offshore EMP will include a MPCP.	Implementation of an EMP including a MPCP which will include planning for accidental spills, address all potential contaminant releases and include key emergency details.	To be secured within the deemed marine licence in Schedule 14 of the draft DCO and expected to be secured within the standalone NRW marine licence.

5.7 Assessment of significant effects

5.7.1 Overview

- 5.7.1.1 The impacts of the construction, operations and maintenance, and decommissioning phases of the Mona Offshore Wind Project on offshore ornithology have been assessed. These potential impacts are listed in Table 5.21, along with the MDS against which each impact has been assessed.
- 5.7.1.2 A description of the potential effect on offshore ornithology receptors caused by each identified impact is given below.

5.7.2 Disturbance and displacement from airborne noise, underwater sound, and presence of vessels and infrastructure

- 5.7.2.1 The construction, operations and maintenance, and decommissioning of the Mona Offshore Wind Project may lead to disturbance and displacement of birds. The MDS is represented by the maximum density of wind turbines and structures across the Mona Array Area and the Mona Offshore Cable Corridor and Access Areas that would cause the greatest extent of disturbance and displacement to birds or the greatest duration of impact. The MDS also represents the maximum underwater sound output from impact piling for each of the relevant infrastructure foundation options and the maximum number of vessel and helicopter movements that would cause greatest visual and sound disturbance and displacement to birds from the Mona Array Area and Mona Offshore Cable Corridor and Access Areas. The MDS is summarised in Table 5.21.
- 5.7.2.2 Disturbance as the result of activities during the construction, operations and maintenance, and decommissioning phases of an offshore wind farm has the potential to displace seabirds from an area of sea in which the activity is occurring. In relation to offshore wind farm development, displacement is defined as a reduction in the number of seabirds occurring within or immediately adjacent to an offshore wind farm (Furness *et al.*, 2013).

MONA OFFSHORE WIND PROJECT

- 5.7.2.3 As the result of disturbance, displaced birds may move to areas already occupied by other birds and thus face higher intra- or inter-specific competition due to a higher density of individuals competing for the same resource. Alternatively, displaced birds may be forced to move into areas of lower quality (e.g. areas of lower prey availability). Such disturbance and resulting displacement could ultimately affect their demographic fitness (i.e. survival rates and breeding productivity) as well as potentially impacting on other birds in areas that displaced birds move to.
- 5.7.2.4 Disturbance as a result of activities during the construction of an offshore wind farm (such as installing foundations, wind turbines, inter-array cabling and associated vessel movements) and the offshore export cable has the potential to displace birds. Cable laying vessels will be active for six months within the construction period. Construction activities then result in a point source of disturbance, for example when construction vessels are at a location to undertake piling and install foundations or the wind turbines. The level of disturbance associated with each location would vary depending on the activity undertaken. With regards to vessels in the Mona Array Area, there is no method to quantify the displacement impact of the activities due to their highly local and temporary nature. An EMP that includes measures to minimise disturbance to rafting birds from transiting vessels is anticipated to be secured within the draft DCO and agreed pre-construction. It is expected that impacts of vessels on seabirds are negligible and this has not been taken forward to further assessment.
- 5.7.2.5 During the operations and maintenance phase, the presence of operational wind turbines has the potential to directly disturb seabirds leading to displacement from the offshore wind farm array area including an area of variable size or buffer around it (Dierschke *et al.*, 2016). Therefore, the presence of wind turbines at the Mona Array Area has the potential to directly disturb and displace seabirds that would normally reside within and around the area of sea. Additionally, activities associated with the operations and maintenance of wind turbines (e.g. vessel, helicopter and inspection drone activity) may disturb and displace species within the Mona Array Area and potentially within surrounding buffers to a lower extent.
- 5.7.2.6 The displacement assessment for the Mona Offshore Wind Project is based on the use of the SNCB Matrix Table approach, which was agreed during consultation with the Offshore Ornithology EWG on 13 July 2022 as part of the Evidence Plan process. As sensitivity to displacement differs considerably between seabird species, species were screened and progressed for the Matrix Table approach using 'Disturbance Sensitivity' and 'Habitat Specialization' scores from Bradbury *et al.* (2014) and Wade *et al.* (2016) as recommended by the Joint SNCB Interim Displacement Advice Note (JNCC *et al.*, 2022). In addition to the species' sensitivity rating, the abundance of birds in the Mona Array Area was considered as to whether species were progressed to the matrix stage.
- 5.7.2.7 For each of the species considered (common guillemot, razorbill, Atlantic puffin, black-legged kittiwake, northern gannet, red-throated diver and Manx shearwater, Table 5.12), displacement impacts were quantified for the population derived within the Mona Array Area plus 2 km buffer (or 4 km buffer if appropriate for the species).
- 5.7.2.8 SNCBs recommend for most species a standard displacement buffer of 2 km with the exception of the species groups of divers and seaducks as they can be affected at distances over 4 km (JNCC, 2022).
- 5.7.2.9 Red-throated diver and common scoter were rarely recorded in the Mona Offshore Ornithology Array Area study area during the baseline surveys and have therefore been excluded from the assessment of displacement from the Mona Array Area but included in the Mona Offshore Cable Corridor and Access Areas assessment. There

MONA OFFSHORE WIND PROJECT

is the potential for disturbance and displacement from airborne noise, underwater sound, and presence of vessels within the Mona Offshore Cable Corridor and Access Areas as the result of site preparation activities in advance of installation activities, cable installation activities, pre-cabling seabed clearance (including Unexploded Ordnance (UXO) detonation), anchor placements and decommissioning activities such as export cable removal.

- 5.7.2.10 The evidence-based for the displacement rates and associated mortality rates for each species is noted below, and the full approach of the displacement assessment is detailed in Volume 6, Annex 5.2: Offshore ornithology displacement technical report of the Environmental Statement (Document reference F6.5.2).

Evidence-based displacement and mortality rates

- 5.7.2.11 Since displacement sensitivity vary between species, the displacement rates and associated mortality rates used to assess the effects of the operations and maintenance phase of the Mona Offshore Wind Project have been derived from previous studies, guidance documents and advice received by SNCBs during the Evidence Plan Process. Given that construction is limited both spatially and temporally and that any potential effects are unlikely to reach the same level as during the operations and maintenance phase, the level to be used for the construction phase of the Mona Offshore Wind Project is a 50% reduction in the displacement rate used for operational phase assessments as recommended by Natural Resource Wales (NRW) during the second EWG (held on 13 July 2022).

- 5.7.2.12 There is limited empirical evidence in which mortality rate to use when assessing the impacts of displacement of offshore wind farms, however, the current SNCBs guidance, based on expert opinion (Natural England 2014), is to consider a mortality rate of up to 10% (SNCBs, 2017). Van Kooten *et al.* (2019) studied the effects of displacement of seabirds using energy-budget models for two scenarios using habitat utilization maps and a fixed 10% mortality rate. The evidence from this study suggests that a 1% mortality rate for displaced birds is more appropriate than the potentially over-precautionary 10% mortality rate. Similarly, Searle *et al.* (2014; 2018) used time and energy budget models to investigate the effects of displacement and barrier effects on breeding populations of seabirds, including auks during the chick rearing period. The study reported changes in time and energy budgets which could impact future survival of auks, however the simulations concluded that the displacement effects were unlikely to result in a mortality rate increase of over 0.5%. Therefore, in line with the advice from the SNCBs (2017), a 1 to 10% mortality of displaced individuals has been used for all species in this assessment, although the Applicant considers that 1% mortality rate to be the more likely impact based on expert judgement. To ensure that the assessments are suitably precautionary for all species, the mortality rates considered for the construction phase remain the same as those used for operational phase impacts.

- 5.7.2.13 Decommissioning activities within the Mona Array Area are equal to or less than those carried out during the construction phase. Therefore, for the purpose of this assessment it is assumed that the impacts are likely to be similar.

Atlantic puffin, common guillemot, razorbill, Manx shearwater

- 5.7.2.14 Evidence shows that auk species exhibit a medium level of sensitivity to vessel and helicopter traffic (Garthe and Hüppop, 2004; Furness and Wade, 2012; Langston, 2010; Bradbury *et al.*, 2014). Furthermore, displacement impacts from post-consent monitoring studies (from 13 different European offshore windfarm sites) have been

MONA OFFSHORE WIND PROJECT

collated and reviewed by Dierschke *et al.*, (2016), which found auk species to show 'weak displacement' overall, but results were highly variable. Similarly, a recent review submitted by Hornsea Four Offshore Wind Farm (Orsted, 2021; APEM 2022) summarises all current post consent-monitoring studies undertaken to date within the North Sea and UK Western Waters and provides an extensive study and analysis of the empirical data from offshore wind farms. This review found that auk displacement varies considerably across different sites, with displacement rates ranging from +112% to -75%.

- 5.7.2.15 Based on the review of the relevant literature, a displacement rate of 50% during the operations and maintenance phase of the Mona Offshore Wind Project has been deemed appropriate for the auk species (i.e. common guillemot, razorbill and Atlantic puffin) considered in this assessment. This rate is considered to be highly precautionary as a study of offshore wind farms in the German North Sea found reduced displacement rates (~20%) of guillemots during the breeding season compared to the non-breeding season (Peschko *et al.*, 2020). This is of important consideration as the mean displacement rates derived from the Dierschke *et al.* (2016) review was primarily from data collected in the non-breeding season. Therefore, by applying a single displacement rate of 50% across all bio-seasons within the Mona Array Area, this ensures a precautionary rate is used for the assessment.
- 5.7.2.16 Furthermore, evidence suggests that although auk species are somewhat sensitive to displacement, the effects are short-term, and studies indicate auk habituation to offshore windfarms. For example, a study at Thanet Offshore Windfarm found auk species became habituated and the displacement rate of 75% to 85% in the first year of operations fell to 31% to 41% within years two and three of operations (Royal Haskoning, 2013). Further evidence is emerging through additional post-construction monitoring of offshore windfarms, for instance, there are reports of auk numbers increasing and observations of foraging behaviour within the offshore wind farm itself (Leopold and Verdaat, 2018). This suggests the displacement rates of auk species within the Mona Array Area will reduce over time, and, given that the site is close to other offshore wind farms (such as Burbo Bank and West of Duddon Sands), some habituation may have already occurred within local populations that would result in reduced avoidance of the Mona Array Area compared to a new offshore wind farm in a previously unimpacted region.
- 5.7.2.17 The conclusion from the literature review suggests that a displacement rate of 50% (range 30% to 70%) during the operations and maintenance phase of the Mona Array Area and 2 km buffer is the most applicable for auk species, whilst still being suitably precautionary for assessment. As there is limited evidence regarding displacement rates in Manx shearwater, it was advised by the SNCBs at the Offshore Ornithology EWG meeting (held 13 July 2023, see S42 Consultation, see Annex 5, Chapter 2: Offshore ornithology displacement technical report (Document reference F6.5.2)) that these are to be treated similarly to the auk species, using a 50% (range 30% to 70%) displacement rate. The use of a 50% displacement rate in Manx shearwater is also likely to be highly precautionary since this species shows weak avoidance to offshore wind farms and the population vulnerability to displacement is very low (Dierschke *et al.*, 2016; Bradbury *et al.*, 2014).
- 5.7.2.18 Few studies have provided empirical displacement rates for the construction phase of offshore windfarms. However, studies suggest the displacement rates of auks is either comparable to or significantly lower than that of the operational phase (Royal Haskoning, 2013; Vallejo *et al.*, 2017). Although potential disturbance from construction activities within a development can be high during the construction phase, it is likely to be both temporally and spatially restricted compared to the operations and

MONA OFFSHORE WIND PROJECT

maintenance phase, and thus the resultant displacement rate of the entire site is lower in comparison.

- 5.7.2.19 Given that the displacement rate used for the construction phase is a 50% reduction from the operational phase displacement rate, the rate used for auks, kittiwake and Manx shearwater during the construction phase is 25% (range 15% to 35%) as agreed with the SNCBs in the second EWG (held on 13/07/2022).

Northern gannet

- 5.7.2.20 To assess the effects of the operations and maintenance phase of the Mona Offshore Wind Project on the northern gannet population in the area, a displacement rate of 70% (range 60% to 80%) and a mortality rate of 1% (range 1% to 10%) was used.
- 5.7.2.21 Evidence suggests that northern gannet show a low level of sensitivity to ship and helicopter traffic (Garthe and Hüppop, 2004; Furness and Wade, 2012), however, their avoidance rates to offshore wind farms can be high. Natural England recently reviewed nine studies that reported on northern gannet avoidance rates using a variation of survey methods (Pavat *et al.*, 2023). The avoidance rates reported range from 61.7% to 100%. Another review by APEM (2022) looked at studies across 25 offshore wind farms, over different seasons, and reported displacement rates of 40% to 60% during the breeding season, and 60% to 80% during the non-breeding season. In light of literature, and following guidance from Natural England (pers. comm., 7 July 2022), using a displacement rate of 70% has been deemed appropriate for this assessment.
- 5.7.2.22 Given that the displacement rate used for the construction phase is a 50% reduction from the operational phase displacement rate, the rate used for northern gannet during the construction phase is 35% (range 30% to 40%) as agreed with the SNCBs.
- 5.7.2.23 Based on expert judgement a mortality rate of 1% (range 1% to 10%) was selected for this assessment. This decision is supported by additional evidence that suggests that northern gannet have a large mean-maximum (315 km) and maximum (709 km) foraging range (Woodward *et al.*, 2019) and feed on a diverse range of prey items and thus displaced birds will have access to suitable alternative foraging opportunities despite the potential reduced foraging activities within the Mona Array Area.

Black-legged kittiwake

- 5.7.2.24 Black-legged kittiwake are considered to have a low habitat specialisation score and low sensitivity to displacement (Bradbury *et al.*, 2014; Furness and Wade, 2012; Nature Scot, 2023). However, the population near the Mona Array Area is of high importance and so, following an agreement through the Evidence Plan Process and at the recommendation of JNCC, the species has been considered for the displacement assessment.
- 5.7.2.25 Studies regarding the displacement at Egmond aan Zee OWF (Leopold *et al.*, 2011), Bligh Bank OWF and Thorntonbank OWF (Vanermen, 2013). Horns Rev OWF, Princess Amalia Windpark (Furness, 2013) reported no significant displacement of black-legged kittiwake.
- 5.7.2.26 A study by Peschko (2020) used a long-term dataset covering 14 years before and 3 years after the construction of OWFs in the southern North Sea to assess the displacement of black-legged kittiwake. They found a 45% decrease in density during the breeding season.
- 5.7.2.27 Nature Scot advise a 30% displacement rate and 1% to 3% mortality rate for black-legged kittiwake in both the breeding and non-breeding season (Nature Scot, 2023).

MONA OFFSHORE WIND PROJECT

In light of this guidance and additional evidence stated, for the purpose of this assessment, precautionary rates of 50% (range 30% to 70%) for displacement and 1% (range 1% to 10%) for mortality have been used for the operations and maintenance phase of the Mona Offshore Wind Project. Given that the displacement rate used for the construction phase is a 50% reduction from the operational phase displacement rate, the rate used for black-legged kittiwake during the construction phase is 25% (range 15% to 35%) as agreed with the SNCBs in the second EWG (held on 13/07/2022)

Construction phase

Magnitude of impact

Mona Offshore Ornithology Offshore Cable Corridor

Red-throated diver

- 5.7.2.28 Red-throated diver was absent from the Mona Array Area + 4 km buffer and therefore was excluded from assessment of impact within this area. However red-throated diver occur within the nearshore environment where the Mona Offshore Cable Corridor intersects with areas of usage by this species. Therefore, red-throated diver has been included for assessment of impact within Mona Offshore Cable Corridor.
- 5.7.2.29 NRW requested that a 2 km buffer for this species be applied around the cable laying vessel. Within the MDS up to two cable laying vessels will be present with up to four support vessels at any one time. Any support vessels will be in the immediate vicinity of the cable laying vessels and so any displacement effect from those vessels will be included within the 2 km buffer. Therefore 25.14 km² of area would be disturbed around the construction vessels at any given time. However, during construction, vessel activity will be clustered around the area of cable laying and the areas of potential disturbance from each vessel will overlap. Therefore, the overall area of disturbance will likely be smaller than 25.14 km².
- 5.7.2.30 During the winter months (October to March) the densities of birds present within the Mona Offshore Cable Corridor and Access Areas are close to the coast at Colwyn Bay, where up to 1.22 birds per km² were present (HiDef, 2023) and therefore up to 30.67 birds could be temporarily displaced.
- 5.7.2.31 During summer months (April to September) the highest densities of birds present within the Mona Offshore Cable Corridor and Access Areas are close to the coast at Colwyn Bay, where up to 0.099 birds per km² were present (Bradbury *et al.*, 2014) and therefore up to 2.49 birds could be temporarily displaced.
- 5.7.2.32 All red-throated diver are assumed to be displaced by vessel activity (displacement rate of 100%). The evidence for the impacts of mortality currently do not support that displacement causes increased mortality among red-throated diver (Dierschke *et al.*, 2017; MacArthur Green, 2019). Between 0.5% and 1% mortality was assumed, which was requested by NRW as part of their S42 response. Therefore, in the non-breeding period between 0.15 and 0.31 birds may experience mortality, whereas in the migration periods between 0.01 to 0.02 birds may experience mortality.
- 5.7.2.33 Using an average adult and immature mortality estimate of 0.233, and a non-breeding population of 2,073 this would lead to a baseline mortality rate of 483.01 individuals. The increase in baseline mortality using the estimates presented then equates to an increase mortality rate of between 0.03% to 0.06% for the Mona Offshore Cable Corridor and Access Areas alone in the non-breeding season.

MONA OFFSHORE WIND PROJECT

- 5.7.2.34 During the migration periods, using an average adult and immature mortality estimate of 0.233, and a population of 4,373 this would lead to a baseline mortality rate of 1,019 individuals. The increase in baseline mortality using the estimates presented then equates to an increase mortality rate of <0.01% for the Mona Offshore Cable Corridor and Access Areas alone.
- 5.7.2.35 As part of the measures adopted for the Mona Offshore Wind Project, no offshore export cable installation activities will occur during the period of 1st November to 31st March within the Liverpool Bay SPA. This therefore means that red-throated diver will not be displaced during the non-breeding period and an increase in baseline mortality of <0.01% is predicted during installation.
- 5.7.2.36 If the unlikely scenario that all 17 cable laying vessels were to be present at the one time during cable laying activities, this would mean that a total area of 213.69 km² would be disturbed, which would equate to an increase in baseline mortality of 0.02% to 0.04% during the summer months for red-throated diver.
- 5.7.2.37 In either case, all scenarios considered are well below a 1% increase in baseline mortality and the magnitude is therefore, considered to be **negligible**.

Common scoter

- 5.7.2.38 Common scoter was absent from the Mona Array Area + 4 km buffer and therefore was excluded from assessment of impact within this area. However, common scoter occur within the nearshore environment where the Mona Offshore Cable Corridor and Access Areas intersects.
- 5.7.2.39 JNCC requested that a 2.5 km buffer for this species, as part of the Section 42 Consultation, be applied around the cable laying vessel (Fliessbach *et al.*, 2019). Within the MDS up to two cable laying vessels will be present with up to four support vessels at any one time. Any support vessels will be in the immediate vicinity of the cable laying vessels and so any displacement effect from those vessels will be included within the 2.5 km buffer. Therefore 39.27 km² of area would be disturbed round the vessels at any given time. However, during construction vessel activity will be clustered around the area of cable laying and the areas of potential disturbance from each vessel will overlap. Therefore, the overall area of disturbance will likely be smaller than 39.27 km².
- 5.7.2.40 During the winter months (October to March) The highest densities of birds present within the Mona Offshore Cable Corridor and Access Areas are close to the coast, where up to 56.51 birds per km² were present (Bradbury *et al.*, 2014) and therefore up to 2,210 birds could be temporary displaced.
- 5.7.2.41 During summer months (April to September) no birds were present within the Mona Offshore Cable Corridor and Access Areas (Bradbury *et al.*, 2014) and therefore no birds would be temporarily displaced and increase in baseline mortality would be 0.00%.
- 5.7.2.42 All common scoter are assumed to be displaced by vessel activity (displacement rate of 100%). Between 0.5% and 1% mortality was assumed and therefore between 11.05 and 22.10 birds may experience mortality.
- 5.7.2.43 Using an average adult and immature mortality estimate of 0.238, and a non-breeding population of 95,931 (HiDef, 2023) this would lead to a baseline mortality rate of 22,831.58 individuals. The increase in baseline mortality using the estimates presented then equates to an increase between 0.05% to 0.10% for the Mona Offshore Cable Corridor and Access Areas alone.

MONA OFFSHORE WIND PROJECT

5.7.2.44 As part of the measures adopted for the Mona Offshore Wind Project, no offshore export cable installation activities will occur during the period of 1st November to 31st March within the Liverpool Bay SPA. This therefore means that common scoter will not be displaced during the non-breeding period and an increase in baseline mortality of 0.00% is predicted during installation.

5.7.2.45 In either case, all scenarios considered are well below a 1% increase in baseline mortality and the magnitude is therefore, considered to be **negligible**.

Other species

5.7.2.46 Within Volume 6, Annex 5.1: Offshore ornithology baseline characterisation technical report (Document reference F6.5.1), the density of birds for all other seabird and raftering birds was no greater than 1 bird per km². As the works being undertaken within the Mona Offshore Cable Corridor and Access Areas are temporary and minor in nature with work likely to be spatially and temporally restricted, no assessment was done for any other species within the Mona Offshore Cable Corridor during construction. The effect has been therefore assessed to be **negligible**.

Mona Offshore Ornithology Array Area

Common guillemot

5.7.2.47 The estimated mortality (when considering a displacement rate of 15% to 35% and a mortality rate of 1% to 10% as requested per guidance of the EWG) resulting from displacement during construction was assessed for each bio-season and for the combined bio-seasons (Table 5.23) as detailed in Volume 6, Annex 5.2: Offshore ornithology displacement technical report of the Environmental Statement (Document reference F6.5.2).

5.7.2.48 In both bio-seasons and annually, the predicted increase in the baseline mortality rate does not surpass the 1% threshold (Table 5.23).

5.7.2.49 The impact is predicted to be of local spatial extent, short term duration, intermittent and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **negligible**.

Table 5.23: Common guillemot bio-season and annual displacement estimates for Mona during construction.

Bio-season	Seasonal abundance (Mona Array Area + 2 km buffer)	Regional baseline population		Number of common guillemot subject to mortality (no. of indiv.)	Increase in baseline mortality (%)
		Population	Baseline mortality		
Breeding (March to July)	4,220	136,680	18,178	6 to 148	0.033 to 0.814
Non-breeding (August to February)	3,756	1,139,220	151,516	6 to 131	0.004 to 0.086
Annual	7,976	1,139,220	151,516	12 to 279	0.008 to 0.184

MONA OFFSHORE WIND PROJECT

Razorbill

- 5.7.2.50 The estimated mortality (when considering a displacement rate of 15% to 35% and a mortality rate of 1% to 10%) resulting from displacement during construction was assessed for each bio-season and for the combined bio-seasons (Table 5.24) as detailed in Volume 6, Annex 5.2: Offshore ornithology displacement technical report of the Environmental Statement (Document reference F6.5.2).
- 5.7.2.51 In all four bio-seasons (breeding, non-breeding, autumn, and spring migration) and for the combined bio-seasons, the predicted increase in the baseline mortality rate does not surpass the 1% threshold.
- 5.7.2.52 The impact is predicted to be of local spatial extent, short term duration, intermittent and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **negligible**.

Table 5.24: Razorbill bio-season and annual displacement estimates for the Mona Array Area plus 2 km buffer during construction.

Bio-season	Seasonal Abundance (Mona Array Area + 2 km buffer)	Regional Baseline Population		Number of razorbill subject to mortality (indiv.)	Increase in baseline mortality (%)
		Population	Baseline mortality		
Spring migration (January to March)	1,924	606,914	104,389	3 to 67	0.003 to 0.064
Breeding (April to July)	83	18,345	3,155	0 to 3	0.000 to 0.095
Autumn migration (August to October)	91	606,914	104,389	0 to 3	0.000 to 0.003
Non-breeding (November to December)	421	341,422	58,725	1 to 15	0.001 to 0.026
Annual	2,519	606,914	104,389	4 to 88	0.004 to 0.084

Atlantic puffin

- 5.7.2.53 The estimated mortality (when considering a displacement rate of 15% to 35% and a mortality rate of 1% to 10%) resulting from displacement during construction was assessed for each bio-season and for the combined bio-seasons (Table 5.25) as detailed further in Volume 6, Annex 5.2: Offshore ornithology displacement technical report of the Environmental Statement (Document reference F6.5.2).
- 5.7.2.54 In both bio-seasons and annually, the predicted increase in the baseline mortality rate does not surpass the 1% threshold.
- 5.7.2.55 The impact is predicted to be of local spatial extent, short term duration, intermittent and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **negligible**.

Table 5.25: Atlantic puffin bio-season and annual displacement estimates for the Mona Array Area plus 2 km buffer during construction.

Bio-season	Seasonal Abundance (Mona Array Area + 2 km buffer)	Regional Baseline Population		Number of Atlantic puffin subject to mortality (indiv.)	Increase in baseline mortality (%)
		Population	Baseline Mortality		
Breeding (April to August)	15	203,302	35,781	0 to 1	0.000 to 0.003
Non-breeding (September to March)	22	304,557	53,602	0 to 1	0.000 to 0.002
Annual	37	304,557	53,602	0 to 1	0.000 to 0.002

Northern gannet

5.7.2.56 The estimated mortality (when considering a displacement rate of 30% to 40% and a mortality rate of 1% to 10%) resulting from displacement during construction was assessed for each bio-season and for the combined bio-seasons Table 5.26 as detailed further in Volume 6, Annex 5.2: Offshore ornithology displacement technical report of the Environmental Statement (Document reference F6.5.2).

5.7.2.57 In all three bio-seasons (spring, breeding and autumn) and annually, the predicted increase in the baseline mortality rate does not surpass the 1% threshold.

5.7.2.58 The impact is predicted to be of local spatial extent, short term duration, intermittent and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **negligible**.

Table 5.26: Northern gannet bio-season and annual displacement estimates for the Mona Array Area plus 2 km buffer during construction.

Bio-season	Seasonal Abundance (Mona Array Area + 2 km buffer)	Regional Baseline Population		Number of Northern gannet subject to mortality (indiv.)	Increase in baseline mortality (%)
		Population	Baseline Mortality		
Spring migration (December to February)	28	661,888	127,744	0 to 1	0.000 to 0.001
Breeding (March to September)	251	552,522 661,888	106,707 127,744	1 to 10	0.001 to 0.009 0.010
Autumn migration (October to November)	58	545,954	105,369	0 to 2	0.000 to 0.002
Annual	336	661,888	127,744	1 to 13	0.001 to 0.010

MONA OFFSHORE WIND PROJECT

Black-legged kittiwake

- 5.7.2.59 The estimated mortality (when considering a displacement rate of 15% to 35% and a mortality rate of 1% to 10%) resulting from displacement during construction was assessed for each bio-season and for the combined bio-seasons (Table 5.27) as detailed further in Volume 6, Annex 5.2: Offshore ornithology displacement technical report of the Environmental Statement (Document reference F6.5.2).
- 5.7.2.60 There is no consensus between the SNCBs regarding the inclusion of a displacement assessment for black-legged kittiwake; however, one is presented here for precaution and for the SNCBs that have requested this information.
- 5.7.2.61 In all three bio-seasons (spring, breeding and autumn) and annually, the predicted increase in the baseline mortality rate does not surpass the 1% threshold.
- 5.7.2.62 The impact is predicted to be of local spatial extent, short term duration, intermittent and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **negligible**.

Table 5.27: Black-legged kittiwake bio-season and annual displacement estimates for the Mona Array Area plus 2 km buffer during construction.

Bio-season	Seasonal Abundance (Mona Array Area + 2 km buffer)	Regional Baseline Population		Number of Black-legged kittiwake subject to mortality (indiv.)	Increase in baseline mortality (%)
		Population	Baseline Mortality		
Spring migration (January to February)	574	691,526	107,878	1 to 20	0.001 to 0.019
Breeding (March to August)	726	156,679	24,442	1 to 25	0.004 to 0.102
Autumn migration (September to December)	560	911,586	142,207	1 to 20	0.001 to 0.014
Annual	1,860	911,586	142,207	5 to 74	0.003 to 0.052

Manx shearwater

- 5.7.2.63 The estimated mortality (when considering a displacement rate of 15% to 35% and a mortality rate of 1% to 10%) resulting from displacement during construction was assessed for each bio-seasons and for the combined bio-seasons (Table 5.28) as detailed further in Volume 6, Annex 5.2: Offshore ornithology displacement technical report of the Environmental Statement (Document reference F6.5.2).
- 5.7.2.64 In all three bio-seasons (spring, breeding and autumn) and annually, the predicted increase in the baseline mortality rate does not surpass the 1% threshold.
- 5.7.2.65 The impact is predicted to be of local spatial extent, short term duration, intermittent and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **negligible**.

MONA OFFSHORE WIND PROJECT
Table 5.28: Manx shearwater bio-season and annual displacement estimates for the Mona Array Area plus 2 km buffer during construction.

Bio-season	Seasonal Abundance (Mona Array Area + 2 km buffer)	Regional Baseline Population		Number of Manx shearwater subject to mortality (indiv.)	Increase in baseline mortality (%)
		Population	Baseline Mortality		
Spring migration (March)	63	1,580,895	205,516	0 to 0	0.000 to 0.000
Breeding (April to August)	1,249	1,821,544	236,801	2 to 44	0.001 to 0.019
Autumn migration (September to December)	16	1,580,895	205,516	0 to 1	0.000 to 0.000
Annual	1,274,268	1,821,544	236,801	2 to 44	0.001 to 0.019

Sensitivity of the receptor

Common Scoter

- 5.7.2.66 Common scoter are very vulnerable to disturbance and displacement caused by offshore wind farms. The species has a score of five (out of five) for displacement due to vessels (Wade *et al.*, 2016).
- 5.7.2.67 Common scoter present within the Mona Offshore Cable Corridor and Access Areas are likely to be part of the Liverpool Bay SPA and therefore, the species is considered to be of high value.
- 5.7.2.68 The wintering population within the UK is increasing at the latest SPA review in the short and long-term (Stroud *et al.*, 2016) and therefore it's considered wintering common scoter have a medium recoverability.
- 5.7.2.69 Common scoter is deemed to be of high vulnerability, medium recoverability and high value. The sensitivity of the receptor is therefore, considered to be **high**.

Red-throated diver

- 5.7.2.70 Red-throated diver are very vulnerable to disturbance and displacement caused by offshore wind farms. The species has a score of five (out of five) for displacement due to vessels (Wade *et al.*, 2016).
- 5.7.2.71 Red-throated diver present within the Mona Offshore Cable Corridor and Access areas are likely to be part of the Liverpool Bay SPA and therefore, the species is considered to be of high value.
- 5.7.2.72 The wintering population within the UK is increasing at the latest SPA review over the short-term (unknown over the long-term) (Stroud *et al.*, 2016) and therefore it's considered wintering common scoter have a medium recoverability. Red-throated diver is deemed to be of high vulnerability, medium recoverability and high value. The sensitivity of the receptor is therefore, considered to be **high**.

MONA OFFSHORE WIND PROJECT

Common guillemot

- 5.7.2.73 According to Wade *et al.* (2016), common guillemot are considered to be sensitive to disturbance from vessels and helicopters at offshore wind farms, with a vulnerability score of three (out of five). Whilst there is evidence from studies that auk species respond negatively to vessel traffic (Ronconi and Clair, 2002), behavioural response to underwater and airborne sounds resulting from construction activities are unknown. Although common guillemot are likely to respond to visual stimuli during the construction phase, the impacts of disturbance/displacement are short-term and common guillemot have the ability to return to the baseline abundance and distribution after construction.
- 5.7.2.74 Although the species has a low reproductive success (i.e. laying one egg and not breeding until five years old) (Robinson, 2005), common guillemot have a medium recoverability given their increasing trend in abundance and productivity in the UK (JNCC, 2020).
- 5.7.2.75 Common guillemot is a qualifying interest for several SPAs likely to be connected to the Mona Array Area (within the mean-max + SD foraging range), however as large colonies from non-SPA sites (i.e. SSSI sites) are also within close proximity (e.g. St Bee's Head) the species is considered to be of medium value.
- 5.7.2.76 Common guillemot is deemed to be of medium vulnerability, medium recoverability and medium value. The sensitivity of the receptor is therefore, considered to be **medium**.

Razorbill

- 5.7.2.77 As with common guillemot, razorbill are deemed to be sensitive to disturbance from vessels and helicopters at offshore wind farms, with a vulnerability score of three (out of five). Although razorbill are likely to respond to visual stimuli during the construction phase, the impacts of disturbance/displacement are short-term and razorbill have the ability to return to the baseline conditions after construction.
- 5.7.2.78 Although the species has a low reproductive success (only laying one egg) and does not breed until four years old (Robinson, 2005), razorbill are deemed to have a medium recoverability given their increasing trend in abundance in the UK (JNCC, 2020).
- 5.7.2.79 Razorbill is a qualifying interest for several SPAs likely to be connected to the Mona Array Area (within the mean-max + SD foraging range), however as several non-SPA colonies are also within range of the Mona Array Area, the species is considered to be of medium value.
- 5.7.2.80 Razorbill is deemed to be of medium vulnerability, medium recoverability and medium value. The sensitivity of the receptor is therefore, considered to be **medium**.

Atlantic puffin

- 5.7.2.81 Together with other auk species, Atlantic puffin are considered to be sensitive to disturbance from vessels and helicopters at offshore wind farms. The species is assigned a vulnerability score of three (out of five) by Wade *et al.* (2016).
- 5.7.2.82 Although Atlantic puffin are likely to respond to visual stimuli during the construction phase, the impacts of disturbance/displacement are short-term and the population using the Mona Array Area has the ability to return to the baseline conditions after construction.

MONA OFFSHORE WIND PROJECT

- 5.7.2.83 Atlantic puffin have a low reproductive success (i.e. laying one egg and not breeding until five years old) (Robinson, 2005) and are deemed to have a low recoverability given the lack of up-to-date census of the size of the UK breeding population and the overall declining trend in abundance (1986 to 2018) (JNCC, 2020).
- 5.7.2.84 Atlantic puffin is a qualifying interest for several SPAs likely to be connected to the Mona Array Area (within the mean-max + SD foraging range), with low to no Atlantic puffin likely coming from the few non-SPA sites within foraging range due to those non-SPA sites consisting of less than 100 birds. The species is therefore considered to be of high value.
- 5.7.2.85 Atlantic puffin is deemed to be of medium vulnerability, low recoverability and high value. The sensitivity of the receptor is therefore, considered to be **high**.

Northern gannet

- 5.7.2.86 Northern gannet are considered to have a medium sensitivity to other sources of disturbance such as ship and helicopter traffic (Garthe and Hüppop, 2004; Furness and Wade, 2012), and so northern gannet are considered to be of medium vulnerability.
- 5.7.2.87 Although northern gannet has a low reproductive success (only laying one egg) and does not breed until five years old (Robinson, 2005), the species is deemed to have a medium recoverability given the consistent increasing trend in abundance since the 1990s (JNCC, 2020). However, the species has suffered significant losses from the outbreak of HPAI during the 2022 breeding season, with it being estimated that around at least 25% of northern gannets within the UK have died due to the disease.
- 5.7.2.88 Northern gannet is a qualifying interest for several SPAs likely to be connected to the Mona Array Area (within the mean-max + SD foraging range), with a large non-SPA colony within close proximity (Monreith Cliffs and Scar Rocks), the species is therefore considered to be of medium value.
- 5.7.2.89 Northern gannet is deemed to be of medium vulnerability, medium recoverability and medium value. The sensitivity of the receptor is therefore, considered to be **medium**.

Black-legged kittiwake

- 5.7.2.90 In terms of behavioural responses to vessels and helicopters at offshore wind farms, black-legged kittiwake are considered to be of low to medium vulnerability to displacement (with a score of two out of five) by Wade *et al.* (2016).
- 5.7.2.91 Although the reproductive success of black-legged kittiwake is higher (i.e. laying two eggs and breeding until four years old) than auk species and northern gannet (Robinson, 2005), the species is deemed to have a low recoverability given the continuing decline in abundance observed between 1986 and 2018 in the UK (JNCC, 2020). During this period, breeding productivity has declined as the result of food shortage, although it has stabilised in recent years (JNCC, 2020). During the 2022 breeding season HPAI was confirmed in some Kittiwake colonies, but not to the same extent as gannet colonies.
- 5.7.2.92 Black-legged kittiwake is a qualifying interest for several SPAs likely to be connected to the Mona Array Area (within the mean-max + SD foraging range), with several non-SPA colonies within range and so the species is considered to be of medium value.
- 5.7.2.93 Black-legged kittiwake is deemed to be of low vulnerability, low recoverability and medium value. The sensitivity of the receptor is therefore, considered to be **medium**.

MONA OFFSHORE WIND PROJECT

Manx shearwater

- 5.7.2.94 In terms of behavioural responses to vessels and helicopters at offshore wind farms, Manx shearwater are considered to be of low vulnerability to displacement (score of one) by Wade *et al.* (2016).
- 5.7.2.95 Owing to their large foraging range, Manx shearwater is a qualifying interest for several SPAs likely to be connected to the Mona Array Area (within the mean-max + SD foraging range). Most of the world population is found in the UK and over 90% of the UK population is found on the Islands of Rum and Eigg (Scotland) and Skomer and Skokholm (Wales) (Mitchell *et al.*, 2004; JNCC, 2020). Therefore, the species is considered to be of high value.
- 5.7.2.96 Manx shearwater has a low reproductive success (i.e. only laying one egg and not breeding until five years old; Robinson, 2005). There is an incomplete spatial-temporal coverage of breeding abundance at UK colonies and thus a lack of long-term trend (JNCC, 2020). In the light of uncertainly and low reproductive success, Manx shearwater are therefore deemed to have a low recoverability.
- 5.7.2.97 Manx shearwater is deemed to be of low vulnerability, low recoverability and high value. The sensitivity of the receptor is therefore, considered to be **medium**.

Significance of the effect

- 5.7.2.98 Given that construction activities will only take place within a small area of the Mona Array Area at any given time, displaced birds will be able to resettle within the Mona Array Area or beyond. As alternative habitats exist, species shown in Table 5.29 are therefore not predicted to suffer a significant decline in bird fitness at a population level. Indeed, the displacement assessment analysis showed the magnitude of the increase in mortality to be negligible and below the 1% threshold increase for the species assessed in Table 5.23 to Table 5.28.
- 5.7.2.99 For common guillemot, negligible was selected from the negligible to minor range (Table 5.20) due to the impact not exceeding a 0.8% increase in baseline mortality. For razorbill, northern gannet, black-legged kittiwake and Manx shearwater, negligible was selected from the negligible to minor range due to the impact not exceeding a 0.1% increase in baseline mortality and hence, was not regarded as a minor significance of effect.

Table 5.29: Table summarising the significance of effect during construction.

Species	Magnitude of impact	Sensitivity of receptor	Significance of effect
Common guillemot	Negligible	Medium	Negligible, not significant in EIA terms
Razorbill	Negligible	Medium	Negligible, not significant in EIA terms
Atlantic puffin	Negligible	High	Minor adverse, not significant in EIA terms
Northern gannet	Negligible	Medium	Negligible, not significant in EIA terms
Black-legged kittiwake	Negligible	Medium	Negligible, not significant in EIA terms
Manx shearwater	Negligible	Medium	Negligible, not significant in EIA terms
Common scoter	Negligible	High	Minor adverse, not significant in EIA terms
Red-throated diver	Negligible	High	Minor adverse, not significant in EIA terms

Operations and maintenance phase

Magnitude of impact

Mona Offshore Ornithology Offshore Cable Corridor

- 5.7.2.100 Routine inspections of the export cable are estimated to occur once per year, with a maximum of two repairs every five years per export cable for the lifetime of the project. It is estimated that a total of 6.4 km of cable repairs would occur per year, with a maximum of eight vessel trips per year (Table 5.21). One reburial even is estimated to occur every five years, with approximately 15 km per reburial event.
- 5.7.2.101 The potential for disturbance and displacement from such activities will be very restricted both temporally and spatially. Whilst unscheduled repair events may occur at any time of year, they are expected to be very rare occurrences. Any scheduled repairs would cause minimal disturbance and displacement which would be spatially restricted to the vicinity of the repair site and access routes, and temporally restricted to the time taken to conduct the repairs. Repairs will generally be undertaken in the shortest timespan possible in order to limit disruption.

Mona Offshore Ornithology Array Area

Common scoter

- 5.7.2.102 There was no common scoter recorded within the Mona Array Area plus 4 km buffer (or during the DAS) and impact therefore magnitude is considered to be **negligible**.

Red-throated diver

- 5.7.2.103 There was no red-throated diver recorded within the Mona Array Area plus 4 km buffer (or during the DAS) and impact therefore magnitude is considered to be **negligible**.

Common guillemot

- 5.7.2.104 The estimated mortality (when considering a displacement rate of 30% to 70% and a mortality rate of 1% to 10%) resulting from displacement during the operations and maintenance phase was assessed for each bio-season and for the combined bio-seasons (Table 5.30) as detailed in Volume 6, Annex 5.2: Offshore ornithology displacement technical report of the Environmental Statement (Document reference F6.5.2).
- 5.7.2.105 In the non-breeding bio-seasons and annually, the predicted increase in the baseline mortality rate does not surpass the 1% threshold increase.
- 5.7.2.106 However, during the breeding bio-season using the unlikely scenario of 70% displacement and 10% mortality, an increase in baseline mortality greater than 1% is predicted (Table 5.30). However, recent evidence from the Beatrice Offshore Wind Farm suggests that 70% displacement and 10% mortality rates are overly precautionary and that common guillemot continued to use the area around Beatrice Offshore Wind Farm regardless of turbine operational status (MacArthur Green, 2023). Taking a more realistic 50% displacement and 5% mortality, the increase in baseline mortality would be 0.52% and therefore below the 1% threshold.
- 5.7.2.107 However, as a precaution, a Population Viability Analysis (PVA) was undertaken for common guillemot to investigate the increase in mortality to two SSSI breeding colonies Pen-y-Gogarth/Great Orme SSSI and Creigiau Rhiwledyn/Little Ormes Head

MONA OFFSHORE WIND PROJECT

SSSI. Full details of the PVA findings are found in Volume 6, Annex 5.6: Offshore ornithology population viability analysis technical report of the Environmental Statement (Document reference F6.5.6).

- 5.7.2.108 The PVA for common guillemot at Pen-y-Gogarth/Great Orme SSSI revealed that the most extreme scenario of 70% displacement and 10% mortality would reduce the unimpacted baseline population growth rate by 0.015 which would result in a maximum reduction in population increase of 91.90% after 35 years. The more likely scenario of 50% displacement and 1% mortality would result in a growth rate reduction of 0.001 and a reduction in population increase of 8.41%. In all scenarios modelled (displacement rate 30% to 70%, mortality rate 1% to 10%), a positive population growth rate was sustained (1.0 to 1.02) indicating that the population is predicted to be growing and will be 36.1% to 123.0% larger than the current size after 35 years.
- 5.7.2.109 The PVA for common guillemot at Creigiau Rhiwledyn/Little Ormes Head SSSI revealed that the most extreme scenario of 70% displacement and 10% mortality would reduce the unimpacted baseline population growth rate by 0.014 which would result in a maximum reduction in population increase of 90.68% after 35 years. The more likely scenario of 50% displacement and 1% mortality would result in a growth rate reduction of 0.001 and a reduction in population increase by 8.32%. In all scenarios modelled, a positive population growth rate was sustained (1.01 to 1.02) indicating that the population is predicted to be growing and will be 37.1% to 123.3% larger than the current size after 35 years.
- 5.7.2.110 The impact is predicted to be of local spatial extent, medium-term duration, continuous and reversible. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**.

Table 5.30: Common guillemot bio-seasons and annual displacement estimates for the Mona Array Area plus 2 km buffer during the operations and maintenance phase.

Bio-season	Seasonal Abundance (Mona Array Area + 2 km buffer)	Regional Baseline Population		Number of common guillemot subject to mortality (no. of indiv.)	Increase in baseline mortality (%)
		Population	Baseline Mortality		
Breeding (March to July)	4,220	136,680	18,178	13 to 295	0.072 to 1.623
Non-breeding (August to February)	3,756	1,139,220	151,516	11 to 263	0.007 to 0.174
Annual	7,976	1,139,220	151,516	24 to 558	0.015 to 0.368

Razorbill

- 5.7.2.111 The estimated mortality (when considering a displacement rate of 30% to 70% and a mortality rate of 1% to 10%) resulting from displacement during the operations and maintenance phase was assessed for each bio-season and for the combined bio-seasons (Table 5.31) as detailed in Volume 6, Annex 5.2: Offshore ornithology displacement technical report of the Environmental Statement (Document reference F6.5.2).
- 5.7.2.112 In all bio-seasons and for all bio-seasons combined, the predicted increase in the baseline mortality rate does not surpass the 1% threshold increase.

MONA OFFSHORE WIND PROJECT

5.7.2.113 The impact is predicted to be of local spatial extent, medium-term duration, continuous and reversible. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **negligible**.

Table 5.31: Razorbill bio-seasons and annual displacement estimates for the Mona Array Area plus 2 km buffer during the operations and maintenance phase.

Bio-season	Seasonal Abundance (Mona Array Area + 2 km buffer)	Regional Baseline Population		Number of razorbill subject to mortality (indiv.)	Increase in baseline mortality (%)
		Population	Baseline Mortality		
Spring migration (January to March)	1,924	606,914	104,389	6 to 135	0.006 to 0.129
Breeding (April to July)	83	18,345	3,155	0 to 6	0.000 to 0.190
Autumn migration (August to October)	91	606,914	104,389	0 to 6	0.000 to 0.006
Non-breeding (November to December)	421	341,422	58,725	1 to 29	0.002 to 0.049
Annual	2,519	606,914	104,389	8 to 176	0.007 to 0.169

Atlantic puffin

5.7.2.114 The estimated mortality (when considering a displacement rate of 30% to 70% and a mortality rate of 1% to 10%) resulting from displacement during the operations and maintenance phase was assessed for each bio-season and for the combined bio-seasons (Table 5.32) as detailed in Volume 6, Annex 5.2: Offshore ornithology displacement technical report of the Environmental Statement (Document reference F6.5.2).

5.7.2.115 In both bio-seasons and for all bio-seasons combined, the predicted increase in baseline mortality does not surpass the 1% increase threshold.

5.7.2.116 The impact is predicted to be of local spatial extent, medium-term duration, continuous and reversible. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **negligible**.

MONA OFFSHORE WIND PROJECT

Table 5.32: Atlantic puffin bio-seasons and annual displacement estimates for the Mona Array Area plus 2 km buffer during the operations and maintenance phase.

Bio-season	Seasonal Abundance (Mona Array Area + 2 km buffer)	Regional Baseline Population		Number of Atlantic puffin subject to mortality (indiv.)	Increase in baseline mortality (%)
		Population	Baseline Mortality		
Breeding (April to August)	15	203,302	35,781	0 to 1	0.000 to 0.003
Non-breeding (September to March)	22	304,557	53,602	0 to 2	0.000 to 0.003
Annual	37	304,557	53,602	0 to 3	0.000 to 0.005

Northern gannet

5.7.2.117 The estimated mortality (when considering a displacement rate of 60% to 80% and a mortality rate of 1% to 10%) resulting from displacement during the operations and maintenance phase was assessed for each bio-season and for the combined bio-seasons (Table 5.33) as detailed in Volume 6, Annex 5.2: Offshore ornithology displacement technical report of the Environmental Statement (Document reference F6.5.2).

5.7.2.118 In all three bio-seasons (spring, breeding and autumn) and for the bio-seasons combined, the predicted increase in baseline mortalities remains well below the 1% increase threshold.

5.7.2.119 The impact is predicted to be of local spatial extent, medium-term duration, continuous and reversible. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **negligible**.

Table 5.33: Northern gannet bio-seasons and annual displacement estimates for the Mona Array Area plus 2 km buffer during the operations and maintenance phase.

Bio-season	Seasonal Abundance (Mona Array Area + 2 km buffer)	Regional Baseline Population		Number of Northern gannet subject to mortality (indiv.)	Increase in baseline mortality (%)
		Population	Baseline Mortality		
Spring migration (December to February)	28	661,888	127,744	0 to 2	0.000 to 0.002
Breeding (March to September)	251	552,522 888	406,707 100,917	2 to 20	0.002 to 0.049 0.020
Autumn migration (October to November)	58	545,954	105,369	0 to 5	0.000 to 0.005
Annual	336	661,888	127,744	2 to 27	0.002 to 0.021

MONA OFFSHORE WIND PROJECT
Black-legged kittiwake

- 5.7.2.120 The estimated mortality (when considering a displacement rate of 30% to 70% and a mortality rate of 1% to 10%) resulting from displacement during the operations and maintenance phase was assessed for each bio-season and for the combined bio-seasons (Table 5.34) as detailed in Volume 6, Annex 5.2: Offshore ornithology displacement technical report of the Environmental Statement (Document reference F6.5.2).
- 5.7.2.121 There is no consensus between the SNCBs regarding the inclusion of a displacement assessment for black-legged kittiwake; however, one is presented here for precaution and for the SNCBs that have requested this information.
- 5.7.2.122 In all three bio-seasons (spring, breeding and autumn) and all bio-seasons combined, the predicted increase in baseline mortalities remains well below the 1% increase threshold.
- 5.7.2.123 The impact is predicted to be of local spatial extent, medium-term duration, continuous and reversible. It is predicted that the impact will affect the receptor directly. The magnitude is, therefore, considered to be **negligible**.

Table 5.34: Black-legged kittiwake bio-seasons and annual displacement estimates for the Mona Array Area plus 2 km buffer during the operations and maintenance phase.

Bio-season	Seasonal Abundance (Mona Array Area + 2 km buffer)	Regional Baseline Population		Number of Black-legged kittiwake subject to mortality (indiv.)	Increase in baseline mortality (%)
		Population	Baseline Mortality		
Spring migration (January to February)	574	691,526	107,878	3 to 40	0.003 to 0.037
Breeding (March to August)	726	156,679	24,442	2 to 51	0.0094 to 0.208
Autumn migration (September to December)	560	911,586	142,207	2 to 39	0.001 to 0.027
Annual	1,860	911,586	142,207	6 to 130	0.004 to 0.092

Manx shearwater

- 5.7.2.124 The estimated mortality (when considering a displacement rate of 30% to 70% and a mortality rate of 1% to 10%) resulting from displacement during the operations and maintenance phase was assessed for each bio-season and for the combined bio-seasons (Table 5.35) as detailed in Volume 6, Annex 5.2: Offshore ornithology displacement technical report of the Environmental Statement (Document reference F6.5.2).
- 5.7.2.125 In all three bio-seasons (spring, breeding season and autumn migration) and for all bio-seasons combined, the predicted increase in baseline mortalities does not surpass the 1% increase threshold.

MONA OFFSHORE WIND PROJECT

5.7.2.126 The impact is predicted to be of local spatial extent, medium-term duration, continuous and reversible. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **negligible**.

Table 5.35: Manx shearwater bio-seasons and annual displacement estimates for the Mona Array Area plus 2 km buffer during the operations and maintenance phase.

Bio-season	Seasonal Abundance (Mona Array Area + 2 km buffer)	Regional Baseline Population		Number of Manx shearwater subject to mortality (indiv.)	Increase in baseline mortality (%)
		Population	Baseline Mortality		
Spring migration (March)	63	1,580,895	205,516	0 to 0	0.000 to 0.000
Breeding (April to August)	1,249	1,821,544	236,801	4 to 87	0.002 to 0.037
Autumn migration (September to October)	16	1,580,895	205,516	0 to 1	0.000 to 0.000
Annual	1,274,268	1,821,544	236,801	4 to 89	0.002 to 0.038

Sensitivity of receptor

Common scoter

- 5.7.2.127 Common scoter are very vulnerable to disturbance and displacement caused by offshore wind farms. The species has a score of five (out of five) for displacement due to vessels (Wade *et al.*, 2016).
- 5.7.2.128 Common scoter present within the Mona Offshore Cable Corridor are likely to be part of the Liverpool Bay SPA and therefore, the species is considered to be of high value.
- 5.7.2.129 The wintering population within the UK is increasing at the latest SPA review in the short and long-term (Stroud *et al.*, 2016) and therefore it's considered wintering common scoter have a medium recoverability.
- 5.7.2.130 Common scoter is deemed to be of high vulnerability, medium recoverability and high value. The sensitivity of the receptor is therefore, considered to be **high**.

Red-throated diver

- 5.7.2.131 Red-throated diver are very vulnerable to disturbance and displacement caused by offshore wind farms. The species has a score of five (out of five) for displacement due to vessels (Wade *et al.*, 2016).
- 5.7.2.132 Red-throated diver present within the Mona Offshore Cable Corridor are likely to be part of the Liverpool Bay SPA and therefore, the species is considered to be of high value.
- 5.7.2.133 The wintering population within the UK is increasing at the latest SPA review over the short-term (unknown over the long-term) (Stroud *et al.*, 2016) and therefore it's considered wintering common scoter have a medium recoverability.

MONA OFFSHORE WIND PROJECT

5.7.2.134 Red-throated diver is deemed to be of high vulnerability, medium recoverability and medium value. The sensitivity of the receptor is therefore, considered to be **high**.

Common guillemot

5.7.2.135 Common guillemot is considered to have a high vulnerability to displacement from offshore wind farms, being assigned a score of four (out of five) by Wade *et al.* (2016).

5.7.2.136 Although the species has a low reproductive success (i.e., laying one egg and not breeding until five years old; Robinson, 2005), common guillemot have a medium recoverability given their increasing trend in abundance and productivity in the UK (JNCC, 2020).

5.7.2.137 Common guillemot is a qualifying interest for several SPAs likely to be connected to the Mona Array Area (within the mean-max + SD foraging range), however as large colonies from non-SPA sites are also within close proximity (e.g. St Bee's Head) the species is considered to be of medium value.

5.7.2.138 Common guillemot is deemed to be of high vulnerability, medium recoverability and medium value. The sensitivity of the receptor is, therefore, considered to be **medium**.

Razorbill

5.7.2.139 Razorbill is considered to have a high vulnerability to displacement from offshore wind farms, being assigned a score of four (out of five) by Wade *et al.* (2016).

5.7.2.140 Although the species has a low reproductive success (Robinson, 2005), razorbill are deemed to have a medium recoverability given their increasing trend in abundance in the UK (JNCC, 2020).

5.7.2.141 Razorbill is a qualifying interest for several SPAs likely to be connected to the Mona Array Area (within the mean-max + SD foraging range), however as several non-SPA colonies are also within range of the Mona Array Area, the species is considered to be of medium value.

5.7.2.142 Razorbill is deemed to be of high vulnerability, medium recoverability and medium value. The sensitivity of the receptor is therefore, considered to be **medium**.

Atlantic puffin

5.7.2.143 Atlantic puffin is considered to have a medium vulnerability to displacement from offshore wind farms, being assigned a score of three (out of five) by Wade *et al.* (2016).

5.7.2.144 Although the species has a low reproductive success (i.e. laying one egg and not breeding until five years old) (Robinson, 2005), Atlantic puffin are deemed to have a low recoverability given the lack of up-to-date census of the size of the UK breeding population and the overall declining trend in abundance (1986 to 2018) (JNCC, 2020).

5.7.2.145 As Atlantic puffin is a qualifying interest for several SPAs likely to be connected to the Mona Array Area (within the mean-max + SD foraging range) the species is considered to be of high value.

5.7.2.146 Atlantic puffin is deemed to be of medium vulnerability, low recoverability and high value. The sensitivity of the receptor is therefore, considered to be **high**.

Northern gannet

5.7.2.147 In terms of behavioural response to offshore wind farm structures, northern gannet are considered to be of high vulnerability, with a score of four (out of five) assigned by

MONA OFFSHORE WIND PROJECT

Wade *et al.* (2016). During the breeding season, northern gannet showed a strong avoidance of offshore wind farms (Peschko *et al.*, 2021).

5.7.2.148 Northern gannet is a qualifying interest for several SPAs likely to be connected to the Mona Array Area (within the mean-max + SD foraging range), with a large non-SPA colony within close proximity (Monreith Cliffs and Scar Rocks), the species is therefore considered to be of medium value.

5.7.2.149 Although northern gannet has a low reproductive success (only laying one egg) and does not breed until five years old (Robinson, 2005), the species is deemed to have a medium recoverability given the consistent increasing trend in abundance since the 1990s (JNCC, 2020). However, the species has suffered from the outbreak of avian flu during the 2022 breeding season.

5.7.2.150 Northern gannet is deemed to be of high vulnerability, medium recoverability and medium value. The sensitivity of the receptor is therefore, considered to be **medium**.

Black-legged kittiwake

5.7.2.151 In terms of behavioural response to offshore wind farm structures, black-legged kittiwake are considered to be of low vulnerability, with a score of two (out of five) assigned by Wade *et al.* (2016).

5.7.2.152 Black-legged kittiwake is a qualifying interest for several SPAs likely to be connected to the Mona Array Area (within the mean-max + SD foraging range), with several non-SPA colonies within range and so the species is considered to be of medium value.

5.7.2.153 Although the reproductive success of black-legged kittiwake is higher (i.e. laying two eggs and breeding until four years old) than auk species and northern gannet (Robinson, 2005), the species is deemed to have a low recoverability given the continuing decline in abundance observed between 1986 and 2018 in the UK (JNCC, 2020). During this period, breeding productivity has declined as the result of food shortage, although it has stabilised in recent years (JNCC, 2020).

5.7.2.154 Black-legged kittiwake is deemed to be of low vulnerability, low recoverability and medium value. The sensitivity of the receptor is therefore, considered to be **medium**.

Manx shearwater

5.7.2.155 In terms of behavioural responses to vessels and helicopters at offshore wind farms, Manx shearwater are considered to be of very low vulnerability to displacement (score of one) by Wade *et al.* (2016).

5.7.2.156 Owing to their large foraging range, Manx shearwater is a qualifying interest for several SPAs likely to be connected to the Mona Array Area (within the mean-max + SD foraging range). Most of the world population is found in the UK and over 90% of the UK population is found on the Islands of Rum and Eigg (Scotland) and Skomer and Skokholm (Wales) (Mitchell *et al.*, 2004; JNCC, 2020). Therefore, the species is considered to be of high value.

5.7.2.157 Manx shearwater has a low reproductive success (i.e. only laying one egg and not breeding until five years old) (Robinson, 2005). There is an incomplete spatial-temporal coverage of breeding abundance at UK colonies and thus a lack of long-term trend (JNCC, 2020). In the light of uncertainly and low reproductive success, Manx shearwater are therefore deemed to have a medium recoverability.

5.7.2.158 Manx shearwater is deemed to be of low vulnerability, medium recoverability and high value. The sensitivity of the receptor is therefore, considered to be **medium**.

Significance of effect

5.7.2.159 The displacement assessment analysis showed the magnitude of the increase in mortality to be negligible and below the 1% threshold increase for the species assessed in Table 5.30 to Table 5.35. A summary of the significant of disturbance and displacement during the operations and maintenance phase of the Mona Array Area is provided in Table 5.36. For Atlantic puffin negligible was selected from the negligible to minor range due to the impact not exceeding a 0.5 % increase in baseline mortality. Additionally, the population is vast with a change in baseline mortality greater than 0.1% would be unnoticeable and hence, was not regarded as a minor significance of effect. For northern gannet, black-legged kittiwake, Manx shearwater, common scoter and red-throated diver, negligible was selected from the negligible to minor range due to the impact not exceeding a 0.1% increase in baseline mortality and hence, was not regarded as a minor significance of effect.

Table 5.36: Table summarising the significance of effect during the operations and maintenance phase.

Species	Magnitude of impact	Sensitivity of receptor	Significance of effect
Common guillemot	Low	Medium	Minor adverse, not significant in EIA terms
Razorbill	Negligible	Medium	Negligible, not significant in EIA terms
Atlantic puffin	Negligible	High	Negligible, not significant in EIA terms
Northern gannet	Negligible	Medium	Negligible, not significant in EIA terms
Black-legged kittiwake	Negligible	Medium	Negligible, not significant in EIA terms
Manx shearwater	Negligible	Medium	Negligible, not significant in EIA terms
Common scoter	Negligible	High	Negligible, not significant in EIA terms
Red-throated diver	Negligible	High	Negligible, not significant in EIA terms

Decommissioning phase

5.7.2.160 Decommissioning activities within the Mona Array Area are equal to or less than those carried out during the construction phase within the Mona Array Area. Therefore, for the purpose of this assessment it is assumed that the level of disturbance is likely to be similar and the potential impact on each species is deemed to be reversible in the short-term as birds are likely to return when activities have been completed.

All receptors

5.7.2.161 Overall, the magnitude of the impact during decommissioning is deemed to be negligible and the sensitivity of the receptor is considered to be medium to high, depending on the species. The effect will, therefore, be of **negligible** or **minor** adverse significance, which is not significant in EIA terms.

5.7.3 Indirect impacts from underwater sound affecting prey species

5.7.3.1 Potential effects on the fish assemblages during the construction and decommissioning phases of the Mona Offshore Wind Project, as identified in Volume

MONA OFFSHORE WIND PROJECT

2, Chapter 3: Fish and shellfish ecology of the Environmental Statement (Document reference F2.3), may have indirect effects on offshore ornithology receptors.

- 5.7.3.2 Herring and sandeel are sensitive to offshore wind development (including underwater sound). Both species are listed as main prey items for several seabird species (Cramp and Simmons, 1983). Volume 2, Chapter 3: Fish and shellfish ecology of the Environmental Statement (Document reference F2.3) detailed the findings of the desktop studies in the Mona Fish and Shellfish Ecology study area. High and low intensity sandeel spawning grounds have been identified by Ellis *et al.* (2012) as being present throughout the Mona Fish and Shellfish Ecology study area. Herring spawning grounds have also been identified by Coull *et al.* (1998) as being present within the Mona Fish and Shellfish Ecology study area. The overlap of possible spawning grounds with the Mona Array Area has the potential to indirectly affect the distribution of seabirds, in particular the species showing a high level of specialisation which feed predominantly on young herring and sandeel.
- 5.7.3.3 Underwater sound produced during piling activities and cable installation during the construction phase may impact upon the availability of prey items. Indeed, underwater sound may cause fish and mobile invertebrates to avoid the construction area. Underwater sound may also affect the physiology and behaviour of fish and mobile invertebrates.
- 5.7.3.4 Species were screened and progressed for the assessment of significance on the basis of habitat specialisation (using scoring from Wade *et al.*, 2016), knowledge of the prey species targeted by each species (Cramp and Simmons, 1983) and their abundance in the Mona Array Area.
- 5.7.3.5 Because the auk species (i.e. Atlantic puffin, razorbill and common guillemot) foraging behaviour and prey species are similar, the species are considered together for the purpose of the assessment of significance.

Table 5.37: Species considered for assessment of underwater sound affecting prey species based on habitat specialisation score (Wade *et al.*, 2016).

Ornithological receptor	Habitat specialisation	Abundance recorded in the Mona Array Area	Assessed for significance
Arctic skua	Low	Very Low	No
Arctic tern	Medium	Very Low	No
Atlantic puffin	Medium	Low	Yes
Black-headed gull	Low	Very Low	No
Black-legged kittiwake	Low	High	No
Common guillemot	Medium	Very high	Yes
Common gull	Low	Low	No
Common scoter	High	Absent	No
Common tern	Medium	Very low	No
European shag	Low	Very low	No
Great black-backed gull	Low	Moderate	No
Great cormorant	Medium	Very low	No
Great skua	Low	Very low	No

MONA OFFSHORE WIND PROJECT

Ornithological receptor	Habitat specialisation	Abundance recorded in the Mona Array Area	Assessed for significance
Herring gull	Very low	Low	No
Leach's storm-petrel	Very low	Very low	No
Lesser black-backed gull	Very low	Low	No
Little gull	N/A	Low	No
Manx shearwater	Very low	Moderate	No
Northern gannet	Very low	High	No
Northern fulmar	Very low	Moderate	No
Razorbill	Medium	High	Yes
Red-throated diver	High	Very low	No
Sandwich tern	Medium	Very low	No

Construction phase

Magnitude of impact

Auk species (common guillemot, razorbill and Atlantic puffin)

- 5.7.3.6 Auks directly responding to visual cues are likely to be displaced during construction; the magnitude of the impact on the baseline mortality has been assessed using a displacement assessment matrix in section 5.7.2. However, in addition to direct visual disturbance, birds may be indirectly displaced due to a reduction in prey availability. Because of the short-term duration of the construction work and localised nature, it is however expected that birds will be able to re-settle in the Mona Array Area or beyond.
- 5.7.3.7 In the absence of quantitative information available, the magnitude is considered qualitatively and taking into consideration the assessment of significance presented in Volume 2, Chapter 3: Fish and shellfish ecology of the Environmental Statement (Document reference F2.3), which concluded of moderate adverse significance for herring and cod and minor adverse for sprat and sandeel.
- 5.7.3.8 The impact is predicted to be of local spatial extent, short-duration, intermittent and reversible. It is predicted that the impact will affect the receptor indirectly. The magnitude is therefore, considered to be **low**.

Sensitivity of the receptor

Auk species (common guillemot, razorbill and Atlantic puffin)

- 5.7.3.9 Although the impact of underwater sound on fish has been well studied, there is no published evidence to our knowledge linking reduction of prey availability to avoidance/displacement of seabirds. In absence of information on vulnerability to underwater sound and reduction of prey availability at offshore wind farms, all species were considered to have a medium vulnerability.

MONA OFFSHORE WIND PROJECT

- 5.7.3.10 Auk species have a low reproductive success (Robinson, 2005), and a low to medium recoverability given their increasing trend in abundance, particularly common guillemot and razorbill (JNCC, 2020).
- 5.7.3.11 As all three species are qualifying interests for several SPAs likely to be connected to the Mona Array Area (within the mean-max + SD foraging range) the species were considered to be of high value.
- 5.7.3.12 Auk species are deemed to be of medium vulnerability, low to medium recoverability and high value. The sensitivity of the receptor is therefore, considered to be **medium**.

Significance of the effect

Auk species (common guillemot, razorbill and Atlantic puffin)

- 5.7.3.13 Overall, the magnitude of the impact is deemed to be low, and the sensitivity of the receptors is considered to be medium. The effect will, therefore, be of **minor** adverse significance, which is not significant in EIA terms.

Decommissioning phase

- 5.7.3.14 Decommissioning activities within the Mona Array Area are equal to or less than those carried out during the construction phase. Therefore, for the purpose of this assessment it is assumed that the level of disturbance is likely to be similar and the potential impact is deemed to be reversible in the short-term as birds are likely to return when activities have been completed.

Significance of the effect

Auk species (common guillemot, razorbill and Atlantic puffin)

- 5.7.3.15 Overall, the magnitude of the impact is deemed to be negligible and the sensitivity of the receptors is considered to be medium to high. The effect will, therefore, be of **minor** adverse significance, which is not significant in EIA terms.

5.7.4 Temporary habitat loss/disturbance and increased suspended sediment concentrations (SSCs)

Construction phase

- 5.7.4.1 Seabirds may be indirectly disturbed and displaced during the construction phase as a result of direct impacts on habitat and increased SSCs, which may result in the loss of a food resource to birds in the Mona Array Area and along the Mona Offshore Cable Corridor and Access Areas.
- 5.7.4.2 As a result, displaced seabirds may move to areas already occupied by other birds and thus face higher intra/inter-specific competition due to a higher density of individuals competing for the same resource. Alternatively, displaced birds may be forced to move into areas of lower quality (e.g. areas of lower prey availability). Such disturbance and resulting displacement could ultimately affect their demographic fitness (i.e. survival rates and breeding productivity) as well as potentially impacting on other birds in areas that displaced birds move to.
- 5.7.4.3 The potential construction phase impacts on fish and shellfish receptors are provided in Volume 2, Chapter 3: Fish and shellfish ecology of the Environmental Statement (Document reference F2.3) and include temporary subtidal habitat loss/disturbance and increased SSCs and associated sediment deposition.

Magnitude of impact

All receptors

- 5.7.4.4 The increase in SSCs may lead to a short-term avoidance of affected areas that support fish and shellfish species which are susceptible to respond increase SSCs. However, many fish and shellfish species are considered to be tolerant of turbid environments and regularly experience changes in the SSC due to the natural variability in the Irish Sea.
- 5.7.4.5 In the absence of quantitative information available, the magnitude is considered qualitatively and taking into consideration the assessment of significance on marine fish species presented in Volume 2, Chapter 3: Fish and shellfish ecology of the Environmental Statement (Document reference F2.3), which concluded of minor adverse significance, which is not significant in EIA terms.
- 5.7.4.6 Temporary habitat loss could potentially affect spawning, nursery or feeding grounds of fish and shellfish receptors, with demersal fish and shellfish, and demersal spawning species the most vulnerable. The MDS assessed in Volume 2, Chapter 3: Fish and shellfish ecology of the Environmental Statement (Document reference F2.3) represented a very small proportion of the Mona Offshore Wind Project.
- 5.7.4.7 The impact is predicted to be of local spatial extent, short-duration, intermittent and reversible. It is predicted that the impact will affect the receptor indirectly. The magnitude is therefore, considered to be **negligible**.

Sensitivity of the receptor

All receptors

- 5.7.4.8 Seabirds are deemed to be of medium vulnerability, medium recoverability and medium to high value. The sensitivity of the receptor is therefore, considered to be **medium**.

Significance of the effect

All receptors

- 5.7.4.9 Overall, the magnitude of the impact is deemed to be negligible, and the sensitivity of the receptors is considered to be medium. The effect will, therefore, be of **minor** adverse significance, which is not significant in EIA terms.

Operations and maintenance phase

Magnitude of impact

All receptors

- 5.7.4.10 Maintenance activities within the Mona Array Area may lead to increases in SSCs and associated sediment deposition over the operational lifetime of the Mona Offshore Wind Project. The magnitude of the impacts would be a small fraction of those quantified for the construction phase.
- 5.7.4.11 The impact is predicted to be of local spatial extent, short-duration, intermittent and reversible. It is predicted that the impact will affect the receptor indirectly. The magnitude is therefore, considered to be **negligible**.

Sensitivity of the receptor

All receptors

- 5.7.4.12 Seabirds are deemed to be of medium vulnerability, medium recoverability and high value. The sensitivity of the receptor is therefore, considered to be **medium**.

Significance of the effect

All receptors

- 5.7.4.13 Overall, the magnitude of the impact is deemed to be negligible, and the sensitivity of the receptors is considered to be medium. The effect will, therefore, be of **minor** adverse significance, which is not significant in EIA terms.

Decommissioning phase

- 5.7.4.14 Decommissioning activities within the Mona Array Area are equal to or less than those carried out during the construction phase within the Mona Array Area. Therefore, for the purpose of this assessment it is assumed that the level of disturbance is likely to be similar and the potential impact is deemed to be reversible in the short-term as seabirds are likely to return when activities have been completed.

Significance of the effect

All receptors

- 5.7.4.15 Overall, the magnitude of the impact is deemed to be negligible and the sensitivity of the receptors is considered to be high. The effect will, therefore, be of **minor** adverse significance, which is not significant in EIA terms.

5.7.5 Collision risk

- 5.7.5.1 During the operations and maintenance phase of the Mona Offshore Wind Project, the turning rotors of the wind turbines may present a risk of collision for seabirds. Stationary structures, such as the tower, nacelle or when rotors are not operating, are not expected to result in a material risk of collision. When a collision occurs between the turning rotor blade and the bird, it is assumed to result in direct mortality of the bird, which potentially could result in population level impacts.

- 5.7.5.2 The ability of seabirds to detect and manoeuvre around wind turbine blades is a factor that is considered when modelling and assessing the risk. In response to this it is standard practice to calculate differing levels of avoidance for different species or species groups. Avoidance rates are applied to collision risk models to predict levels of impact more realistically, based on available literature and expert advice about seabird behaviour and their flight response to wind turbines.

- 5.7.5.3 Species differ in their susceptibility to collision risk, depending on their flight behaviour and avoidance responses, and the vulnerability of their populations (Garthe and Hüppop, 2004; Furness and Wade, 2012; Wade *et al.*, 2016). As sensitivity to collision differs considerably between species, species were screened and progressed for assessment of significance on the basis of the density of flying birds recorded within the Mona Array Area and consideration of their perceived risk from collision (Garthe and Hüppop, 2004; Furness and Wade, 2012; Wade *et al.*, 2016, Table 5.12).

- 5.7.5.4 Five seabird species were identified as potentially at risk due to their recorded abundance in the Mona Array Area and their likelihood of flying at potential collision height between the lowest and highest sweep of the wind turbine rotor blades above

MONA OFFSHORE WIND PROJECT

sea level. Additionally, consideration was given to species that may not have been accurately captured during baseline DAS due to the diurnal timing of the surveys, with such species likely to be more active during the nocturnal, dusk and dawn periods (e.g. Manx shearwater and northern fulmar). In total, the significance of the collision effect was assessed for seven seabird species. The magnitude of change was determined by calculating the estimated number of collisions with the wind turbines and the resulting percentage increase in the background mortality rate.

- 5.7.5.5 There is the potential that aviation and navigation lighting on wind turbines might attract seabirds and thus increase the risk of collision. Conversely, aviation and navigation lighting could repel birds moving through the Mona Array Area. To our knowledge, there is little published evidence showing the effects of lighting on seabird collision and displacement, although earlier work on seaducks by Desholm and Kahlert (2005) showed that migrating flocks were more prone to enter the offshore wind farm but the higher risk of collision in the dark was counteracted by increasing distance from individual turbines and flying in the corridors between turbines. For true seabirds, there is published evidence showing that seabirds are less active at night compared to daytime (Kotzerka *et al.*, 2010; Furness *et al.*, 2018). Wade *et al.* (2016) ranked vulnerability of seabirds to collision by accounting for the nocturnal activity rate of seabirds.
- 5.7.5.6 CRM was undertaken using the sCRM developed by Marine Scotland (McGregor *et al.*, 2018). The User Guide for the sCRM Shiny App provided by Marine Scotland (Donovan, 2017) has been followed for the modelling of collision impacts predicted for the Mona Array Area. The full methodology is provided in Volume 6, Annex 5.3: Offshore ornithology collision risk technical report of the Environmental Statement (Document reference F6.5.3).
- 5.7.5.7 The collision risk models incorporated draft guidance on recommended avoidance rates, bird size, flight speed, flight type and nocturnal activity scores from Natural England (Natural England, pers. Comm., 7 July 2022). Throughout the document, outputs have been presented alongside recently published parameters from JNCC (Ozanlav-Harris *et al.*, 2023). In some instances, values for certain species (e.g. northern fulmar and Manx shearwater) had not been provided within the Natural England guidance document. sCRM parameters for these species therefore followed best available evidence (e.g. Garthe and Hüppop, 2004; Pennycuick, 1997; Gibb *et al.*, 2017; Robinson, 2005).
- 5.7.5.8 It is acknowledged that migratory passage movements may be ‘missed’ by aerial survey methods. Therefore, a combination of two approaches/tools were followed to quantify the number of birds that may cross the Mona Array Area during migration periods:
- The SOSS Migration Assessment Tool (SOSSMAT) was used to assess the population size of migratory bird species designated as features of the UK SPA network that may cross the Mona Array Area; instructions are given in Wright *et al.* (2012)
 - An approach used in a strategic assessment of collision risk of Scottish offshore wind (WWT Consulting and MacArthur Green, 2014) to estimate proportions of the seabird population likely to pass the Scottish offshore wind farm sites.
- 5.7.5.9 The resulting number of seabird and non-seabirds estimated to cross the Mona Array Area was inputted into the Band (2012) single transit CRM.

MONA OFFSHORE WIND PROJECT

5.7.5.10 The methodology and detailed results of the CRM for 60 migratory birds are provided in Volume 6, Annex 5.4: Offshore ornithology migratory bird collision risk modelling technical report of the Environmental Statement (Document reference F6.5.4).

Operations and maintenance phase

Magnitude of impact

Black-legged kittiwake

5.7.5.11 In all three bio-seasons (pre-breeding, breeding and post breeding) and annually the estimated increase in baseline mortalities remains well below the 1% increase threshold for both the species-group (0.993 ± 0.0003) and species-specific (0.9979 ± 0.0013) avoidance rates. As black-legged kittiwake forage mainly in daytime, aviation and navigation lighting at the Mona Offshore Wind Project is unlikely to result in increasing collision risk.

5.7.5.12 The impact is predicted to be of local spatial extent, medium to long term duration, continuous and reversible. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **negligible**.

Table 5.38: Black-legged kittiwake expected collision mortality across bio-seasons.

Bio-season	Regional baseline population	Baseline mortality	Collision mortality (indiv.) species-group avoidance rate	Collision mortality (indiv.) species-specific avoidance rate	Increase in baseline mortality (%) (species-group avoidance rate)	Increase in baseline mortality (%) (species-specific avoidance rate)
Pre-breeding (January to February)	691,526	107,878	8.74	2.62	0.008	0.002
Breeding (March to August)	156,679	24,442	15.52	4.66	0.063	0.019
Post-breeding (September to December)	911,586	142,207	8.41	2.52	0.006	0.002
Annual	911,586	142,207	32.67	9.80	0.023	0.007

Great black-backed gull

5.7.5.13 In both bio-seasons (breeding and non-breeding) and annually the estimated increase in baseline mortalities remains well below the 1% increase threshold for the species-specific avoidance rate (0.9991 ± 0.0002). However, when using species-group avoidance rate (0.994 ± 0.0004) during the breeding season the increase in baseline mortality is marginally greater than 1%.

5.7.5.14 The impact is predicted to be of local spatial extent, medium to long term duration, continuous and reversible. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**.

MONA OFFSHORE WIND PROJECT
Table 5.39: Great black-backed gull expected additional mortality due to collisions with turbines across bio-seasons.

Bio-season	Regional baseline population	Baseline mortality	Collision mortality (indiv.) species-group avoidance rate	Collision mortality (indiv.) species-specific avoidance rate	Increase in baseline mortality (%) (species-group avoidance rate)	Increase in baseline mortality (%) (species-specific avoidance rate)
Breeding (March to August)	1,496	142	1.67	0.25	1.176	0.176
Non-breeding (September to February)	17,742	1,685	3.16	0.47	0.187	0.028
Annual	17,742	1,685	4.83	0.72	0.287	0.043

European herring gull

- 5.7.5.15 In both bio-seasons (breeding and non-breeding) and for all bio-seasons combined, the estimated increase in baseline mortalities remains well below the 1% increase threshold for both the species-group (0.994 ± 0.0004) and species-specific (0.9952 ± 0.0003) avoidance rates. As gulls forage mainly in daytime, aviation and navigation lighting at the Mona Offshore Wind Project is unlikely to result in increasing collision risk.
- 5.7.5.16 The impact is predicted to be of local spatial extent, medium to long term duration, continuous and reversible. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **negligible**.

MONA OFFSHORE WIND PROJECT

Table 5.40: European herring gull expected additional mortality due to collisions with turbines across bio-seasons.

Bio-season	Regional baseline population	Baseline mortality	Collision mortality (indiv.) species-group avoidance rate	Collision mortality (indiv.) species-specific avoidance rate	Increase in baseline mortality (%) (species-group avoidance rate)	Increase in baseline mortality (%) (species-specific avoidance rate)
Breeding (March to August)	31,214	5,338	0.03	0.02	0.001	<0.001
Non-breeding (September to February)	173,299	29,634	1.48	1.18	0.005	0.004
Annual	173,299	29,634	1.51	1.20	0.005	0.004

Lesser black-backed gull

5.7.5.17 When using an avoidance rate of 0.994 (± 0.0004), the estimated mortalities in all four bio seasons and for all bio-seasons combined were very low and did not surpass the 1% increase threshold for both the species-group (0.994 ± 0.0004) and species-specific (0.9954 ± 0.0003) avoidance rates. As gulls forage mainly in daytime, aviation and navigation lighting at the Mona Offshore Wind Project is unlikely to result in increasing collision risk.

5.7.5.18 The impact is predicted to be of local spatial extent, medium to long term duration, continuous and reversible. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **negligible**.

Table 5.41: Lesser black-backed gull expected additional mortality due to collisions with turbines across bio-seasons.

Bio-season	Regional baseline population	Baseline mortality	Collision mortality (indiv.) species-group avoidance rates	Collision mortality (indiv.) species-specific avoidance rates	Increase in baseline mortality (%) (species-group avoidance rates)	Increase in baseline mortality (%) (species-specific avoidance rates)
Pre-breeding (March)	163,304	19,760	0.83	0.64	0.004	0.003
Breeding (April to August)	109,785	13,284	0.33	0.26	0.002	0.002
Post-breeding (September to October)	163,304	19,760	No predicted collisions		N/A	

MONA OFFSHORE WIND PROJECT

Bio-season	Regional baseline population	Baseline mortality	Collision mortality (indiv.) species-group avoidance rates	Collision mortality (indiv.) species-specific avoidance rates	Increase in baseline mortality (%) (species-group avoidance rates)	Increase in baseline mortality (%) (species-specific avoidance rates)
Non-breeding (November to February)	41,159	4,980	0.76	0.58	0.015	0.012
Annual	163,304	19,760	1.92	1.47	0.010	0.007

Northern gannet

5.7.5.19 In all three bio-seasons (pre-breeding, breeding and post-breeding) and for all bio-seasons combined, the estimated increase in baseline mortality remains well below the 1% increase threshold for the species-group (0.993 ± 0.0003) avoidance rate. As northern gannet forage mainly in daytime, aviation and navigation lighting at the Mona Offshore Wind Project is unlikely to result in increasing collision risk.

5.7.5.20 The impact is predicted to be of local spatial extent, medium to long term duration, continuous and reversible. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **negligible**.

Table 5.42: Northern gannet expected additional mortality due to collisions with turbines across bio-seasons, assuming no displacement.

Bio-season	Regional baseline population	Baseline mortality	Collision mortality (indiv.) species-group avoidance rates	Increase in baseline mortality (%) (species-group avoidance rates)
Pre-breeding (December to February)	661,888	127,744	0.41	<0.001
Breeding (March to September)	552,522 888	106,707 100,917	4.73	0.004 0.005
Post-breeding (October to November)	545,954	105,369	0.51	<0.000
Annual	682,989 661,888	131,817 127,744	5.65	0.004

MONA OFFSHORE WIND PROJECT

Table 5.43: Northern gannet expected additional mortality due to collisions with turbines across bio-seasons, assuming 70% displacement.

Bio-season	Regional baseline population	Baseline mortality	Collision mortality (indiv.) species-group avoidance rates	Increase in baseline mortality (%) (species-group avoidance rates)
Pre-breeding (December to February)	661,888	127,744	0.12	<0.001
Breeding (March to September)	552,522 ,888	406,707 <u>100,917</u>	1.42	0.001
Post-breeding (October to November)	545,954	105,369	0.15	<0.001
Annual	682,989 <u>661,888</u>	431,817 <u>127,744</u>	1.70	0.001

Northern fulmar

5.7.5.21 When using the species-group avoidance rate of 0.991 (± 0.0004), the estimated increase in baseline mortality represents negligible impact in all four bio-seasons and for the combined bio-seasons (Table 5.44). In the absence of quantitative information available on the effect of aviation and navigation lighting on collision risk, the magnitude is considered qualitatively for northern fulmar. Although the species has a higher activity rate than most seabird species, aviation and navigation lighting at the Mona Offshore Wind Project is unlikely to result in increasing collision risk, with very few flights likely to be at collision risk height (Wade *et al.*, 2016).

5.7.5.22 The impact is predicted to be of local spatial extent, medium to long term duration, continuous and reversible. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **negligible**.

Table 5.44: Northern fulmar expected additional mortality due to collisions with turbines across bio-seasons.

Bio-season	Regional baseline population	Baseline mortality	Collision mortality (indiv.) species-group avoidance rates	Increase in baseline mortality (%) (species-group avoidance rates)
Pre-breeding (December)	828,194	183,031	0.03	<0.001
Breeding (January to August)	54,403	12,023	0.32	0.002
Post-breeding (September to October)	828,194	183,031	No predicted collisions	N/A
Non-breeding November	556,367	122,957	0.01	<0.001

MONA OFFSHORE WIND PROJECT

Bio-season	Regional baseline population	Baseline mortality	Collision mortality (individ.) species-group avoidance rates	Increase in baseline mortality (%) (species-group avoidance rates)
Annual	828,194	183,031	0.36	<0.001

Manx shearwater

5.7.5.23 When using the species-group avoidance rate 0.991 (± 0.0004) there are no predicted collisions during the operations phase of the offshore wind farm, and thus no increase in mortality relative to the baseline mortality. In the absence of quantitative information available on the effect of aviation and navigation lighting on collision risk, the magnitude is considered qualitatively for Manx shearwater. Although the species has a high activity rate, aviation and navigation lighting at the Mona Offshore Wind Project is unlikely to result in increasing collision risk, with very few flights likely to be at collision risk height (Wade *et al.*, 2016) with Manx shearwater flying close to the sea surface.

5.7.5.24 The impact is predicted to be of local spatial extent, medium to long term duration, continuous and reversible. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **negligible**.

Table 5.45: Manx shearwater expected additional mortality due to collisions with turbines across bio-seasons.

Bio-season	Regional baseline population	Baseline mortality	Collision mortality (individ.) species-group avoidance rates	Increase in baseline mortality (%) (species-group avoidance rates)
Pre-breeding (March)	1,580,895	205,516	No predicted collisions	N/A
Breeding (April to August)	2,372,485 1,821,544	308,423 236,801	No predicted collisions	N/A
Post-breeding (September to October)	1,580,895	205,516	No predicted collisions	N/A
Annual	2,372,485 1,821,544	308,423 236,801	No predicted collisions	N/A

Migratory birds

5.7.5.25 Predictions for collision risk using a range of avoidance rates are provided in Volume 6, Annex 5.4: Offshore ornithology migratory bird collision risk modelling technical report of the Environmental Statement (Document reference F6.5.4), and the annual collision rate of the assessed species is also presented within Table 5.46.

5.7.5.26 Even assuming a highly precautionary avoidance rate of 98%, the estimated numbers of collisions were low and predicted to be below one bird per annum for all but nine species found to be crossing the Mona Array Area. Details of species assessed and

MONA OFFSHORE WIND PROJECT

the associated increase in baseline mortality as a percentage are provided in Table 5.46. UK population estimates are taken from Woodward *et al.* (2020) unless otherwise stated within Table 5.46.

- 5.7.5.27 Due to their very large biogeographic population size and migration routes through the Irish Sea, wader species were at the greatest risk of collision. From the nine species identified as having an estimated number of collisions greater than one bird per annum, six belonged to the wader group. The three remaining species were duck species.
- 5.7.5.28 Of the wader species/populations considered, oystercatcher (non-breeding), European golden plover (non-breeding), northern lapwing, red knot, dunlin (sub-species *schinzii* and *arctica*) and common snipe were predicted to be above one collision per year (assuming a 98% avoidance rate).
- 5.7.5.29 Of the non-wader species/populations considered three duck species were predicted to be above one collision per year (assuming a 98% avoidance rate), these were Eurasian wigeon, mallard and Eurasian teal.
- 5.7.5.30 In the context of their large populations, the estimated increase in baseline mortalities of both the wader and duck species as the result of collision during migration is expected to be minimal and undetectable given the size of the bio-geographic populations.
- 5.7.5.31 When looking at the predicted increase in baseline mortality, no species are anticipated to experience an increase in baseline mortality greater than 0.03%.
- 5.7.5.32 The impact is predicted to be of local spatial extent, medium to long term duration, continuous and reversible within the short-term. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **negligible**.

MONA OFFSHORE WIND PROJECT
Table 5.46: Summary of collision risk assessment on migratory birds at the Mona Offshore Wind Project.

Note: *denotes species which have had to refer to related species as a proxy for adult baseline mortality rates (goosander used as a proxy for red-breasted merganser, great crested grebe used as a proxy Slavonian grebe, European golden plover used as a proxy for dotterel, common redshank used as a proxy for common greenshank, great skua used as a proxy for pomarine skua and long-tailed skua and long-eared owl used as a proxy for short-eared owl).

Species	UK population	Adult baseline mortality	UK baseline mortality	Avoidance rate (%)	Annual collision rate	Increase in baseline mortality (%)
Tundra swan (Bewick's swan)	4,350	0.178	774	98.0	0.01	0.001
Whooper swan	19,500	0.199	3,881	98.0	0.40	0.010
Greenland white-fronted goose	14,000	0.276	3,864	98.0	0.15	0.004
Light-bellied brent goose (Canadian population)	135,000	0.100	13,500	98.0	0.01	0.0001
Common shelduck	51,000	0.114	5,814	98.0	0.22	0.004
Eurasian wigeon	450,000	0.470	211,500	98.0	1.78	0.001
Gadwall	31,000	0.280	8,680	98.0	0.14	0.002
Eurasian teal	435,000	0.470	204,450	98.0	1.60	0.001
Mallard	675,000	0.373	251,775	98.0	2.89	0.001
Northern pintail	20,000	0.337	6,740	98.0	0.08	0.001
Northern shoveler	19,500	0.420	8,190	98.0	0.08	0.001
Common pochard	29,000	0.350	10,150	98.0	0.12	0.001
Tufted duck	140,000	0.290	40,600	98.0	0.54	0.001
Greater scaup	6,400	0.520	3,328	98.0	0.03	0.001
Long-tailed duck	13,500	0.280	3,780	98.0	0.05	0.001
Common scoter	135,000	0.217	29,295	98.0	0.04	0.0001
Common goldeneye	21,000	0.228	4,788	98.0	0.08	0.002

MONA OFFSHORE WIND PROJECT

Species	UK population	Adult baseline mortality	UK baseline mortality	Avoidance rate (%)	Annual collision rate	Increase in baseline mortality (%)
Red-breasted merganser*	11,000	0.180	1,980	98.0	0.04	0.002
Great northern diver*	2,000 (Forrester <i>et al.</i> 2007)	0.160	320	98.0	0.02	0.006
European storm petrel	27,214 (Wright <i>et al.</i> , 2012)	0.130	3,538	98.0	0.30	0.008
Leach's storm petrel	50,658 (Wright <i>et al.</i> , 2012)	0.120	6,079	98.0	0.75	0.012
Eurasian bittern	795	0.300	239	98.0	0.03	0.013
Great crested grebe*	18,000	0.180	3,240	98.0	0.06	0.002
Horned grebe (Slavonian grebe)*	995	0.180	179	98.0	0.00	0.000
Hen harrier	545	0.190	104	98.0	0.01	0.010
Western osprey	240	0.150	36	98.0	0.01	0.028
Merlin	1,150	0.380	437	98.0	0.01	0.002
Corncrake	1,100	0.714	785	98.0	0.01	0.001
Eurasian oystercatcher (breeding)	95,500	0.120	11,460	98.0	0.57	0.005
Eurasian oystercatcher (non-breeding)	305,000	0.120	36,600	98.0	1.82	0.005
Common ringed plover (breeding)	5,450	0.228	1,243	98.0	0.03	0.002
Common ringed plover (non-breeding)	42,500	0.228	9,690	98.0	0.24	0.002
Eurasian dotterel*	425	0.270	115	98.0	0.00	0.000
European golden plover (breeding)	50,500	0.270	13,635	98.0	0.27	0.002

MONA OFFSHORE WIND PROJECT

Species	UK population	Adult baseline mortality	UK baseline mortality	Avoidance rate (%)	Annual collision rate	Increase in baseline mortality (%)
European golden plover (non-breeding)	410,000	0.270	110,700	98.0	2.22	0.002
Grey plover	33,500	0.140	4,690	98.0	0.20	0.004
Northern lapwing	635,000	0.295	187,325	98.0	3.40	0.002
Red knot	265,000	0.159	42,135	98.0	1.55	0.004
Sanderling	20,500	0.170	3,485	98.0	0.11	0.003
Purple sandpiper	9,900	0.205	2,030	98.0	0.05	0.002
Dunlin (sub-species <i>schinzii</i> and <i>arctica</i>)	350,000	0.260	91,000	98.0	1.77	0.002
Dunlin (sub-species <i>alpina</i>)	35,000	0.260	9,100	98.0	0.24	0.003
Ruff	820	0.476	390	98.0	0.01	0.003
Common snipe	1,100,000	0.519	570,900	98.0	6.16	0.001
Black-tailed godwit (Icelandic race)	41,000	0.060	2,460	98.0	0.26	0.011
Bar-tailed godwit	53,500	0.285	15,248	98.0	0.40	0.003
Whimbrel	310	0.110	34	98.0	0.00	0.000
Eurasian curlew (breeding)	58,500	0.101	5,909	98.0	0.39	0.007
Eurasian curlew (non-breeding)	125,000	0.101	12,625	98.0	0.84	0.007
Common greenshank*	290	0.260	75	98.0	0.00	0.000
Wood sandpiper	68	0.464	32	98.0	0.00	0.000
Common redshank (breeding)	22,000	0.260	5,720	98.0	0.11	0.002

MONA OFFSHORE WIND PROJECT

Species	UK population	Adult baseline mortality	UK baseline mortality	Avoidance rate (%)	Annual collision rate	Increase in baseline mortality (%)
Common redshank (Icelandic race - non-breeding)	100,000	0.260	26,000	98.0	0.52	0.002
Ruddy turnstone	43,000	0.140	6,020	98.0	0.23	0.004
Great skua	9,634 (Wright <i>et al.</i> , 2012)	0.112	1,079	98.0	0.22	0.020
Pomarine skua*	2,000 (Forrester <i>et al.</i> , 2007)	0.112	224	98.0	0.03	0.013
Long-tailed skua*	1,000 (Forrester <i>et al.</i> , 2007)	0.112	112	98.0	0.01	0.009
Black-headed gull	276,028 (Wright <i>et al.</i> , 2012)	0.100	27,603	98.0	0.83	0.003
Short-eared owl*	2,200	0.310	682	98.0	0.03	0.004

Sensitivity of the receptor

Black-legged kittiwake

- 5.7.5.33 Black-legged kittiwake was rated as relatively highly vulnerable to collision impacts by Wade *et al.* (2016), due to the proportion of flights likely to occur at potential risk height and percentage of time in flight.
- 5.7.5.34 Despite a higher reproductive success (i.e. laying two eggs and breeding until four years old) than most seabird species (Robinson, 2005), the species is deemed to have a low recoverability given the continuing decline in abundance observed between 1986 and 2018 in the UK (JNCC, 2020). During this period, breeding productivity has declined as the result of food shortage, although it has stabilised in recent years (JNCC, 2020).
- 5.7.5.35 Black-legged kittiwake is a qualifying interest for several SPAs likely to be connected to the Mona Array Area (within the mean-max + SD foraging range), with several non-SPA colonies within range and so the species is considered to be of medium value.
- 5.7.5.36 Black-legged kittiwake is deemed to be of high vulnerability, low recoverability and medium value. The sensitivity of the receptor is therefore, considered to be **high**.

Great black-backed gull

- 5.7.5.37 Great black-backed gull was rated as one of the most vulnerable seabird species to collision impacts by Wade *et al.* (2016), due to the proportion of flights likely to occur at potential risk height and percentage of time in flight.
- 5.7.5.38 The abundance of breeding great black-backed gull in the UK has changed relatively little between census (JNCC, 2020). The species is deemed to have a medium recoverability due to a low reproductive success and the stable trend in breeding abundance.
- 5.7.5.39 As great black-backed gull is a qualifying interest for several SPAs likely to be connected to the Mona Array Area (within the mean-max + SD foraging range), with a non-SPA colony within range and so the species is considered to be of medium value.
- 5.7.5.40 Great black-backed gull is deemed to be of high vulnerability, medium recoverability and medium value. The sensitivity of the receptor is therefore, considered to be **medium**.

European herring gull

- 5.7.5.41 European herring gull was rated as one of the most vulnerable seabird species to collision impacts by Wade *et al.* (2016), due to the proportion of flights likely to occur at potential risk height and percentage of time in flight.
- 5.7.5.42 As European herring gull is a qualifying interest for several SPAs likely to be connected to the Mona Array Area (within the mean-max + SD foraging range) with multiple non-SPA colonies within range, the species is considered to be of medium value.
- 5.7.5.43 Although European herring gull have a relatively high reproductive success, breeding abundance is declining in the coastal natural nesting population, and this may be indicative of decline in the entire UK breeding population (JNCC, 2020). There is evidence that the urban nesting gull population has increased in recent years, but census of these sites is lacking to derive a UK wide trend that includes both the urban and natural populations. The species is therefore deemed to be of medium recoverability.

MONA OFFSHORE WIND PROJECT

5.7.5.44 European herring gull is deemed to be of high vulnerability, medium recoverability and medium value. The sensitivity of the receptor is therefore, considered to be **medium**.

Lesser black-backed gull

5.7.5.45 Lesser black-backed gull was rated as one of the most vulnerable seabird species to collision impacts by Wade *et al.* (2016), due to the proportion of flights likely to occur at potential risk height and percentage of time in flight.

5.7.5.46 As lesser black-backed gull is a qualifying interest for several SPAs likely to be connected to the Mona Array Area (within the mean-max + SD foraging range), with multiple non-SPA colonies within range, the species is considered to be of medium value.

5.7.5.47 Although lesser black-backed gull has a relatively high reproductive success, the species breeding abundance has exhibited a downward trend over the last 15 to 20 years in the UK (JNCC, 2020). It must be noted that this trend excludes urban nesting gulls from the sample and, therefore, may not be representative of trends in the entire UK population. The species is deemed to be of medium recoverability.

5.7.5.48 Lesser black-backed gull is deemed to be of high vulnerability, medium recoverability and medium value. The sensitivity of the receptor is therefore, considered to be **medium**.

Northern gannet

5.7.5.49 Although the latest scientific guidance showed the species to display a high level of macro-avoidance (Peschko *et al.*, 2021), the species is rated as relatively vulnerable to collision impacts by Wade *et al.* (2016).

5.7.5.50 Northern gannet is a qualifying interest for several SPAs likely to be connected to the Mona Array Area (within the mean-max + SD foraging range), with a large non-SPA colony within close proximity (Monreith Cliffs and Scar Rocks), the species is therefore considered to be of medium value.

5.7.5.51 Although northern gannet has a low reproductive success, the species is deemed to have a medium recoverability given the consistent increasing trend in abundance since the 1990s (JNCC, 2020). It is of note that the species has suffered from the outbreak of avian flu during the 2022 breeding season. The species is deemed to be of medium recoverability.

5.7.5.52 Northern gannet is deemed to be of medium vulnerability, medium recoverability and medium value. The sensitivity of the receptor is therefore, considered to be **medium**.

Northern fulmar

5.7.5.53 Northern fulmar was rated as the least vulnerable seabird to collision impacts by Wade *et al.* (2016).

5.7.5.54 As northern fulmar is a qualifying interest for several SPAs likely to be connected to the Mona Array Area (within the mean-max + SD foraging range) with multiple non-SPAs within range, the species is considered to be of medium value. Furthermore, the northern fulmar population is endemic to the North Atlantic and most breed in Britain and Ireland (Mitchell *et al.*, 2004).

5.7.5.55 The species has a very low reproductive success (Robinson, 2005). Long term trend data suggests that breeding abundance peaked in 1996 (JNCC, 2020) and recent

MONA OFFSHORE WIND PROJECT

declines represent a period of 're-adjustment' following a period of artificially inflated population size. The species is deemed to be of medium recoverability.

- 5.7.5.56 Northern fulmar is deemed to be of low vulnerability, medium recoverability and medium value. The sensitivity of the receptor is therefore, considered to be **low**.

Manx shearwater

- 5.7.5.57 Manx shearwater was rated as the least vulnerable seabirds to collision impacts by Wade *et al.* (2016).

- 5.7.5.58 As Manx shearwater is a qualifying interest for several SPAs likely to be connected to the Mona Array Area (within the mean-max + SD foraging range) the species is considered to be of high value. Furthermore, the Manx shearwater population is endemic to the North Atlantic and most breed in Britain and Ireland (Mitchell *et al.*, 2004).

- 5.7.5.59 The species has a very low reproductive success (Robinson, 2005). Most of the world population is found in the UK and over 90% of the UK population is found on the Islands of Rum and Eigg (Scotland) and Skomer and Skokholm (Wales) (Mitchell *et al.*, 2004; JNCC, 2020). Therefore, the species is considered to be of high value.

- 5.7.5.60 Manx shearwater has a low reproductive success (i.e. only laying one egg and not breeding until five years old; Robinson, 2005). There is an incomplete spatial-temporal coverage of breeding abundance at UK colonies and thus a lack of long-term trend (JNCC, 2020). In the light of uncertainty and low reproductive success, Manx shearwater are therefore deemed to have a medium recoverability.

- 5.7.5.61 Manx shearwater is deemed to be of low vulnerability, medium recoverability and high value. The sensitivity of the receptor is therefore, considered to be **medium**.

Migratory bird species

- 5.7.5.62 Although migratory bird species have not been significantly studied in the offshore environment, vulnerability to collisions is likely to be generally low, since most migration will occur on a broad front and also above rotor height, although during periods of poor weather this risk may increase.

- 5.7.5.63 Recoverability of populations of migrants may vary considerably, with smaller wader species with a relatively favourable conservation status (e.g. dunlin) faring better than larger species with lower reproductive rates (e.g. Eurasian curlew). This assessment of migratory birds included the following migratory seabirds: European storm petrel, Leach's storm petrel, great skua, pomarine skua, long-tailed skua and black-headed gull. On a precautionary basis and for the purposes of this assessment migratory bird species (including seabirds) are assumed to have **medium** sensitivity to collision.

Significance of the effect

- 5.7.5.64 Overall, the magnitude of the collision risk impact at the Mona offshore wind farm is expected to be negligible to low depending on the species (Table 5.47). Although sensitivity of the receptor varies from low to high, the effect is expected to be of **negligible to minor adverse** significance depending on species, which is not significant in EIA terms.

- 5.7.5.65 For great black-backed gull, a minor adverse effect was concluded when using the species-group avoidance rate as the increase in baseline mortality was estimated to be 1.176%. However, the species-specific avoidance rate estimated an increase in baseline mortality of 0.176%, therefore for precaution the higher estimate of impact

MONA OFFSHORE WIND PROJECT

was taken forward to this conclusion of a negligible to minor adverse effect. However, as there are two potential avoidance rates which provided varying outputs and the species-group avoidance rate was only marginally above the 1% threshold (1.176% increase in baseline mortality), no PVA was undertaken for the project alone. A PVA for cumulative collision impact on great black-backed gull was undertaken (see section 5.9.3), which concluded low magnitude of impact, therefore if a project alone PVA was undertaken the same conclusions would be made.

5.7.5.66 For black-legged kittiwake, European herring gull, lesser black-backed gull, northern gannet, northern fulmar and migratory birds, negligible was selected from the negligible to minor range due to the impact not exceeding a 1% increase in baseline mortality and hence, was not regarded as a minor significance of effect.

Table 5.47: Table summarising the significance of effect of collision from the Mona Offshore Wind Project impacts during the operations and maintenance phase.

Species	Magnitude of impact	Sensitivity of receptor	Significance of effect
Black-legged kittiwake	Negligible	High	Negligible, not significant in EIA terms
Great black-backed gull	Low	Medium	Minor adverse, not significant in EIA terms
European herring gull	Negligible	Medium	Negligible, not significant in EIA terms
Lesser black-backed gull	Negligible	Medium	Negligible, not significant in EIA terms
Northern gannet	Negligible	Medium	Negligible, not significant in EIA terms
Northern fulmar	Negligible	Low	Negligible, not significant in EIA terms
Manx shearwater	Negligible	Medium	Negligible, not significant in EIA terms
Migratory birds	Negligible	Medium	Negligible, not significant in EIA terms

5.7.6 Combined displacement and collision risk

Operations and maintenance phase

Magnitude of impact

5.7.6.1 Two species are known to be adversely affected by both displacement and collision during the operations and maintenance phase, these are black-legged kittiwake and northern gannet. Impacts must be combined in order for the true magnitude of impact to be understood. There is no consensus between the SNCBs regarding the inclusion of a displacement assessment for black-legged kittiwake; however, one is presented here for precaution and for the SNCBs that have requested this information.

5.7.6.2 It is recognised that assessing these two potential impacts together could amount to double counting, as birds that are subject to displacement could not be subject to potential collision risk as they are already assumed to have not entered the array area. Equally, birds estimated to be subject to collision risk mortality would not be able to be subjected to displacement consequent mortality as well. As a more refined method to consider displacement and collision together whilst reducing any double counting of impacts is not agreed with SNCBs and therefore the precautionary and highly unlikely approach is presented in this assessment.

MONA OFFSHORE WIND PROJECT

5.7.6.3 Outputs from the impact assessments from disturbance and displacement (section 5.7.2) and collision risk (section 5.7.5) combined are tabulated and presented in Table 5.48.

Table 5.48: Combined displacement and collision cumulative impacts.

Species	Impact	Pre-breeding/Spring Migration	Breeding	Post-breeding/Autumn Migration	Annual
Black-legged kittiwake	Displacement (30 to 70% displacement and 1 to 10% mortality)	3 to 40	2 to 51	2 to 39	6 to 126
	Collisions (species-group avoidance rate)	8.74	15.52	8.41	32.67
	Collisions (species-specific avoidance rate)	2.55	4.53	2.52	9.80
	Combined (minimum estimate)	5.55	6.53	4.52	15.80
	Combined (maximum estimate)	48.74	66.52	47.41	158.67
	Regional population baseline mortality	107,878	24,442	142,207	142,207
	Increase in baseline mortality (%)	0.005 to 0.045	0.026 to 0.272	0.003 to 0.033	0.011 to 0.112
Northern gannet	Displacement (60 to 80% displacement and 1 to 10% mortality)	0 to 2	2 to 20	0 to 5	2 to 27
	Collisions (species-group avoidance rates)	0.41	4.73	0.51	5.65
	Combined (minimum estimate)	0.41	6.73	0.51	7.22
	Combined (maximum estimate)	2.41	26.73	5.51	34.22
	Regional population baseline mortality	127,744	131,817 100,917	105,369	131,817 127,744
	Increase in baseline mortality (%)	<0.001 to 0.002	0.005007 to 0.026026	<0.001 to 0.005	0.005006 to 0.026027

MONA OFFSHORE WIND PROJECT

Black-legged kittiwake

- 5.7.6.4 The combined estimated mortality (when considering a displacement rate of 30% to 70% and a mortality rate of 1% to 10%) and collisions using both species-group and species-specific avoidance rates was assessed for each bio-season and annually (Table 5.48).
- 5.7.6.5 In all three bio-seasons (spring, breeding and autumn) and annually, the predicted increase in baseline mortalities remains well below the 1% increase threshold.
- 5.7.6.6 The impact is predicted to be of local spatial extent, medium-term duration, continuous and reversible. It is predicted that the impact will affect the receptor directly. The magnitude is, therefore, considered to be **negligible**.

Northern gannet

- 5.7.6.7 The combined estimated mortality (when considering a displacement rate of ~~3060~~% to ~~7080~~% and a mortality rate of 1% to 10%) and collisions using the species-group avoidance rate was assessed for each bio-season and annually (Table 5.48).
- 5.7.6.8 In all three bio-seasons (spring, breeding and autumn) and annually, the predicted increase in baseline mortalities remains well below the 1% increase threshold.
- 5.7.6.9 The impact is predicted to be of local spatial extent, medium-term duration, continuous and reversible. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **negligible**.

Sensitivity of the receptor

Black-legged kittiwake

- 5.7.6.10 As previously described in displacement (paragraph 5.7.2.93) and collision (paragraph 5.7.5.36), black-legged kittiwake is deemed to be of overall medium vulnerability, low recoverability and medium value. The sensitivity of the receptor is therefore, considered to be **medium**.

Northern gannet

- 5.7.6.11 As previously described in displacement (paragraph 5.7.2.89) and collision (paragraph 5.7.5.52), northern gannet is deemed to be overall of medium vulnerability, medium recoverability and medium value. The sensitivity of the receptor is therefore, considered to be **medium**.

Significance of the effect

Black-legged kittiwake

- 5.7.6.12 Overall, the magnitude of the combined displacement and collision cumulative impact is low, and the sensitivity of the receptor is medium. The effect will, therefore, be of **minor** adverse significance, which is not significant in EIA terms.

Northern gannet

- 5.7.6.13 Overall, the magnitude of the combined displacement and collision cumulative impact is low and the sensitivity of the receptor is considered to be medium. The effect will, therefore, be of **minor** adverse significance, which is not significant in EIA terms.

MONA OFFSHORE WIND PROJECT

5.7.7 Barrier to movement

- 5.7.7.1 Barrier effects may arise in addition to displacement. Whilst displacement is a reduction in the number of seabirds occurring within or immediately adjacent to an offshore wind farm (Furness *et al.*, 2013), the barrier effect refers to the disruption of preferred flight lines. This might impose an additional energetic cost to movements, particularly during the breeding season when seabirds make daily commutes between foraging grounds at sea and nesting sites. Additional energetic costs could have long-term implications for individuals and impact bird fitness (breeding productivity and survival). Birds may also have to navigate around the offshore wind farms during migratory movements. In the case of migrating birds, avoidance of a single offshore wind farm may be trivial relative to the total length and cost of the journey. There is a general lack of empirical data on the barrier effects for migratory birds.
- 5.7.7.2 For breeding seabirds, in a study of the effects of offshore wind farms as barriers to movement on seabirds of differing morphology, Masden *et al.* (2010) found additional costs, expressed in relation to typical daily energetic expenditures, to be the highest per unit flight for seabirds with high wing loadings, such as cormorants. Most importantly the authors found costs of extra flight to avoid an offshore wind farm to appear to be much less than those imposed by low food abundance or adverse weather, although such costs will be additive to these.
- 5.7.7.3 Although the Mona Array Area lies within the mean-maximum foraging ranges of several breeding colonies, connectivity has to be established to the Mona Array Area and it is unlikely that the site will provide a barrier to foraging movements given that birds generally forage widely within their mean-maximum foraging ranges. The risk of collision (as detailed in paragraph 5.7.5) is deemed to be greater than the risk of barrier effect.
- 5.7.7.4 Because the magnitude of the effect is likely to be similar amongst bird species moving through the area, receptors are grouped in the assessment of the barrier effect.

Operations and maintenance phase

Magnitude of impact

All receptors

- 5.7.7.5 In the absence of quantitative information available, the magnitude is considered qualitatively for breeding seabird and migratory non-seabirds.
- 5.7.7.6 As breeding seabirds generally forage widely within their foraging range of breeding colonies, the Mona Offshore Wind Project is unlikely to form a significant barrier to the movement from any breeding colonies. Furthermore, the Mona Offshore Wind Project is unlikely to form a barrier to the movement of migratory birds given that migratory movements at sea occur over a broad front.
- 5.7.7.7 The impact is predicted to be of local spatial extent, long term duration, continuous and reversible. It is predicted that the impact will affect the receptor directly. Due to the likely absence of any detectable impact on the fitness of individuals and the demography of the populations, the magnitude is therefore, considered to be **negligible**.

Sensitivity of receptor

All receptors

- 5.7.7.8 Seabird species vary in their vulnerability to barrier effects. Some species such as gulls, fulmars, gannets and terns are considered to have a low sensitivity (Maclean *et al.*, 2009). Other species such as divers and auks are considered to have higher sensitivity to barrier effects due to a higher wing-loading (i.e. they have a higher ratio of body weight to wing area and therefore energy expenditure during flight is likely to be higher. These species are notable by their characteristically direct flight paths) compared with other species (Maclean *et al.*, 2009). Evidence from studies at operational offshore wind farms (Everaert and Kuijken, 2007; Krijgsveld *et al.*, 2011; Everaert, 2014) has shown that gulls are unlikely to see wind turbines as a barrier to movement.
- 5.7.7.9 Overall breeding seabirds and migratory non-seabirds are deemed to be of medium vulnerability, medium recoverability and medium value. The sensitivity of the receptor is therefore, considered to be **medium**.

Significance of effect

- 5.7.7.10 Overall, the magnitude of the impact is deemed to be negligible and the sensitivity of the receptor is considered to be medium. The effect will, therefore, be of **negligible** adverse significance, which is not significant in EIA terms.

5.7.8 Future monitoring

- 5.7.8.1 No future monitoring is considered given the level of certainty around the potential effects.

5.8 Cumulative effects assessment methodology

5.8.1 Methodology

- 5.8.1.1 For offshore ornithology, a ZOI has been applied for the CEA to ensure direct and indirect cumulative effects can be appropriately identified and assessed. The ZOI has been defined as the area within the BDMPS region as defined by Furness (2015) following advice from the EWG (Meeting 6 held 19 October 2023).
- 5.8.1.2 The CEA takes into account the impact associated with the Mona Offshore Wind Project together with all other projects and plans within the ZOI. The projects and plans selected as relevant to the CEA presented within this chapter are based upon the results of a screening exercise (see Volume 5, Annex 5.1: Cumulative effects screening matrix of the Environmental Statement (Document reference F5.5.1)). Each project has been considered on a case-by-case basis for screening in or out of this chapter's assessment based upon data confidence, effect-receptor pathways and the spatial/temporal scales involved.
- 5.8.1.3 The offshore ornithology CEA methodology has followed the methodology set out in Volume 1, Chapter 5: EIA methodology of the Environmental Statement (Document reference F1.5). As part of the assessment, all projects and plans considered alongside the Mona Offshore Wind Project have been allocated into 'tiers' reflecting their current stage within the planning and development process, these are listed below.

MONA OFFSHORE WIND PROJECT

5.8.1.4 The tiered approach uses the following categorisations:

- Tier 1
 - Those currently operational that were not operational when baseline data was collected, and/or those that are operational but have an on-going impact
 - Under construction
 - Permitted application
 - Submitted application
- Tier 2
 - Scoping report has been submitted and is in the public domain
- Tier 3
 - Scoping report has not been submitted and is not in the public domain
 - Identified in a relevant development plan
 - Identified in other plans and programmes.

5.8.1.5 This tiered approach is adopted to provide a clear assessment of the Mona Offshore Wind Project alongside other projects, plans and activities.

5.8.1.6 The specific projects, plans and activities screened into the CEA are outlined in Table 5.49. The location of screened in projects and their proximity to the Mona Offshore Wind Project are further shown in Figure 5.2. All projects screened out are detailed within Volume 5, Annex 5.1 Cumulative effects screening annex of the Environmental Statement (Document reference F5.5.1). Table 5.49 only includes projects which have been assigned tier 1 or tier 2, with tier 3 projects not listed. This is due to tier 3 projects being predominantly 'proposed' or only identified in development plans, and so may not actually be taken forward. Projects under construction are likely to contribute to cumulative impacts (providing effect or spatial pathways exist), whereas those proposals (listed as tier 3 projects) not yet approved are less likely to contribute to such an impact, as some may not achieve approval or may not ultimately be built due to other factors. Tier 3 projects are detailed within Volume 5, Annex 5.1 Cumulative effects screening annex of the Environmental Statement (Document reference F5.5.1).

5.8.1.7 Some of the potential impacts considered within the Mona Offshore Wind Project alone assessment are specific to a particular phase of development (e.g. construction, operations and maintenance or decommissioning). Where the potential for cumulative effects with other plans or projects only have potential to occur where there is spatial or temporal overlap with the Mona Offshore Wind Project during certain phases of development, impacts associated with a certain phase may be omitted from further consideration where no plans or projects have been identified that have the potential for cumulative effects during this period.

5.8.1.8 Other aspects, namely indirect impacts associated with prey distribution and availability are very difficult to quantify, and although it is acknowledged that cumulative effects are possible, the magnitude of these impacts is not considered to be significant at a population level for any offshore ornithology receptor and is therefore not considered further within the CEA. The impacts excluded from the cumulative assessment are:

- Indirect impacts (affecting prey species) from airborne noise, underwater sound and the presence of vessels at any phase of the Mona Offshore Wind Project as they will be spatially limited and all were predicted as low

MONA OFFSHORE WIND PROJECT

- Temporary habitat loss/disturbance and increased SSCs at any phase of the Mona Offshore Wind Project as there is low potential for cumulative effect because the contribution from the Mona Offshore Wind Project and surrounding offshore wind farms is small (and even if these occurred at the same time this would not constitute a significant effect)
- Impacts associated with the construction phase including construction activities at the landfall and laying of the export cable. Adjudged to cause changes of such small magnitude that these will not contribute in any meaningful way at a population level to a potential cumulative impact (based on determination for the Mona Offshore Wind Project effects alone).

5.8.1.9 Impacts considered in the cumulative assessment are as follows:

- Disturbance and displacement from infrastructure (and barrier effects)
- Collision risk
- Combined displacement and collision risk.

MONA OFFSHORE WIND PROJECT

Table 5.49: List of other projects, plans and activities considered within the offshore ornithology CEA.

Project/Plan	Status	Distance from Mona Array Area (km)	Distance from Mona offshore cable corridor (km)	Description of project/plan	Dates of construction (if applicable)	Dates of operation (if applicable)	Overlap with the Mona Offshore Wind Project
Tier 1							
Gwynt y Môr Offshore Wind Farm	Operational	17.8 km	9.9 km	Capacity of 576 MW, 90 km ² area.	2012	2015 to 2033	Project operations and maintenance phase overlap
Rhyl Flats Offshore Wind Farm	Operational	25.6 km	3.8 km	25 wind turbines, 90 MW capacity.	2007	2009 to 2027	Project operations and maintenance phase overlap
Walney Extension 3 Offshore Wind Farm	Operational	27.3 km	53.6 km	330 MW capacity..	2017	2018 to 2039	Project operations and maintenance phase overlap
Walney Extension 4 Offshore Wind Farm	Operational	27.2 km	47.8 km	329 MW capacity.	2017	2018 to 2039	Project operations and maintenance phase overlap
West of Duddon Sands Offshore Wind Farm	Operational	30.4 km	43.9 km	389 MW capacity	2013	2014 to 2033	Project operations and maintenance phase overlap
Burbo Bank Extension Offshore Wind Farm	Operational	30.6 km	26.1 km	Capacity - 258 MW - 32 wind turbines.	2016	2017 to 2045	Project operations and maintenance phase overlap

MONA OFFSHORE WIND PROJECT

Project/Plan	Status	Distance from Mona Array Area (km)	Distance from Mona offshore cable corridor (km)	Description of project/plan	Dates of construction (if applicable)	Dates of operation (if applicable)	Overlap with the Mona Offshore Wind Project
Walney Extension blade tip boosters	Operational	30.7 km	47.8 km	This licence allows for adding aerodynamic tip boosters to each blade (87 wind turbines so 261 total blades), which will increase the rotor diameters for Walney 3 from 164 m to 165 m, and from 154 m to 155.3 m for Walney 4.	unknown	unknown	Project operations and maintenance phase overlap
Walney 1 Offshore Wind Farm	Operational	35.4 km	49.6 km	183.6 MW capacity. Area - 36.5 km ² .	2010	2011 to 2032	Project operations and maintenance phase overlap
Walney 2 Offshore Wind Farm	Operational	34.0 km	51.5 km	183.6 MW capacity. Area - 36.5 km ² .	2011	2012 to 2032	Project operations and maintenance phase overlap
Burbo Bank Offshore Wind Farm	Operational	40.3 km	32.8 km	Capacity of 90 MW. Area - 10 km ² .	2006	2007 to 2039	Project operations and maintenance phase overlap
Ormonde Wind Farm	Operational	44.0 km	58.0 km	150 MW capacity. Area - 8.7 km ² .	2010	2012 to 2036	Project operations and maintenance phase overlap
Robin Rigg Offshore Wind Farm	Operational	98.6 km	126.0 km	174 MW capacity	2009	2010 to 2023	Project operations and maintenance phase overlap
Rampion Offshore Wind Farm	Operational	401.2 km	365.1 km	400 MW capacity. Area - 72 km ² .	2015	2017 to 2042	Project operations and maintenance phase overlap

MONA OFFSHORE WIND PROJECT

Project/Plan	Status	Distance from Mona Array Area (km)	Distance from Mona offshore cable corridor (km)	Description of project/plan	Dates of construction (if applicable)	Dates of operation (if applicable)	Overlap with the Mona Offshore Wind Project
Awel y Môr Offshore Wind Farm	Consent granted	13.5 km	3.6 km	500 MW capacity.	2026 to 2029	2030 to 2055	Potential construction phase overlap with the Mona Offshore Wind Project construction phase. Project operations and maintenance phase overlap
West Anglesey Demonstration Zone tidal site (Morlais)	Consent granted	53.8. km	50.6 km	240 MW	unknown	unknown	Project operations and maintenance phase overlap
Holyhead Deep – Tidal energy (Minesto)	Operational	57.9 km	55.6 km	0.5 MW	2018	2018 to unknown	Project operations and maintenance phase overlap
Erebus Floating Wind Demo	Submitted application	259.9 km	240.2 km	100 MW capacity.	2025	2026 to 2051	Potential construction phase overlap with Mona Offshore Wind Project construction phase. Project operations and maintenance phase overlap

MONA OFFSHORE WIND PROJECT

Project/Plan	Status	Distance from Mona Array Area (km)	Distance from Mona offshore cable corridor (km)	Description of project/plan	Dates of construction (if applicable)	Dates of operation (if applicable)	Overlap with the Mona Offshore Wind Project
White Cross Offshore Windfarm	Submitted application	287.7 km	211.2 km	100 MW site. Planned floating offshore wind farm off the coast of Pembrokeshire. Comprises up to 18 wind turbines.	2026	unknown	Potential construction phase overlap with Mona Offshore Wind Project construction phase. Project operations and maintenance phase overlap
TwinHub (Wave Hub Floating Wind Farm)	Consent granted	377.1 km	350.9 km	Two floating offshore wind platforms, each with two wind turbines. Installed capacity of 32 MW.	unknown	unknown	Project operations and maintenance phase overlap
Rampion 2 Offshore Wind Farm	Submitted application	394.8 km	358.1 km	Up to 1,200 MW capacity. Area - 270 km ² .	2025	2029 to unknown	Potential construction phase overlap with Mona Offshore Wind Project construction phase. Project operations and maintenance phase overlap
West of Orkney Windfarm	Submitted application	553.9 km	573.9 km	Offshore wind project comprising up to 125 wind turbines, 30 km from the coast of Orkney.	2027	unknown	Project operations and maintenance phase overlap

MONA OFFSHORE WIND PROJECT

Project/Plan	Status	Distance from Mona Array Area (km)	Distance from Mona offshore cable corridor (km)	Description of project/plan	Dates of construction (if applicable)	Dates of operation (if applicable)	Overlap with the Mona Offshore Wind Project
Tier 2							
Morgan Offshore Wind Project Generation Assets (hereafter referred to as the Morgan Generation Assets)	Pre-application	5.52 km	32.93 km	1,500 MW capacity.	2026 to 2029	2030 to 2065	Potential construction phase overlap with Mona Offshore Wind Project construction phase. Project operations and maintenance phase overlap
Morecambe Offshore Windfarm Generation Assets (hereafter referred to as the Morecambe Generation Assets)	Pre-application	8.9 km	21.5 km	480 MW capacity, Area: 497 km ²	2026 to 2028	2029 to 2064	Potential construction phase overlap with Mona Offshore Wind Project construction phase. Project operations and maintenance phase overlap
Morgan and Morecambe Offshore Wind Farms Transmission Assets	Pre-application	8.92 km	21.53 km	Cable corridor	2026 to 2029	2029 to 2065	Potential construction phase overlap

MONA OFFSHORE WIND PROJECT

Project/Plan	Status	Distance from Mona Array Area (km)	Distance from Mona offshore cable corridor (km)	Description of project/plan	Dates of construction (if applicable)	Dates of operation (if applicable)	Overlap with the Mona Offshore Wind Project
ENI Hynet – carbon capture storage (CCS)	Pre-application	12.1 km	9.5 km	project in the east Irish Sea. Works will include installation of a new cable, a new Douglas CCS platform and work on the existing Hamilton, Hamilton North and Lennox wellhead platforms.	Unknown	Unknown	Project operations and maintenance phase overlap
Moor Vannin Offshore Wind Farm	Scoping report submitted	34.53 km	54.45 km	Up to 700 MW capacity	Unknown	Unknown	Project operations and maintenance phase overlap
North Irish Sea Array offshore Wind Farm	Scoping report submitted	112.7 km	118.6 km	500 MW capacity.	unknown	unknown	Project operations and maintenance phase overlap
Codling Wind Park	Scoping report submitted	125.1 km	123.6 km	900 MW planned capacity, off of the coast Wicklow. Spread over an area of 125 km ²	unknown	unknown	Project operations and maintenance phase overlap
Dublin Array Offshore Wind Farm	Scoping report submitted	126.1 km	129.0 km	600 MW offshore wind power project. Area of 54 km ² .	unknown	unknown	Project operations and maintenance phase overlap
North Channel Wind 2	Scoping report submitted	128.5 km	151.5 km	Site area of approx. 38 km ² . Using Tension Leg platform. 5-7 wind turbines	unknown	unknown	Project operations and maintenance phase overlap
Oriel Wind Farm	Scoping report submitted	130.4 km	138.1 km	375 MW capacity, spread over 28 km ² .	unknown	unknown	Project operations and maintenance phase overlap

MONA OFFSHORE WIND PROJECT

Project/Plan	Status	Distance from Mona Array Area (km)	Distance from Mona offshore cable corridor (km)	Description of project/plan	Dates of construction (if applicable)	Dates of operation (if applicable)	Overlap with the Mona Offshore Wind Project
Arklow Bank Wind Park Phase 2	Scoping report submitted	146.7 km	142.8 km	800 MW capacity.	unknown	unknown	Project operations and maintenance phase overlap
North Channel Wind 1	Scoping report submitted	157.3 km	180.9 km	Site area of approx. 38 km ² . Using Tension Leg platform. 5-7 wind turbines	unknown	unknown	Project operations and maintenance phase overlap
Shelmalere Offshore Wind Farm	Scoping report submitted	177.1 km	168.9 km	1,000 MW capacity.	unknown	unknown	Project operations and maintenance phase overlap
North Celtic Sea Offshore Wind Farm	Scoping report submitted	256.4 km	248.8 km	Up to 800 MW Planned capacity.	unknown	unknown	Project operations and maintenance phase overlap
Llyr 1 Floating Wind Farm	Scoping report submitted	267.0 km	245.9 km	100 MW capacity.	Unknown	Unknown	Project operations and maintenance phase overlap
Llyr 2 Floating Wind Farm	Scoping report submitted	263.17 km	240.12 km	1,000 MW capacity.	Unknown	Unknown	Project operations and maintenance phase overlap
Valorous Floating Offshore Wind Project	Scoping report submitted	271.7 km	252.4 km	300 MW floating offshore wind project in the Celtic Sea region.	Unknown	Unknown	Project operations and maintenance phase overlap
Inis Ealga Marine Energy Park offshore wind farm	Scoping report submitted	302.1 km	292.0 km	1,000 MW capacity.	Unknown	Unknown	Project operations and maintenance phase overlap
Emerald Floating Wind Project	Scoping report submitted	338.8 km	331.3 km	1,000 MW capacity.	Unknown	Unknown	Project operations and maintenance phase overlap

MONA OFFSHORE WIND PROJECT

Project/Plan	Status	Distance from Mona Array Area (km)	Distance from Mona offshore cable corridor (km)	Description of project/plan	Dates of construction (if applicable)	Dates of operation (if applicable)	Overlap with the Mona Offshore Wind Project
Project Saoirse Wave energy	Scoping report submitted	392.5 km	395.4 km	Pre-commercial demonstration wave energy conversion project located 4-6 km offshore Co. Clare, starting with 5 MW of capacity	Unknown	Unknown	Project operations and maintenance phase overlap
Project Ilen Floating Offshore Wind Project	Scoping report submitted	433.9 km	436.8 km	1.35 GW floating offshore wind project located at least 35 km offshore Co. Clare. One of the Western Star projects.	Unknown	Unknown	Project operations and maintenance phase overlap

MONA OFFSHORE WIND PROJECT

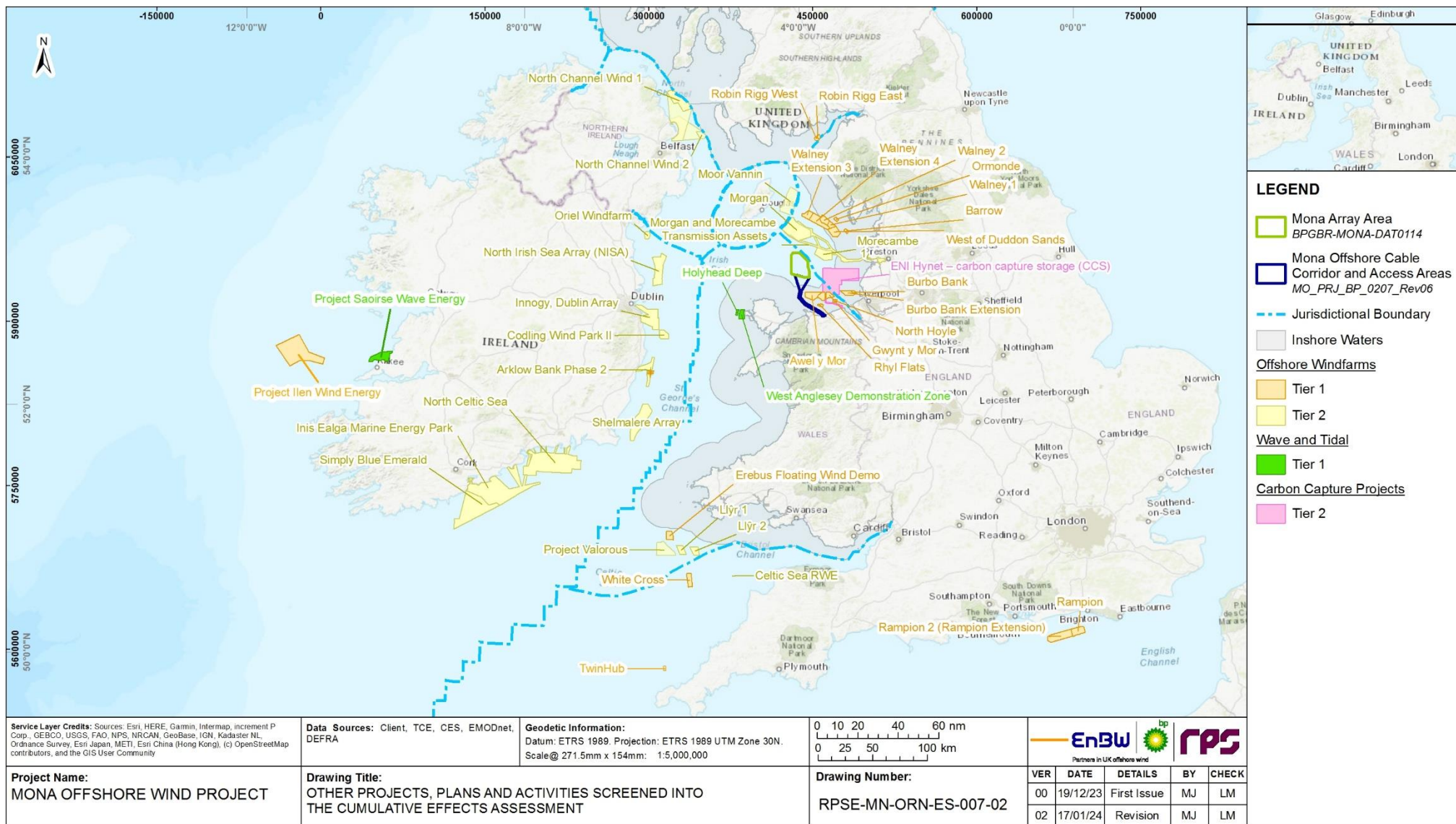


Figure 5.2: Other projects, plans and activities screened into the cumulative effects assessment.

MONA OFFSHORE WIND PROJECT

- 5.8.1.10 The MDSs identified in Table 5.50 have been selected as those having the potential to result in the greatest effect on an identified receptor or receptor group. The cumulative effects presented and assessed in this section have been selected from the MDS above (Table 5.21) due to there being a potential for cumulative effects. Effects of greater adverse significance are not predicted to arise should any other development scenario (e.g. different wind turbine layout), to that assessed here, be taken forward in the final design scheme.

MONA OFFSHORE WIND PROJECT

Table 5.50: Maximum design scenario considered for the assessment of potential cumulative effects on offshore ornithology.

a C=construction, O=operations and maintenance, D=decommissioning

b Barrier effect is included as CEA is based on SNCB Matrix approach (JNCC, 2017)

Potential cumulative effect	Phase ^a			Maximum Design Scenario	Justification
	C	O	D		
Disturbance and displacement from infrastructure	✓	✓	✓	<p>MDS as described for the Mona Offshore Wind Project (Table 5.21) assessed cumulatively with the following offshore wind farms:</p> <p>Construction phase</p> <p>Tier 1</p> <ul style="list-style-type: none"> • Awel y Môr Offshore Wind Farm • Erebus Floating Wind Demo • White Cross Offshore Windfarm • Rampion 2 Wind Farm • West of Orkney Windfarm <p>Tier 2</p> <ul style="list-style-type: none"> • Morgan Generation Assets • Morecambe Offshore Windfarm Generation Assets. • Morgan and Morecambe Offshore Wind Farms Transmission Assets <p>Operations and maintenance Phase</p> <p>Tier 1</p> <ul style="list-style-type: none"> • Gwynt y Môr Offshore Wind Farm • Rhyl Flats Offshore Wind Farm • Walney (3 & 4) Extension Offshore Wind Farm • West of Duddon Sands Offshore Wind Farm • Burbo Bank Extension Offshore Wind Farm • Walney 1 & 2 Offshore Wind Farms 	<p>There is a possibility that construction could overlap temporally with Awel y Môr, the Morgan Generation Assets, Morecambe Offshore Windfarm Generation Assets, Morgan and Morecambe Offshore Wind Farms Transmission Assets and Erebus. There is a possibility that decommissioning could overlap temporally with Awel y Môr and Erebus. However, the impact from construction and decommissioning are of small, temporary magnitude.</p> <p>There is potential for a cumulative effect from operations and maintenance activities and so a quantitative cumulative effect assessment is required.</p>

MONA OFFSHORE WIND PROJECT

Potential cumulative effect	Phase ^a			Maximum Design Scenario	Justification
	C	O	D		
				<ul style="list-style-type: none"> Burbo Bank Offshore Wind Farm Ormonde Wind Farm Robin Rigg Offshore Wind Farm Rampion Offshore Wind Farm Awel y Môr Offshore Wind Farm Erebus Floating Wind Demo White Cross Offshore Windfarm TwinHub (Wave Hub Floating Wind Farm) Rampion 2 Wind Farm West of Orkney Windfarm <p>Tier 2</p> <ul style="list-style-type: none"> Morgan Generation Assets Morecambe Offshore Windfarm Generation Assets Morgan and Morecambe Offshore Wind Farms Transmission Assets ENI Hynet –CCS Moor Vannin Offshore Wind Farm North Irish Sea Array Offshore Wind Farm Codling Wind Park Dublin Array Offshore Wind Farm North Channel Wind 2 Oriel Wind Farm Arklow Bank Wind Park Phase 2 North Channel Wind 1 Shelmalere Offshore Wind Farm 	

MONA OFFSHORE WIND PROJECT

Potential cumulative effect	Phase ^a			Maximum Design Scenario	Justification
	C	O	D		
				<ul style="list-style-type: none"> • North Celtic Sea • Llyr 1 Floating Wind Farm • Llyr 2 Floating Wind Farm • Valorous Floating Offshore Wind Project • Inis Ealga Marine Energy Park • Emerald Floating Wind Project <p>Decommissioning Phase</p> <p>Tier 1</p> <ul style="list-style-type: none"> • Awel y Môr Offshore Wind Farm • Erebus Floating Wind Demo • White Cross Offshore Windfarm • Rampion 2 Wind Farm • West of Orkney Windfarm 	
Collision risk	x	✓	x	<p>MDS as described for the Mona Offshore Wind Project (Table 5.21) assessed cumulatively with the following offshore wind farms:</p> <p>Operations and maintenance Phase</p> <p>Tier 1</p> <ul style="list-style-type: none"> • Gwynt y Môr Offshore Wind Farm • Rhyl Flats Offshore Wind Farm • Walney (3 & 4) Extension Offshore Wind Farm • West of Duddon Sands Offshore Wind Farm • Burbo Bank Extension Offshore Wind Farm • Walney 1 & 2 Offshore Wind Farms • Burbo Bank Offshore Wind Farm • Ormonde Wind Farm 	There is potential for a cumulative effect from operations and maintenance activities, so a detailed, quantitative cumulative effect assessment is required.

MONA OFFSHORE WIND PROJECT

Potential cumulative effect	Phase ^a			Maximum Design Scenario	Justification
	C	O	D		
				<ul style="list-style-type: none"> Robin Rigg Offshore Wind Farm Rampion Offshore Wind Farm Awel y Môr Offshore Wind Farm West Anglesey Demonstration Zone Tidal Site (Morlais) Holyhead Deep – tidal energy (Minesto) Erebus Floating Wind Demo White Cross Offshore Windfarm TwinHub (Wave Hub Floating Wind Farm) Rampion 2 Wind Farm West of Orkney Windfarm <p>Tier 2</p> <ul style="list-style-type: none"> Morgan Generation Assets Morecambe Offshore Windfarm Generation Assets Moor Vannin Offshore Wind Farm North Irish Sea Array Offshore Wind Farm Codling Wind Park Dublin Array Offshore Wind Farm North Channel Wind 2 Oriel Wind Farm Arklow Bank Wind Park Phase 2 North Channel Wind 1 Shelmalere Offshore Wind Farm North Celtic Sea Wind Farm Llyr 1 Floating Wind Farm Llyr 2 Floating Wind Farm Valorous Floating Offshore Wind Project 	

MONA OFFSHORE WIND PROJECT

Potential cumulative effect	Phase ^a			Maximum Design Scenario	Justification
	C	O	D		
				<ul style="list-style-type: none"> • Inis Ealga Marine Energy Park • Emerald Floating Wind Project • Project lien wave energy 	

5.9 Cumulative effects assessment

5.9.1 Overview

5.9.1.1 A description of the significance of cumulative effects upon offshore ornithology receptors arising from each identified impact is given below.

5.9.1.2 The CEA is limited by the data available upon which to base the assessment. Due to the age of developments in the Irish Sea and surrounding areas which have the potential to have a cumulative impact upon receptors, few have comparable datasets upon which to base an assessment. However, every effort has been made to obtain quantitative estimates for both displacement and collision from project-specific documentation. For displacement impacts this includes following the approach applied by many previous offshore wind farms using any available population data to calculate mean-pack or peak population estimates for use in displacement analyses

5.9.1.3 Additionally, older developments did not carry out certain impact assessments (e.g. displacement and/or collision risk) for species such as black-legged kittiwake, northern gannet, northern fulmar, Manx shearwater and gull species (European herring gull, great black-backed gull and lesser black-backed gull) due to limited data at the time of assessment on the species' behavioural response to the presence of offshore turbines. As such the CEA is carried out using data from offshore wind farms with available species data to do so. For projects in early stages (i.e. Tier 3) there was insufficient project information in the public domain to allow the effects to be reasonably understood and a cumulative assessment undertaken. Tier 3 projects have therefore not been included in the cumulative assessment below.

5.9.1.4 For the cumulative assessment, impacts from Tier 1 and Tier 2 projects have been assessed together to provide the most precautionary impact on the population. If any Tier 2 project does not get consented/built the assessment presented here still includes the impacts.

5.9.1.5 There is a possibility that construction and decommissioning could overlap temporally with Morgan and Morecambe Offshore Wind Farms Transmission Assets, with the potential to impact red-throated diver. However, the impact from construction and decommissioning are of small, temporary magnitude. Additionally, there is no spatial overlap between Mona Offshore Wind Project and Morgan and Morecambe Offshore Wind Farms Transmission Assets during construction and decommissioning. As such, the cumulative impact on red-throated divers is not considered further.

5.9.2 Disturbance and displacement from airborne noise, underwater sound, and presence of vessels and infrastructure

5.9.2.1 There is potential for cumulative displacement as a result of construction and operations and maintenance activities associated with the Mona Offshore Wind Project along with other developments.

5.9.2.2 Disturbance and subsequent displacement of seabirds during the construction phase is primarily centred around where construction vessels and piling activities are occurring. The activities may displace individuals that would normally reside within and around the area of sea where the Mona Offshore Wind Project is located. This in effect represents indirect habitat loss, which will potentially reduce the area available to those seabirds to forage, loaf and/or moult.

5.9.2.3 The level of data available and the ease with which disturbance and displacement impacts can be combined across the offshore wind farms is quite variable, reflecting

MONA OFFSHORE WIND PROJECT

the availability of relevant data for other projects and the approach to assessment taken. A maximum design approach would be to assume complete overlap in construction for all projects, while the minimum design approach would be to assume no overlap. The most realistic assumption is that at most there will be a degree of construction overlap (and hence increased vessel and helicopter activity), but that it will be limited to a small number of CEA projects and other activities.

- 5.9.2.4 During the operations and maintenance phase, the presence of offshore wind turbines has the potential to directly disturb and displace seabirds that would normally reside within and around the area of sea where offshore wind farms are located. Displacement may contribute to individual birds experiencing fitness consequences, which at an extreme level could lead to the mortality of individuals. Cumulative displacement therefore has the potential to lead to effects on a wider scale.
- 5.9.2.5 The species assessed for cumulative displacement impacts were common guillemot, razorbill, Atlantic puffin, northern gannet, black-legged kittiwake and Manx shearwater.
- 5.9.2.6 The cumulative results are presented as displacement matrices ranging from 1% to 100% mortality and 5% to 100% displacement. Each cell presents potential cumulative bird mortality following displacement from the Mona Offshore Wind Project and the other offshore wind farm projects during each bio-season. Light blue highlighted cells are based on the displacement and mortality rates used in the alone assessment. Additionally, orange highlighted cells represent a displacement rate within the middle of the range presented.
- 5.9.2.7 With regards to vessels in the Mona Offshore Wind Project, there is no method to quantify the displacement impact of the activities due to their local and temporary nature. An offshore EMP that will include measures to minimise disturbance to rafting birds from transiting vessels is secured as a requirement of the draft DCO (Document Reference C1). It is therefore expected that impacts of vessels on seabirds are negligible due to the management of vessel traffic.

Tier 1 and Tier 2

Construction phase

Magnitude of impact

Common guillemot

- 5.9.2.8 The estimated number of birds present within the array area of each of the other relevant projects (projects that potentially overlap in their construction activities with Mona Offshore Wind Project) during each bio-season are presented in Table 5.51.

Table 5.51: Common guillemot cumulative abundances for potential overlapping construction phase offshore wind projects for disturbance and displacement assessment.

Project	Annual Abundance	Breeding Season Abundance	Non-breeding Season Abundance
Tier 1			
Awel y Môr Offshore Wind Farm	4,488	1,569	2,919
Erebus Floating Wind Demo	35,389339	7,001	28,388338

MONA OFFSHORE WIND PROJECT

Project	Annual Abundance	Breeding Season Abundance	Non-breeding Season Abundance
White Cross Offshore Windfarm	4,363	3,304	1,059
West of Orkney Windfarm	9,136	4,861	4,275
Tier 2			
Morecambe Offshore Windfarm Generation Assets	11,697	4,050	7,647
Morgan Offshore Wind Project Generation Assets	8,994	4,893	4,101
TOTAL (minus the Mona Offshore Wind Project)	74,067,017	25,678	48,389,339
Mona Offshore Wind Project	7,976	4,220	3,756
TOTAL (all projects)	82,043,81,993	29,898	52,145,095

5.9.2.9 The following displacement matrices provide the estimated cumulative mortality of common guillemot predicted to occur due to displacement during construction, as determined by the relevant specified rates of displacement and mortality (Table 5.52 to Table 5.54). The approach used for the cumulative displacement assessment follows that presented in Volume 6, Annex 5.2: Offshore ornithology displacement technical report of the Environmental Statement (Document reference F6.5.2).

Table 5.52: Construction phase cumulative common guillemot mortality following displacement from offshore wind farms in the breeding season.

Mortality level (% of displaced birds at risk of mortality)		Displacement level (% at risk of displacement)							
		1%	2%	5%	10%	25%	50%	100%	
52145	5%	15	30	75	149	374	747	1,495	
	10%	30	60	149	299	747	1,495	2,990	
	15%	45	90	224	448	1,121	2,242	4,485	
	20%	60	120	299	598	1,495	2,990	5,980	
	25%	75	149	374	747	1,869	3,737	7,475	
	30%	90	179	448	897	2,242	4,485	8,969	
	35%	105	209	523	1,046	2,616	5,232	10,464	
	60%	179	359	897	1,794	4,485	8,969	17,939	
	80%	239	478	1,196	2,392	5,980	11,959	23,918	
	100%	299	598	1,495	2,990	7,475	14,949	29,898	

MONA OFFSHORE WIND PROJECT

Table 5.53: Construction phase cumulative common guillemot mortality following displacement from offshore wind farms in the non-breeding season.

		Mortality level (% of displaced birds at risk of mortality)						
		1%	2%	5%	10%	25%	50%	100%
Displacement level (% at risk of displacement)	5%	26	52	130	264260	652651	1,304302	2,607605
	10%	52	104	264260	521	1,304302	2,607605	5,215210
	15%	78	156	391	782781	1,955954	3,911907	7,822814
	20%	104	209208	521	1,043042	2,607605	5,215210	10,429419
	25%	130	264260	652651	1,304302	3,259256	6,518512	13,036024
	30%	156	313	782781	1,564563	3,911907	7,822814	15,644629
	35%	183182	365	913912	1,825823	4,563558	9,125117	18,251233
	60%	313	626625	1,564563	3,429126	7,822814	15,644629	31,287257
	80%	417	834	2,086084	4,172168	10,429419	20,858838	41,716676
	100%	521	1,043042	2,607605	5,215210	13,036024	26,073048	52,145095

Table 5.54: Construction phase cumulative common guillemot mortality following displacement from offshore wind farms annually.

		Mortality level (% of displaced birds at risk of mortality)						
		1%	2%	5%	10%	25%	50%	100%
Displacement level (% at risk of displacement)	5%	41	82	205	410	1,026025	2,054050	4,102100
	10%	82	164	410	820	2,054050	4,102100	8,204199
	15%	123	246	615	1,234230	3,077075	6,153149	12,306299
	20%	164	328	820	1,644640	4,102100	8,204199	16,409399
	25%	205	410	1,026025	2,054050	5,128122	10,255249	20,511498
	30%	246	492	1,234230	2,464460	6,153149	12,306299	24,613598
	35%	287	574	1,436435	2,872870	7,179174	14,358349	28,715698
	60%	492	985984	2,464460	4,923920	12,306299	24,613598	49,226196
	80%	656	1,313312	3,282280	6,563559	16,409399	32,817797	65,634594
	100%	820	1,644640	4,102100	8,204199	20,511498	41,02240,997	82,04381,993

MONA OFFSHORE WIND PROJECT

- 5.9.2.10 During the breeding season, the potential displacement from construction when using a displacement rate of 25% (range: 15 to 35%) and a mortality of 1% (range: 1% to 10%), results in an additional loss of 75 (45 to 1,046) individuals from the breeding population (Table 5.52). The justification for the displacement and mortality rates are given in section 5.7.2. The regional seas UK Western Waters BDMPS population of common guillemots within the breeding season is estimated to be 1,145,528 individuals (Table 5.14). Assuming an average baseline mortality rate of 0.133 (Table 5.15), background mortality in the breeding season is 152,355 individuals. The addition of 75 (45 to 1,046) individual mortalities due to cumulative displacement from construction activities would increase the mortality relative to the baseline mortality by 0.049 % (0.030 to 0.687%).
- 5.9.2.11 During the non-breeding season, the displacement from construction results in an additional loss of 130 (78 to 1,825,823) individuals from the non-breeding population (Table 5.53). The regional seas UK Western Waters BDMPS population of common guillemots within the non-breeding season is estimated to be 1,139,220 individuals (Table 5.14). Assuming an average baseline mortality rate of 0.133, background mortality in the non-breeding season is 151,516 individuals. The addition of 130 (78 to 1,825,823) individual mortalities due to cumulative displacement from construction activities would increase the mortality relative to the baseline mortality by 0.086 % (0.051 to 1.205,203%).
- 5.9.2.12 The annual estimated mortality resulting from displacement during construction is 205 (123 to 2,872,870) individuals (Table 5.54). Using the largest BDMPS UK Western Waters population of 1,145,528 individuals and, using the average baseline mortality rate of 0.133 (Table 5.15), the annual background predicted mortality would be 152,355. The of 205 (123 to 2,872,870) mortalities would increase the baseline mortality rate by 0.134% (0.081% to 1.885,883%). The annual predicted mortality from the cumulative assessment during construction is above the 1% threshold increase when using 35% displacement and 10% mortality, which is highly precautionary. The construction period is short term, with the extent of construction overlap varying between each offshore wind farm (Table 5.51) and so it is likely that the impact estimated even at the 25% displacement and 1% mortality range is an overestimate. Expected mortality arising from construction activities is likely to be on the lower end of the range considered.
- 5.9.2.13 The cumulative impact is therefore predicted to be of national spatial extent, short term duration, intermittent and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore considered to be **low**.

Razorbill

- 5.9.2.14 The estimated cumulative abundance of razorbill from the relevant projects (projects that overlap in their construction activities with the Mona Offshore Wind Project) are presented in Table 5.55.

MONA OFFSHORE WIND PROJECT
Table 5.55: Razorbill cumulative abundances for overlapping construction phase offshore wind projects for disturbance and displacement assessment.

Project	Annual Cumulative Abundance	Pre-breeding Cumulative Abundance	Breeding Season Cumulative Abundance	Post-breeding Cumulative Abundance	Non-breeding Cumulative Abundance
Tier 1					
Awel y Môr Offshore Wind Farm	692	336	140	66	150
Erebus Floating Wind Demo	3,867	896	194	1,708	1,069
West of Orkney Windfarm	326	97	70	144	15
White Cross Offshore Windfarm	786	345	40	40	361
Tier 2					
Morecambe Offshore Windfarm Generation Assets	1,881	389	222	674	596
Morgan Offshore Wind Project Generation Assets	622	166	120	103	233
TOTAL (minus the Mona Offshore Wind Project)	8,174	2,229	786	2,735	2,424
Mona Offshore Wind Project	2,519	1,924	83	91	421
TOTAL (all projects)	10,693	4,153	869	2,826	2,845

5.9.2.15 The following displacement matrices provide the estimated cumulative mortality of guillemot predicted to occur due to displacement during construction, as determined by the relevant specified rates of displacement and mortality (Table 5.56 to Table 5.60). The approach used for the cumulative displacement assessment follows that presented in Volume 6, Annex 5.2: Offshore ornithology displacement technical report of the Environmental Statement (Document reference F6.5.2).

MONA OFFSHORE WIND PROJECT

Table 5.56: Construction phase cumulative razorbill mortality following displacement from offshore wind farms in the pre-breeding season.

		Mortality level (% of displaced birds at risk of mortality)						
		1%	2%	5%	10%	25%	50%	100%
Displacement level (% at risk of displacement)	5%	2	4	10	21	52	104	208
	10%	4	8	21	42	104	208	415
	15%	6	12	31	62	156	311	623
	20%	8	17	42	83	208	415	831
	25%	10	21	52	104	260	519	1,038
	30%	12	25	62	125	311	623	1,246
	35%	15	29	73	145	363	727	1,454
	60%	25	50	125	249	623	1,246	2,492
	80%	33	66	166	332	831	1,661	3,322
	100%	42	83	208	415	1,038	2,077	4,153

Table 5.57: Construction phase cumulative razorbill mortality following displacement from offshore wind farms in the breeding season.

		Mortality level (% of displaced birds at risk of mortality)						
		1%	2%	5%	10%	25%	50%	100%
Displacement level (% at risk of displacement)	5%	0	1	2	4	11	22	43
	10%	1	2	4	9	22	43	87
	15%	1	3	7	13	33	65	130
	20%	2	3	9	17	43	87	174
	25%	2	4	11	22	54	109	217
	30%	3	5	13	26	65	130	261
	35%	3	6	15	30	76	152	304
	60%	5	10	26	52	130	261	521
	80%	7	14	35	70	174	348	695
	100%	9	17	43	87	217	435	869

MONA OFFSHORE WIND PROJECT

Table 5.58: Construction phase cumulative razorbill mortality following displacement from offshore wind farms in the post-breeding season.

		Mortality level (% of displaced birds at risk of mortality)						
		1%	2%	5%	10%	25%	50%	100%
Displacement level (% at risk of displacement)	5%	1	3	7	14	35	71	141
	10%	3	6	14	28	71	141	283
	15%	4	8	21	42	106	212	424
	20%	6	11	28	57	141	283	565
	25%	7	14	35	71	177	353	707
	30%	8	17	42	85	212	424	848
	35%	10	20	49	99	247	495	989
	60%	17	34	85	170	424	848	1,696
	80%	23	45	113	226	565	1,130	2,261
	100%	28	57	141	283	707	1,413	2,826

Table 5.59: Construction phase cumulative razorbill mortality following displacement from offshore wind farms in the non-breeding season.

		Mortality level (% of displaced birds at risk of mortality)						
		1%	2%	5%	10%	25%	50%	100%
Displacement level (% at risk of displacement)	5%	1	3	7	14	36	71	142
	10%	3	6	14	28	71	142	285
	15%	4	9	21	43	107	213	427
	20%	6	11	28	57	142	285	569
	25%	7	14	36	71	178	356	711
	30%	9	17	43	85	213	427	854
	35%	10	20	50	100	249	498	996
	60%	17	34	85	171	427	854	1,707
	80%	23	46	114	228	569	1,138	2,276
	100%	28	57	142	285	711	1,423	2,845

Table 5.60: Construction phase cumulative razorbill mortality following displacement from offshore wind farms annually.

		Mortality level (% of displaced birds at risk of mortality)						
		1%	2%	5%	10%	25%	50%	100%
Displacement level (% at risk of displacement)	5%	5	11	27	53	134	267	535
	10%	11	21	53	107	267	535	1,069
	15%	16	32	80	160	401	802	1,604
	20%	21	43	107	214	535	1,069	2,139
	25%	27	53	134	267	668	1,337	2,673
	30%	32	64	160	321	802	1,604	3,208
	35%	37	75	187	374	936	1,871	3,743
	60%	64	128	321	642	1,604	3,208	6,416
	80%	86	171	428	855	2,139	4,277	8,554
	100%	107	214	535	1,069	2,673	5,347	10,693

- 5.9.2.16 During the spring migration (pre-breeding) season the displacement from construction when using a displacement rate of 25% (range: 15% to 35%) and a mortality of 1% (range: 1 to 10%), results in an additional loss of 10 (six to 145) individuals (Table 5.56). The regional seas UK Western Waters BDMPS population of razorbill in the spring migration period is estimated to be 606,914 individuals (Table 5.14). Assuming an average baseline mortality rate of 0.172 (Table 5.15), background mortality during spring migration is 104,389 individuals. The addition of 10 (six to 145) individual mortalities due to cumulative displacement from construction activities would increase the mortality relative to the baseline mortality by 0.009 % (0.006 to 0.139%).
- 5.9.2.17 During the breeding season, displacement from construction results in the loss of 2 (1 to 30) individual from the breeding population (Table 5.57). The regional seas UK Western Waters BDMPS population of razorbill within the breeding season is estimated to be 198,969 individuals (Table 5.14). Assuming an average baseline mortality rate of 0.172, background mortality in the breeding season is 34,223 individuals. The addition of two (one to 30) individual mortalities due to cumulative displacement from construction activities would increase the mortality relative to the baseline mortality by 0.006 % (0.003 to 0.088%).
- 5.9.2.18 During the autumn migration season (post-breeding), displacement from construction results in a loss of seven (four to 99) individual from the migratory population (Table 5.58). The regional seas UK Western Waters BDMPS population of razorbill during the autumn migration period is estimated to be 606,914 individuals (Table 5.14). Assuming an average baseline mortality rate of 0.172, background mortality during autumn migration is 104,389 individuals. The addition of seven (four to 99) individual mortalities due to cumulative displacement from construction activities would increase the mortality relative to the baseline mortality by 0.007 % (0.004 to 0.095%).
- 5.9.2.19 During the non-breeding season (winter season), displacement from construction results a in a loss of seven (four to 100) individuals from the non-breeding population (Table 5.59). The regional seas UK Western Waters BDMPS population of razorbill within the non-breeding season is estimated to be 341,422 individuals (Table 5.14).

MONA OFFSHORE WIND PROJECT

Assuming an average baseline mortality rate of 0.172, background mortality in the breeding season is 58,724 individuals. The addition of seven (four to 100) individual mortalities due to cumulative displacement from construction activities would increase the mortality relative to the baseline mortality by 0.046 % (0.003 to 0.066%).

5.9.2.20 The annual estimated mortality resulting from displacement during construction is 27 (16 to 374) individuals (Table 5.60). Using the largest UK Western Waters BDMPS population of 606,914 razorbill and, using the average baseline mortality rate of 0.172, the background predicted mortality would be 104,389 individuals. The addition of 27 (16 to 374) mortalities would increase the baseline mortality rate by 0.026% (0.003% to 0.358%). The annual predicted mortality from the cumulative assessment is below the 1% threshold increase in baseline mortality.

5.9.2.21 The cumulative effect is predicted to be of national spatial extent, medium term duration, intermittent and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore considered to be **negligible**.

Atlantic puffin

5.9.2.22 The estimated cumulative abundance of Atlantic puffin from the relevant projects is presented in Table 5.61.

Table 5.61: Atlantic puffin cumulative abundances for overlapping construction phase offshore wind projects for disturbance and displacement assessment.

Project	Annual Abundance	Breeding Season Abundance	Non-breeding Season Abundance
Tier 1			
Awel y Môr Offshore Wind Farm	8	8	0
Erebus Floating Wind Demo	1,576	1,416	160
West of Orkney Windfarm	6,449	5,272	1,177
White Cross Offshore Wind Farm	80	49	31
Tier 2			
Morecambe generation	67	57	10
Morgan Offshore Wind Project Generation Assets	18	18	0
TOTAL (minus Mona)	8,198	6,820	1,378
Mona	37	15	22
TOTAL (all projects)	8,235	6,835	1,400

5.9.2.23 The following displacement matrices provide the estimated cumulative mortality of Atlantic puffin predicted to occur due to displacement, as determined by the relevant specified rates of displacement and mortality (Table 5.62 to Table 5.64). The approach used for the cumulative displacement assessment follows that presented in Volume 6, Annex 5.2: Offshore ornithology displacement technical report of the Environmental Statement (Document reference F6.5.2).

MONA OFFSHORE WIND PROJECT

Table 5.62: Construction phase cumulative Atlantic puffin mortality following displacement from offshore wind farms in the breeding season.

		Mortality level (% of displaced birds at risk of mortality)						
		1%	2%	5%	10%	25%	50%	100%
Displacement level (% at risk of displacement)	5%	3	7	17	34	85	171	342
	10%	7	14	34	68	171	342	684
	15%	10	21	51	103	256	513	1,025
	20%	14	27	68	137	342	684	1,367
	25%	17	34	85	171	427	854	1,709
	30%	21	41	103	205	513	1,025	2,051
	35%	24	48	120	239	598	1,196	2,392
	60%	41	82	205	410	1,025	2,051	4,101
	80%	55	109	273	547	1,367	2,734	5,468
	100%	68	137	342	684	1,709	3,418	6,835

Table 5.63: Construction phase cumulative Atlantic puffin mortality following displacement from offshore wind farms in the non-breeding season.

		Mortality level (% of displaced birds at risk of mortality)						
		1%	2%	5%	10%	25%	50%	100%
Displacement level (% at risk of displacement)	5%	1	3	7	14	35	70	140
	10%	3	6	14	28	70	140	280
	15%	4	8	21	42	105	210	420
	20%	6	11	28	56	140	280	560
	25%	7	14	35	70	175	350	700
	30%	8	17	42	84	210	420	840
	35%	10	20	49	98	245	490	980
	60%	11	22	56	112	280	560	1,120
	80%	13	25	63	126	315	630	1,260
	100%	14	28	70	140	350	700	1,400

Table 5.64: Construction phase cumulative Atlantic puffin mortality following displacement from offshore wind farms annually.

		Mortality level (% of displaced birds at risk of mortality)						
		1%	2%	5%	10%	25%	50%	100%
Displacement level (% at risk of displacement)	5%	8	16	41	82	206	412	824
	10%	16	33	82	165	412	824	1,647
	15%	25	49	124	247	618	1,235	2,471
	20%	33	66	165	329	824	1,647	3,294
	25%	41	82	206	412	1,029	2,059	4,118
	30%	49	99	247	494	1,235	2,471	4,941
	35%	58	115	288	576	1,441	2,882	5,765
	60%	66	132	329	659	1,647	3,294	6,588
	80%	74	148	371	741	1,853	3,706	7,412
	100%	82	165	412	824	2,059	4,118	8,235

- 5.9.2.24 During the breeding season, the displacement from construction when using a displacement rate of 25% (range: 15% to 35%) and a mortality of 1% (range: 1 to 10%), results in an additional loss of 17 (10 to 239) individuals from the breeding population (Table 5.62). The regional seas UK Western Waters BDMPSS population of Atlantic puffin within the breeding season is estimated to be 1,482,791 individuals (Table 5.14). Assuming an average baseline mortality rate of 0.176 (Table 5.15), background mortality in the breeding season is 260,971 individuals. The addition of 17 (10 to 239) individual mortalities due to cumulative displacement from construction activities would increase the mortality relative to the baseline mortality by 0.006 % (0.003 to 0.092%).
- 5.9.2.25 During the non-breeding season, the displacement from construction results in an additional loss of seven (four to 98) individual from the non-breeding population (Table 5.63). The regional seas UK Western Waters BDMPSS population of common guillemots within the non-breeding season is estimated to be 304,557 individuals (Table 5.14). Assuming an average baseline mortality rate of 0.176, background mortality in the non-breeding season is 53,602 individuals. The addition of seven (four to 98) individual mortalities due to cumulative displacement from construction activities would increase the mortality relative to the baseline mortality by 0.013% (0.007 to 0.183%).
- 5.9.2.26 The annual estimated mortality resulting from displacement during construction is 41 (25 to 576) individuals (Table 5.64). Using the largest UK Western Waters BDMPS population of 1,482,791 Atlantic puffin and, using the average baseline mortality rate of 0.176, the background predicted mortality would be 260,971 individuals. The addition of 20 (13 to 266) mortalities would increase the baseline mortality rate by 0.016% (0.010% to 0.221%). The annual predicted mortality from the cumulative assessment is below the 1% threshold increase in baseline mortality.
- 5.9.2.27 The cumulative effect is predicted to be of national spatial extent, medium term duration, intermittent and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **negligible**.

MONA OFFSHORE WIND PROJECT

Northern gannet

5.9.2.28 The estimated cumulative abundance of northern gannet from the relevant projects is presented in Table 5.65.

Table 5.65: Northern gannet cumulative abundances for overlapping construction phase offshore wind projects for disturbance and displacement assessment.

Project	Annual Abundance	Pre-breeding Abundance	Breeding Season Abundance	Post-breeding Abundance
Tier 1				
Awel y Môr Offshore Wind Farm	529	0	328	201
Erebus Floating Wind Demo	658	100	224	334
West of Orkney Windfarm	2,188	59	958	1,171
White Cross Offshore Wind Farm	456	141	239	76
Tier 2				
Morecambe Offshore Windfarm Generation Assets	912	0	748	164
Morgan Offshore Wind Project Generation Assets	454	53	209	192
TOTAL (minus the Mona Offshore Wind Project)	5,197	353	2,706	2,138
Mona Offshore Wind Project	337	28	251	58
TOTAL (all projects)	5,534	381	2,957	2,196

5.9.2.29 The following displacement matrices provide the estimated cumulative mortality of northern gannet predicted to occur due to displacement, as determined by the relevant specified rates of displacement and mortality (Table 5.66 to Table 5.69). The approach used for the cumulative displacement assessment follows that presented in Volume 6, Annex 5.2: Offshore ornithology displacement technical report of the Environmental Statement (Document reference F6.5.2).

MONA OFFSHORE WIND PROJECT

Table 5.66: Construction phase cumulative northern gannet mortality following displacement from offshore wind farms in the pre-breeding season.

281 Mortality level (% of displaced birds at risk of mortality)		1%	2%	5%	10%	25%	50%	100%
Displacement level (% at risk of displacement)	10%	0	1	2	4	10	19	38
	20%	1	2	4	8	19	38	76
	30%	1	2	6	11	29	57	114
	35%	1	3	7	13	33	67	133
	40%	2	3	8	15	38	76	152
	50%	2	4	10	19	48	95	191
	60%	2	5	11	23	57	114	229
	70%	3	5	13	27	67	133	267
	80%	3	6	15	30	76	152	305
	90%	3	7	17	34	86	171	343
100%	4	8	19	38	95	191	381	

Table 5.67: Construction phase cumulative northern gannet mortality following displacement from offshore wind farms in the breeding season.

Mortality level (% of displaced birds at risk of mortality)		1%	2%	5%	10%	25%	50%	100%
Displacement level (% at risk of displacement)	10%	3	6	15	30	74	148	296
	20%	6	12	30	59	148	296	591
	30%	9	18	44	89	222	444	887
	35%	10	21	52	103	259	517	1,035
	40%	12	24	59	118	296	591	1,183
	50%	15	30	74	148	370	739	1,479
	60%	18	35	89	177	444	887	1,774
	70%	21	41	103	207	517	1,035	2,070
	80%	24	47	118	237	591	1,183	2,366
	90%	27	53	133	266	665	1,331	2,661
100%	30	59	148	296	739	1,479	2,957	

MONA OFFSHORE WIND PROJECT

Table 5.68: Construction phase cumulative northern gannet mortality following displacement from offshore wind farms in the post-breeding season.

		Mortality level (% of displaced birds at risk of mortality)						
		1%	2%	5%	10%	25%	50%	100%
Displacement level (% at risk of displacement)	10%	2	4	11	22	55	110	220
	20%	4	9	22	44	110	220	439
	30%	7	13	33	66	165	329	659
	35%	8	15	38	77	192	384	769
	40%	9	18	44	88	220	439	878
	50%	11	22	55	110	275	549	1,098
	60%	13	26	66	132	329	659	1,318
	70%	15	31	77	154	384	769	1,537
	80%	18	35	88	176	439	878	1,757
	90%	20	40	99	198	494	988	1,976
100%	22	44	110	220	549	1,098	2,196	

Table 5.69: Construction phase cumulative northern gannet mortality following displacement from offshore wind farms annually.

		Mortality level (% of displaced birds at risk of mortality)						
		1%	2%	5%	10%	25%	50%	100%
Displacement level (% at risk of displacement)	10%	6	11	28	55	138	277	553
	20%	11	22	55	111	277	553	1,107
	30%	17	33	83	166	415	830	1,660
	35%	19	39	97	194	484	968	1,937
	40%	22	44	111	221	553	1,107	2,214
	50%	28	55	138	277	692	1,384	2,767
	60%	33	66	166	332	830	1,660	3,320
	70%	39	77	194	387	968	1,937	3,874
	80%	44	89	221	443	1,107	2,214	4,427
	90%	50	100	249	498	1,245	2,490	4,981
100%	55	111	277	553	1,384	2,767	5,534	

5.9.2.30 During the spring migration (pre-breeding) season the displacement from construction when using a displacement rate of 35% (range: 30% to 40%) and a mortality of 1% (range: 1 to 10%), results in an additional loss of 1 (1 to 15) individual (Table 5.66). The regional seas UK Western Waters BDMPS population of northern gannet in the

MONA OFFSHORE WIND PROJECT

spring migration period is estimated to be 661,888 individuals (Table 5.14). Assuming an average baseline mortality rate of 0.193 (Table 5.15), background mortality during spring migration is 127,744 individuals. The addition of one (one to 15) individual mortalities due to cumulative displacement from construction activities would increase the mortality relative to the baseline mortality by 0.001 % (0.001 to 0.009%).

- 5.9.2.31 During the breeding season, displacement from construction results in the loss of 10 (9 to 118) individuals from the breeding population (Table 5.67). The regional seas UK Western Waters BDMPS population of northern gannet within the breeding season is estimated to be 522,888 individuals (Table 5.14). Assuming an average baseline mortality rate of 0.193, background mortality in the breeding season is 100,917 individuals. The addition of 10 (nine to 118) individual mortalities due to cumulative displacement from construction activities would increase the mortality relative to the baseline mortality by 0.010 % (0.009 to 0.117%).
- 5.9.2.32 During the post breeding season, displacement from construction results in the loss of eight (seven to 88) individuals (Table 5.68). The regional seas UK Western Waters BDMPS population of northern gannet during the autumn migration period is estimated to be 545,954 individuals (Table 5.14). Assuming an average baseline mortality rate of 0.193, background mortality during autumn migration is 105,369 individuals. The addition of eight (seven to 88) individual mortalities due to cumulative displacement from construction activities would increase the mortality relative to the baseline mortality by 0.008 % (0.007 to 0.084%).
- 5.9.2.33 The annual estimated mortality resulting from displacement during construction is 19 (17 to 221) individuals (Table 5.69). Using the largest UK Western Waters BDMPS population of 661,888 individuals, with an average baseline mortality rate of 0.193, the background predicted mortality would be 127,744. The addition of 19 (17 to 221) mortalities would increase the baseline mortality rate by 0.015% (0.013% to 0.173%). The annual predicted mortality from the cumulative assessment is below the 1% threshold increase in baseline mortality.
- 5.9.2.34 The cumulative effect is predicted to be of national spatial extent, medium term duration, intermittent and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **negligible**.

Black-legged kittiwake

- 5.9.2.35 The estimated cumulative abundance of black-legged kittiwake from the relevant projects is presented in Table 5.70.

Table 5.70: Black-legged kittiwake cumulative abundances for overlapping construction phase offshore wind projects for disturbance and displacement assessment.

Project	Annual Abundance	Pre-breeding Abundance	Breeding Season Abundance	Post-breeding Abundance
Tier 1				
Awel y Môr Offshore Wind Farm	467	298	87	82
Erebus Floating Wind Demo	2,532	2	2,022	508
West of Orkney Windfarm	2,706	1,217	690	799

MONA OFFSHORE WIND PROJECT

Project	Annual Abundance	Pre-breeding Abundance	Breeding Season Abundance	Post-breeding Abundance
White Cross Offshore Windfarm	914	698	44	172
Tier 2				
Morecambe Offshore Windfarm Generation Assets	9,106	1,161	3,899	4,046
Morgan Offshore Wind Project Generation Assets	2,724	645	460	1,619
Rampion 2 (Rampion Extension)	388	286	5	97
TOTAL (minus the Mona Offshore Wind Project)	18,837	4,307	7,207	7,323
Mona Offshore Wind Project	1,860	574	726	560
TOTAL (all projects)	20,697	4,881	7,933	7,883

5.9.2.36 The following displacement matrices provide the estimated cumulative mortality of black-legged kittiwake predicted to occur due to displacement, as determined by the relevant specified rates of displacement and mortality (Table 5.71 to Table 5.74). The approach used for the cumulative displacement assessment follows that presented in Volume 6, Annex 5.2: Offshore ornithology displacement technical report of the Environmental Statement (Document reference F6.5.2).

Table 5.71: Construction phase cumulative black-legged kittiwake mortality following displacement from offshore wind farms in the pre-breeding season.

		Mortality level (% of displaced birds at risk of mortality)						
		1%	2%	5%	10%	25%	50%	100%
Displacement level (% at risk of displacement)	5%	2	5	12	24	61	122	244
	10%	5	10	24	49	122	244	488
	15%	7	15	37	73	183	366	733
	20%	10	20	49	98	244	488	977
	25%	12	24	61	122	305	611	1,221
	30%	15	29	73	147	366	733	1,465
	35%	17	34	85	171	427	855	1,709
	60%	29	59	147	293	733	1,465	2,930
	80%	39	78	195	391	977	1,954	3,907
	100%	49	98	244	488	1,221	2,442	4,884

MONA OFFSHORE WIND PROJECT

Table 5.72: Construction phase cumulative black-legged kittiwake mortality following displacement from offshore wind farms in the breeding season.

		Mortality level (% of displaced birds at risk of mortality)						
		1%	2%	5%	10%	25%	50%	100%
Displacement level (% at risk of displacement)	5%	4	8	20	40	99	198	397
	10%	8	16	40	79	198	397	793
	15%	12	24	59	119	297	595	1,190
	20%	16	32	79	159	397	793	1,587
	25%	20	40	99	198	496	992	1,983
	30%	24	48	119	238	595	1,190	2,380
	35%	28	56	139	278	694	1,388	2,777
	60%	48	95	238	476	1,190	2,380	4,760
	80%	63	127	317	635	1,587	3,173	6,346
	100%	79	159	397	793	1,983	3,967	7,933

Table 5.73: Construction phase cumulative black-legged kittiwake mortality following displacement from offshore wind farms in the post-breeding season.

		Mortality level (% of displaced birds at risk of mortality)						
		1%	2%	5%	10%	25%	50%	100%
Displacement level (% at risk of displacement)	5%	4	8	20	39	99	197	394
	10%	8	16	39	79	197	394	788
	15%	12	24	59	118	296	591	1,182
	20%	16	32	79	158	394	788	1,577
	25%	20	39	99	197	493	985	1,971
	30%	24	47	118	236	591	1,182	2,365
	35%	28	55	138	276	690	1,380	2,759
	60%	47	95	236	473	1,182	2,365	4,730
	80%	63	126	315	631	1,577	3,153	6,306
	100%	79	158	394	788	1,971	3,942	7,883

MONA OFFSHORE WIND PROJECT

Table 5.74: Construction phase cumulative black-legged kittiwake mortality following displacement from offshore wind farms annually.

		Mortality level (% of displaced birds at risk of mortality)						
		1%	2%	5%	10%	25%	50%	100%
Displacement level (% at risk of displacement)	5%	10	21	52	103	259	517	1,035
	10%	21	41	103	207	517	1,035	2,070
	15%	31	62	155	310	776	1,552	3,105
	20%	41	83	207	414	1,035	2,070	4,139
	25%	52	103	259	517	1,294	2,587	5,174
	30%	62	124	310	621	1,552	3,105	6,209
	35%	72	145	362	724	1,811	3,622	7,244
	60%	124	248	621	1,242	3,105	6,209	12,418
	80%	166	331	828	1,656	4,139	8,279	16,558
	100%	207	414	1,035	2,070	5,174	10,349	20,697

5.9.2.37 During the spring migration (pre-breeding) season the displacement from construction when using a displacement rate of 25% (range: 15% to 35%) and a mortality of 1% (range: 1 to 10%), results in an additional loss of 12 (seven to 171) individuals (Table 5.71). The regional seas UK Western Waters & Channel BDMPS population of black-legged kittiwake in the spring migration period is estimated to be 691,526 individuals (Table 5.14). Assuming an average baseline mortality rate of 0.156 (Table 5.15), background mortality during spring migration is 107,878 individuals. The addition of 132(seven to 171) individual mortalities due to cumulative displacement from construction activities would increase the mortality relative to the baseline mortality by 0.011 % (0.006 to 0.159%).

5.9.2.38 During the breeding season, displacement from construction results in the loss of 20 (12 to 278) individuals from the breeding population (Table 5.72) The regional seas UK Western Waters & Channel BDMPS population of black-legged kittiwake within the breeding season is estimated to be 245,234 individuals (Table 5.14). Assuming an average baseline mortality rate of 0.156, background mortality in the breeding season is 38,256 individuals. The addition of 20 (12 to 278) individual mortalities due to cumulative displacement from construction activities would increase the mortality relative to the baseline mortality by 0.052 % (0.031 to 0.727%).

5.9.2.39 During the autumn migration season (post-breeding), displacement from construction results in a loss of 20 (12 to 276) individuals from the migratory population (Table 5.73). The regional seas UK Western Waters & Channel BDMPS population of black-legged kittiwake during the autumn migration period is estimated to be 911,586 individuals (Table 5.14). Assuming an average baseline mortality rate of 0.156, background mortality during autumn migration is 142,207 individuals. The addition of 20 (12 to 276) individual mortalities due to cumulative displacement from construction activities would increase the mortality relative to the baseline mortality by 0.014 % (0.008 to 0.194%).

5.9.2.40 The annual estimated mortality resulting from displacement during construction is 52 (31 to 724) individuals (Table 5.74).Using the largest UK Western Waters & Channel

MONA OFFSHORE WIND PROJECT

BDMPS population of 911,586 individuals, with an average baseline mortality rate of 0.156, the background predicted mortality would be 142,207. The addition of 52 (31 to 724) mortalities would increase the baseline mortality rate by 0.036% (0.022% to 0.509%). The annual predicted mortality from the cumulative assessment is below the 1% threshold increase in baseline mortality.

5.9.2.41 The cumulative effect is predicted to be of national spatial extent, medium term duration, intermittent and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **negligible**.

Manx shearwater

5.9.2.42 The estimated cumulative abundances of Manx shearwater are presented in Table 5.75 for the relevant projects.

Table 5.75: Manx shearwater cumulative abundances for overlapping construction phase offshore wind projects for disturbance and displacement assessment.

Project	Annual Cumulative Abundance	Pre-breeding Cumulative Abundance	Breeding Season Cumulative Abundance	Post-breeding Cumulative Abundance
Tier 1				
Awel y Môr Offshore Wind Farm	417	214	26	177
Erebus Floating Wind Demo	2,115	18	1,540	557
West of Orkney Windfarm	11	0	8	3
White Cross Offshore Windfarm	12,181	12,126	33	22
Tier 2				
Morecambe Offshore Windfarm Generation Assets	7,583	0	7,577	6
Morgan Offshore Wind Project Generation Assets	993	59	467	467
Rampion 2 (Rampion Extension) Offshore Wind Farm	0	0	0	0
TOTAL (minus the Mona Offshore Wind Project)	23,300	12,417	9,651	1,232
Mona Offshore Wind Project	1,274,268	63	1,249	16
TOTAL (all projects)	24,574,568	12,420	10,900	1,248

5.9.2.43 The following displacement matrices provide the estimated cumulative mortality of Manx shearwater predicted to occur due to displacement, as determined by the relevant specified rates of displacement and mortality (Table 5.76 to Table 5.79). The

MONA OFFSHORE WIND PROJECT

approach used for the cumulative displacement assessment follows that presented in Volume 6, Annex 5.2: Offshore ornithology displacement assessment technical report of the Environmental Statement (Document reference F6.5.2).

Table 5.76: Construction phase cumulative Manx shearwater mortality following displacement from offshore wind farms in the pre-breeding season.

Mortality level (% of displaced birds at risk of mortality)		1%	2%	5%	10%	25%	50%	100%
Displacement level (% at risk of displacement)	5%	6	12	31	62	155	311	621
	10%	12	25	62	124	311	621	1,242
	15%	19	37	93	186	466	932	1,863
	20%	25	50	124	248	621	1,242	2,484
	25%	31	62	155	311	776	1,553	3,105
	30%	37	75	186	373	932	1,863	3,726
	35%	43	87	217	435	1,087	2,174	4,347
	60%	75	149	373	745	1,863	3,726	7,452
	80%	99	199	497	994	2,484	4,968	9,936
	100%	124	248	621	1,242	3,105	6,210	12,420

Table 5.77: Construction phase cumulative Manx shearwater mortality following displacement from offshore wind farms in the breeding season.

Mortality level (% of displaced birds at risk of mortality)		1%	2%	5%	10%	25%	50%	100%
Displacement level (% at risk of displacement)	5%	5	11	27	55	136	273	545
	10%	16	33	82	164	409	818	1,635
	15%	22	44	109	218	545	1,090	2,180
	20%	27	55	136	273	681	1,363	2,725
	25%	33	65	164	327	818	1,635	3,270
	30%	38	76	191	382	954	1,908	3,815
	35%	44	87	218	436	1,090	2,180	4,360
	60%	65	131	327	654	1,635	3,270	6,540
	80%	87	174	436	872	2,180	4,360	8,720
	100%	109	218	545	1,090	2,725	5,450	10,900

Table 5.78: Construction phase cumulative Manx shearwater mortality following displacement from offshore wind farms in the post-breeding season.

Mortality level (% of displaced birds at risk of mortality)		1%	2%	5%	10%	25%	50%	100%
Displacement level (% at risk of displacement)	5%	1	1	3	6	16	31	62
	10%	1	2	6	12	31	62	125
	15%	2	4	9	19	47	94	187
	20%	2	5	12	25	62	125	250
	25%	3	6	16	31	78	156	312
	30%	4	7	19	37	94	187	374
	35%	4	9	22	44	109	218	437
	60%	7	15	37	75	187	374	749
	80%	10	20	50	100	250	499	998
	100%	12	25	62	125	312	624	1,248

Table 5.79: Construction phase cumulative Manx shearwater mortality following displacement from offshore wind farms annually.

Mortality level (% of displaced birds at risk of mortality)		1%	2%	5%	10%	25%	50%	100%
Displacement level (% at risk of displacement)	5%	12	25	61	123	307	614	1,229,228
	10%	25	49	123	246	614	1,229,228	2,457
	15%	37	74	184	369	921	1,843	3,686,685
	20%	49	98	246	491	1,229	2,457	4,914
	25%	61	123	307	614	1,536	3,071	6,143,142
	30%	74	147	369	737	1,843	3,686,685	7,374,370
	35%	86	172	430	860	2,150	4,300,299	8,600,599
	60%	147	295	737	1,474	3,686	7,374,370	14,743,741
	80%	197	393	983	1,966	4,914	9,828,827	19,657,654
	100%	246	491	1,229	2,457	6,143,142	12,286,284	24,574,568

5.9.2.44 During the spring migration (pre-breeding) season the displacement from construction when using a displacement rate of 25% (range: 15% to 35%) and a mortality of 1% (range: 1 to 10%), results in an additional loss of 31 (19 to 435) individuals (Table 5.76). The regional seas UK Western Waters & Channel BDMPs population of Manx shearwater in the spring migration period is estimated to be 1,580,895 individuals (Table 5.14). Assuming an average baseline mortality rate of 0.130 (Table 5.15), background mortality during spring migration is 205,516 individuals. The

MONA OFFSHORE WIND PROJECT

addition of 31 (19 to 435) individual mortalities due to cumulative displacement from construction activities would increase the mortality relative to the baseline mortality by 0.015 % (0.009 to 0.212%).

- 5.9.2.45 During the breeding season the displacement from construction when using a displacement rate of 25% (range: 15% to 35%) and a mortality of 1% (range: 1 to 10%), results in an additional loss of 33 (22 to 436) individuals (Table 5.77). The regional seas UK Western Waters & Channel BDMPS population of Manx shearwater within the breeding season is estimated to be 1,821,544 individuals (Table 5.14). Assuming an average baseline mortality rate of 0.130, background mortality in the breeding season is 236,801 individuals. The addition of 33 (22 to 436) individual mortalities due to cumulative displacement from construction activities would increase the mortality relative to the baseline mortality by 0.014 % (0.009 to 0.184%).
- 5.9.2.46 During the autumn migration season (post-breeding), displacement from construction results in a loss of three (two to 44) individuals from the migratory population (Table 5.78). The regional seas UK Western Waters & Channel BDMPS population of Manx shearwater during the autumn migration period is estimated to be 1,580,895 individuals (Table 5.14). Assuming an average baseline mortality rate of 0.130, background mortality during autumn migration is 205,516 individuals. The addition of three (two to 44) individual mortalities due to cumulative displacement from construction activities would increase the mortality relative to the baseline mortality by 0.001 % (0.001 to 0.021%).
- 5.9.2.47 The annual estimated mortality resulting from displacement during construction 61 (37 to 860) individuals (Table 5.79). Using the largest population of 1,821,544 individuals, with an average baseline mortality rate of 0.130, the background predicted mortality would be 236,801. The addition of 61 (37 to 860) mortalities would increase the baseline mortality rate by 0.026% (0.016 to 0.363%). The annual predicted mortality from the cumulative assessment is below the 1% threshold increase in baseline mortality.
- 5.9.2.48 The cumulative effect is predicted to be of national spatial extent, medium term duration, intermittent and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **negligible**.

Sensitivity of the receptor

Common guillemot

- 5.9.2.49 Evidence of common guillemot sensitivity to displacement from the construction phase of offshore wind farms is summarised from paragraph 5.9.2.8 onwards. Overall, based on evidence from studies and reviews, common guillemot is deemed to be of medium vulnerability, medium recoverability and medium value. The sensitivity of the receptor is therefore, considered to be **medium**.

Razorbill

- 5.9.2.50 Evidence of razorbill sensitivity to displacement from the construction phase of offshore wind farms is summarised in paragraph 5.9.2.14 onwards. Overall, based on evidence from studies and reviews, razorbill is deemed to be of medium vulnerability, medium recoverability and medium value. The sensitivity of the receptor is therefore, considered to be **medium**.

MONA OFFSHORE WIND PROJECT

Atlantic puffin

5.9.2.51 Evidence of Atlantic puffin sensitivity to displacement from the construction phase of offshore wind farms is summarised in paragraph 5.9.2.22 onwards. Overall, based on evidence from studies and reviews, Atlantic puffin is deemed to be of medium vulnerability, low recoverability and high value. The sensitivity of the receptor is therefore, considered to be **high**.

Northern gannet

5.9.2.52 Evidence of northern gannet sensitivity to displacement from the construction phase of offshore wind farms is summarised in paragraph 5.9.2.28 onwards. Based on evidence from operational wind farms demonstrating that northern gannet show a high avoidance of offshore wind farms, this species is deemed to be of medium vulnerability, medium recoverability and medium value. The sensitivity of the receptor is therefore, considered to be **medium**.

Black-legged kittiwake

5.9.2.53 Evidence of black-legged kittiwake sensitivity to displacement from the construction phase of offshore wind farms is summarised in paragraph 5.9.2.35 onwards. For kittiwake, there is evidence from other operating offshore wind farm projects that displacement is not likely to occur to any significant level. However, due to low reproductive rates, black-legged kittiwake is deemed to be of low vulnerability, low recoverability and medium value. The sensitivity of the receptor is therefore, considered to be **medium**.

Manx shearwater

5.9.2.54 For Manx shearwater, there is evidence from other operating offshore wind farm projects that displacement is not likely to occur to any significant level (JNCC, 2022). However, due to low reproductive rates, Manx shearwater is deemed to be of low vulnerability, low recoverability and high value. The sensitivity of the receptor is therefore, considered to be **medium**.

Significance of effect

5.9.2.55 Table 5.80 summarises the significance of effect cumulative on the species susceptible to disturbance and displacement impacts. Common guillemot was the only species with a magnitude assessed to be greater than negligible. All impacts are considered non-significant in EIA terms.

Table 5.80: Table summarising the cumulative significance of effect during construction.

Species	Magnitude of impact	Sensitivity of receptor	Significance of effect
Common guillemot	Low	Medium	Minor adverse, not significant in EIA terms
Razorbill	Negligible	Medium	Negligible, not significant in EIA terms
Atlantic puffin	Negligible	High	Negligible, not significant in EIA terms
Northern gannet	Negligible	Medium	Negligible, not significant in EIA terms
Black-legged kittiwake	Negligible	Medium	Negligible, not significant in EIA terms
Manx shearwater	Negligible	Medium	Negligible, not significant in EIA terms

MONA OFFSHORE WIND PROJECT

Tier 1 and Tier 2

Operations and maintenance phase

Magnitude of impact

Common guillemot

5.9.2.56 The estimated cumulative abundance of guillemots from the relevant projects with available data is presented in Table 5.81. There are several projects for which there are no, or limited, data on the number of guillemot predicted to be displaced, for some of the earlier developments which are discussed in Table 5.85.

Table 5.81: Guillemot cumulative abundances for offshore wind projects for disturbance and displacement assessment during the operations and maintenance phase.

Project	Annual Abundance	Breeding Season Abundance	Non-breeding Season Abundance
Tier 1			
Awel y Môr Offshore Wind Farm	4,488	1,569	2,919
Burbo Bank Offshore Wind Farm	Unavailable	Unavailable	Unavailable
Burbo Bank Extension Offshore Wind Farm	2,562	1,000	1,561
Erebus Floating Wind Demo	35,339	7,001	28,338
Gwynt y Môr Offshore Wind Farm	unavailable	Unavailable	Unavailable
Twinhub (Wave Hub Floating Wind Farm)	256	39	217
Ormonde Wind Farm	912	912	Unavailable
Robin Rigg Offshore Wind Farm	138	Unavailable ¹³⁸	Unavailable
Rhyl Flats Offshore Wind Farm	Unavailable	Unavailable	Unavailable
Walney 1 & 2 Offshore Wind Farms	Unavailable	Unavailable	Unavailable
Walney (3 & 4) Extension Offshore Wind Farm	6,096	4,169	1,927
West of Duddon Sands Offshore Windfarm	1,321	1,321	Unavailable
West of Orkney Windfarm	9,136	4,861	4,275
White Cross Offshore Windfarm	4,363	3,304	1,059
Tier 2			
Morecambe Offshore Windfarm Generation Assets	11,697	4,050	7,647

MONA OFFSHORE WIND PROJECT

Project	Annual Abundance	Breeding Season Abundance	Non-breeding Season Abundance
Morgan Offshore Wind Project Generation Assets	8,994	4,893	4,101
Total abundance (minus the Mona Offshore Wind Project)	85,302	32,849 33,257	52,044
Mona Offshore Wind Project	7,976	4,220	3,756
Cumulative total abundance (all projects)	93,278	37,069477	55,800

Collision impacts

Tier 1

Holyhead Deep – Tidal Energy	8	Unavailable	Unavailable
West Anglesey Demonstration Zone tidal site	46	38	8

5.9.2.57 The following displacement matrices provide the estimated cumulative mortality of guillemot predicted to occur due to displacement, as determined by the relevant specified rates of displacement and mortality (Table 5.82 to Table 5.84). The approach used for the cumulative displacement assessment follows that presented in Volume 6, Annex 5.2: Offshore ornithology displacement technical report of the Environmental Statement (Document reference F6.5.2).

Table 5.82: Operations and maintenance phase cumulative guillemot mortality following displacement from offshore wind farms in the breeding season.

Mortality level (% of displaced birds at risk of mortality)		1%	2%	5%	10%	25%	50%	100%
Displacement level (% at risk of displacement)	10%	37	7475	485187	374375	927937	1,853874	3,707748
	20%	7475	448150	374375	744750	1,853874	3,707748	7,414495
	30%	444112	222225	556562	1,442124	2,780811	5,560622	11,424243
	40%	448150	297300	744750	1,483499	3,707748	7,414495	14,828991
	50%	485187	374375	927937	1,853874	4,634685	9,267369	18,535739
	60%	222225	445450	1,442124	2,224249	5,560622	11,424243	22,244486
	70%	259262	549525	1,297312	2,595623	6,487558	42,97413,177	25,94826,234
	80%	297300	593600	1,483499	2,966998	7,414495	14,828991	29,655982
	90%	334337	667675	1,668686	3,336373	8,344342	16,684865	33,362729
	100%	374375	744750	1,853874	3,707748	9,267369	18,535739	37,069477

MONA OFFSHORE WIND PROJECT

Table 5.83: Operations and maintenance phase cumulative guillemot mortality following displacement from offshore wind farms in the non-breeding season.

		Mortality level (% of displaced birds at risk of mortality)						
		1%	2%	5%	10%	25%	50%	100%
Displacement level (% at risk of displacement)	10%	56	112	279	558	1,395	2,790	5,580
	20%	112	223	558	1,116	2,790	5,580	11,160
	30%	167	335	837	1,674	4,185	8,370	16,740
	40%	223	446	1,116	2,232	5,580	11,160	22,320
	50%	279	558	1,395	2,790	6,975	13,950	27,900
	60%	335	670	1,674	3,348	8,370	16,740	33,480
	70%	391	781	1,953	3,906	9,765	19,530	39,060
	80%	446	893	2,232	4,464	11,160	22,320	44,640
	90%	502	1,004	2,511	5,022	12,555	25,110	50,220
	100%	558	1,116	2,790	5,580	13,950	27,900	55,800

Table 5.84: Operations and maintenance phase cumulative guillemot mortality following displacement from offshore wind farms annually.

		Mortality level (% of displaced birds at risk of mortality)						
		1%	2%	5%	10%	25%	50%	100%
Displacement level (% at risk of displacement)	10%	93	187	466	933	2,332	4,664	9,328
	20%	187	373	933	1,866	4,664	9,328	18,656
	30%	280	560	1,399	2,798	6,996	13,992	27,983
	40%	373	746	1,866	3,731	9,328	18,656	37,311
	50%	466	933	2,332	4,664	11,660	23,320	46,639
	60%	560	1,119	2,798	5,597	13,992	27,983	55,967
	70%	653	1,306	3,265	6,529	16,324	32,647	65,295
	80%	746	1,492	3,731	7,462	18,656	37,311	74,622
	90%	840	1,679	4,198	8,395	20,988	41,975	83,950
	100%	933	1,866	4,664	9,328	23,320	46,639	93,278

MONA OFFSHORE WIND PROJECT
Table 5.85: Qualitative assessment of projects considered cumulatively with the Mona Offshore Wind Project for which quantitative consideration of displacement impacts was not undertaken in project-specific documentation for guillemot.

Project	Reason for estimates being unavailable	Qualitative assessment	Final conclusion
Tier 1			
Burbo Bank Offshore Wind Farm (Seascope Energy Ltd., 2002)	Disturbance impacts considered qualitatively	<p>Surveys of the project comprised aerial and boat-based surveys both of which were undertaken during winter months (aerial = November to April and boat-based = December and February). Aerial surveys covered a large area encompassing the Liverpool Bay SPA with boat-based surveys covering the project area. The surveys were undertaken to provide abundance and distribution data for those species considered to be of most importance, namely common scoter and red-throated diver.</p> <p>Guillemots were recorded in all months during which aerial surveys were undertaken however, there is no information on the numbers recorded within the wind farm. During boat-based surveys, which were undertaken across a much smaller area, numbers of guillemot were far smaller with a highest count of 34 birds.</p>	Low levels of disturbance were predicted resulting in a conclusion of a negligible magnitude and a very low significance.
Gwynt y Môr Offshore Wind Farm (RWE Group and Npower Renewables, 2005)	Disturbance impacts considered qualitatively	<p>Site-specific surveys undertaken in support of the project included boat-based surveys undertaken between February 2003 and March 2005. Surveys between February 2003 and February 2004 covered a large area along the Welsh coast incorporating the project area with surveys between March 2004 and March 2005 more focussed on the project area. The assessment also used data from aerial surveys undertaken between 2000 2005 which were targeted at recording common scoter.</p> <p>The majority of guillemot identified to species level during aerial surveys occurred in July and August. Based on the aerial survey data collected during the November 2004 survey, 32 guillemot were estimated to be present in the wind farm area. Birds were seen in or around the wind farm area in most months during which boat-based survey were undertaken with fewer observed between June and September.</p>	It was considered that displacement (termed avoidance of turbines in the assessments conducted) would result in an impact of low significance for auk species.

MONA OFFSHORE WIND PROJECT

Project	Reason for estimates being unavailable	Qualitative assessment	Final conclusion
Ormonde Wind Farm (Ecology Consulting, 2005)	Disturbance impacts considered qualitatively	<p>Site-specific surveys included boat-based surveys undertaken monthly between May 2004 and April 2005. In addition, three aerial surveys were conducted during the summer of 2004 with four further aerial surveys in the winter of 2004/5.</p> <p>The peak population of guillemot recorded in the wind farm plus a 2 km buffer during boat-based surveys was 238 birds. During aerial surveys the equivalent population was 0, although 1,086 auk species were recorded. Peak numbers occurred in autumn months (September or November)</p> <p>The species was considered to be regionally important in the context of the assessments conducted.</p>	The magnitude of the effect for guillemot was considered to be low with a low significance.
Robin Rigg Offshore Wind Farm (Natural Power, 2002)	Disturbance impacts considered qualitatively	<p>The project utilised site-specific boat-based surveys to characterise the baseline environment. Two surveys were completed in each month from May 2001 for one year. In addition, aerial surveys were undertaken from November 2001 on a monthly basis through winter and spring to verify the distribution and abundance of seabirds.</p> <p>The mean count of guillemot during boat-based surveys in the wind farm was 7.9 (and 0.4 for auk species) birds with a peak of 39 birds (3 for auk species). Guillemot was considered to be of local importance based on the populations recorded in the wind farm. Aerial surveys undertaken in the non-breeding season recorded a maximum of two auks.</p>	The magnitude of the effect was considered to be low with a low significance.
Rhyl Flats Offshore Wind Farm (Ecology Consulting, 2002)	Disturbance impacts considered qualitatively	<p>Surveys of the project comprised aerial and boat-based surveys. Aerial surveys were undertaken between December 2001 and January 2002 and targeted common scoter, with non-target species not uniformly reported upon. Boat-based surveys were undertaken between January and March 2002 to record movements of common scoter and the flight height of birds.</p> <p>Few auks were recorded in the wind farm area. It was considered that the wind farm area represented an area of low importance for foraging for guillemot from the Puffin Island, Anglesey and moderate importance for guillemot from the Great Ormes Head SSSI.</p>	Wind farm area not considered to be importance for seabirds and significant effects were considered unlikely.

MONA OFFSHORE WIND PROJECT

Project	Reason for estimates being unavailable	Qualitative assessment	Final conclusion
Walney 1 & 2 Offshore Wind Farms (RPS, 2006)	Disturbance impacts considered qualitatively	<p>Site-specific surveys included boat-based surveys undertaken across an area of 512 km² in the vicinity of the project between May 2004 and September 2005. The project also utilised survey data collected by regional aerial surveys, undertaken across their aerial survey area between 2002 and 2006 and radar survey data collected between 1st October and 29th October 2005.</p> <p>The peak population of guillemot recorded in the project area plus 2 km buffer during aerial surveys was 30 birds with a peak count of 391 auk species in the same area. In boat-based surveys the equivalent populations were 1,256 guillemot and 65 auk species.</p>	<p>It was considered that the wind farm area did not represent a favoured foraging habitat and the magnitude of any impact was considered to be low. The species was considered to be of medium importance (termed sensitivity in the Walney 1&2 assessments).</p> <p>The overall significance of impacts associated with the project was considered to be low.</p>

MONA OFFSHORE WIND PROJECT

- 5.9.2.58 During the breeding season, the displacement from operation when using a displacement of 50% (range of 30 to 70%) and a mortality of 1% (range of 1 to 10%), results in an additional loss of ~~185 (111 187 (112~~ to 2,595623) individuals from the breeding population. The regional seas UK Western Waters BDMPS population of common guillemots within the breeding season is estimated to be 1,145,528 individuals (Table 5.14). Assuming an average baseline mortality rate of 0.133 (Table 5.15), background mortality in the breeding season is 152,355 individuals. The addition of ~~185 (111 187 (112~~ to 2,595623) individual mortalities due to cumulative displacement from the presence of infrastructure, plus the additional 38 mortalities from collision with underwater turbines, would increase the mortality relative to the baseline mortality by ~~0.422 123%~~ (0.073074 to 1.703722%).
- 5.9.2.59 During the non-breeding season, the displacement from operation results in an additional loss of 279 (167 to 3,906) individuals from the non-breeding population (Table 5.83). The regional seas UK Western Waters BDMPS population of common guillemots within the non-breeding season is estimated to be 1,139,220 individuals (Table 5.14). Assuming an average baseline mortality rate of 0.133, background mortality in the non-breeding season is 151,516 individuals. The addition of 279 (167 to 3,906) individual mortalities due to cumulative displacement from the presence of infrastructure, plus the additional 8 mortalities from collision with underwater turbines, would increase the mortality relative to the baseline mortality by 0.184 % (0.110 to 2.578%).
- 5.9.2.60 The annual estimated mortality resulting from displacement during operation is 466 (280 to 6,529) individuals (Table 5.84). Using the largest BDMPS UK Western Waters population of 1,145,528 individuals and, using the average baseline mortality rate of 0.133 (Table 5.15), the annual background predicted mortality would be 152,355. The additional of 466 (280 to 6,529) mortalities, plus the additional 54 mortalities from collision with underwater turbines would increase the baseline mortality rate by 0.306% (0.184% to 4.286%).
- 5.9.2.61 These numbers demonstrate that the operations and maintenance phase of the Mona Offshore Wind Project combined with the operations phase of the surrounding offshore wind farms in the Irish Sea could cumulatively cause an increase greater than a 1% increase in baseline mortality and further assessment (using PVA) was required.
- 5.9.2.62 If the upper ranges of displacement and mortality are used, the predicted increase in baseline mortality of the BDMPS populations for common guillemot would exceed a threshold increase of 1%. To understand the consequence of a 1% increase or above in baseline mortality, the impact on the demographic rates was assessed in Volume 6, Annex 5.6: Offshore ornithology PVA of the Environmental Statement.
- 5.9.2.63 The PVA revealed that the SNCB recommended upper scenario of 70% displacement and 10% mortality would result in the population being 20.6% smaller after 35 years (in 2065), than a non-impacted population. The counterfactual of growth rate would be 0.994, but the population is still predicted to increase with a median growth rate of 1.091 (1.014 to 1.024, lower and upper confidence intervals). Under all of the nine modelled scenarios, which present a range of potential impacts as suggested by the SNCBs, the population is predicted to continue to grow. The full PVA results are presented in Volume 6, Annex 5.6: Offshore Ornithology Population Viability Analysis Technical Report (Document reference F6.5.6). The more likely scenario of 50% displacement and 1% mortality resulted in a counterfactual growth rate of 1.000 resulting in a 1.6% decrease in population size after 35 years.
- 5.9.2.64 Regardless of which of the nine modelled scenarios (up to 70% displacement and 10% mortality) is considered, the common guillemot population in the UK Western waters

MONA OFFSHORE WIND PROJECT

BDMPS is predicted to grow. The population is still expected to continue to grow and will be larger after 35 years than that which is currently recorded, even in the event of the largest impact, which is not significant in EIA terms.

5.9.2.65 Due to the minimal level of change to baseline conditions, the cumulative effect is predicted to be of national spatial extent, long term duration, continuous and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**.

Razorbill

5.9.2.66 The estimated cumulative abundance of razorbill from the relevant projects with available data is presented in Table 5.86. There are several projects for which there are no, or limited, data on the number of razorbill predicted to be displaced, for some of the earlier developments which are discussed in Table 5.92.

Table 5.86: Razorbill cumulative abundances for offshore wind projects for disturbance and displacement assessment during the operations and maintenance phase.

Project	Annual Abundance	Pre-breeding Abundance	Breeding Season Abundance	Post-breeding Abundance	Non-breeding Abundance
Tier 1					
Awel y Môr Offshore Wind Farm	692	336	140	66	150
Burbo Bank Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Burbo Bank Extension Offshore Wind Farm	93	Bioseason not presented in original application	64	Bioseason not presented in original application	29
Erebus Floating Wind Demo	3,867	896	194	1,708	1,069
Gwynt y Môr Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
TwinHub (Wave Hub Floating Wind Farm)	65	Unavailable	12	Unavailable	53
Ormonde Wind Farm	174	Unavailable	174	Unavailable	Unavailable
Robin Rigg Offshore Wind Farm	63	Unavailable	Unavailable ⁶³	Unavailable	Unavailable
Rhyl Flats Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Walney 1 & 2 Offshore Wind Farms	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Walney (3 & 4) Extension Offshore Wind Farm	4,016	0	76	874	3,066
West of Duddon Sands Offshore Windfarm	202	Unavailable	Unavailable	Unavailable	202
West of Orkney Windfarm	326	97	70	144	15

MONA OFFSHORE WIND PROJECT

Project	Annual Abundance	Pre-breeding Abundance	Breeding Season Abundance	Post-breeding Abundance	Non-breeding Abundance
White Cross Offshore Windfarm	786	345	40	40	361

Tier 2

Morecambe Offshore Windfarm Generation Assets	1,881	389	222	674	596
Morgan Offshore Wind Project Generation Assets	622	166	120	103	233
Total (minus the Mona Offshore Wind Project)	12,787	2,229	1,442 175	3,609	5,774
Mona Offshore Wind Project	2,519	1,924	83	91	421
Cumulative total (all projects)	15,306	4,153	1,495 258	3,700	6,195

Collision impacts

Tier 1

Holyhead Deep – Tidal Energy	1	Unavailable	Unavailable	Unavailable	Unavailable
West Anglesey Demonstration Zone tidal site	23.7	0	11.7	0	12

5.9.2.67 The following displacement matrices provide the estimated cumulative mortality of razorbill predicted to occur due to displacement, as determined by the relevant specified rates of displacement and mortality (Table 5.87 to Table 5.91). The approach used for the cumulative displacement assessment follows that presented in Volume 6, Annex 5.2: Offshore ornithology displacement technical report of the Environmental Statement (Document reference F6.5.2).

MONA OFFSHORE WIND PROJECT

Table 5.87: Operations and maintenance phase cumulative razorbill mortality following displacement from offshore wind farms in the pre-breeding season.

		Mortality level (% of displaced birds at risk of mortality)						
		1%	2%	5%	10%	25%	50%	100%
Displacement level (% at risk of displacement)	10%	4	8	21	42	104	208	415
	20%	8	17	42	83	208	415	831
	30%	12	25	62	125	311	623	1,246
	40%	17	33	83	166	415	831	1,661
	50%	21	42	104	208	519	1,038	2,077
	60%	25	50	125	249	623	1,246	2,492
	70%	29	58	145	291	727	1,454	2,907
	80%	33	66	166	332	831	1,661	3,322
	90%	37	75	187	374	934	1,869	3,738
	100%	42	83	208	415	1,038	2,077	4,153

Table 5.88: Operations and maintenance phase cumulative razorbill mortality following displacement from offshore wind farms in the breeding season.

		Mortality level (% of displaced birds at risk of mortality)						
		1%	2%	5%	10%	25%	50%	100%
Displacement level (% at risk of displacement)	10%	1	23	6	4213	3031	6063	420126
	20%	23	5	4213	2425	6063	420126	239252
	30%	4	78	4819	3638	9094	479189	359377
	40%	5	10	2425	4850	420126	239252	478503
	50%	6	4213	3031	6063	449157	299315	598629
	60%	78	4415	3638	7275	479189	359377	717755
	70%	89	4718	4244	8488	209220	418440	837881
	80%	10	4920	4850	96101	239252	478503	9561,006
	90%	11	2223	5457	408113	269283	538566	1,076132
	100%	4213	2425	6063	420126	299315	598629	1,495258

MONA OFFSHORE WIND PROJECT

Table 5.89: Operations and maintenance phase cumulative razorbill mortality following displacement from offshore wind farms in the post-breeding season.

		Mortality level (% of displaced birds at risk of mortality)						
		1%	2%	5%	10%	25%	50%	100%
Displacement level (% at risk of displacement)	10%	4	7	19	37	93	185	370
	20%	7	15	37	74	185	370	740
	30%	11	22	56	111	278	555	1,110
	40%	15	30	74	148	370	740	1,480
	50%	19	37	93	185	463	925	1,850
	60%	22	44	111	222	555	1,110	2,220
	70%	26	52	130	259	648	1,295	2,590
	80%	30	59	148	296	740	1,480	2,960
	90%	33	67	167	333	833	1,665	3,330
	100%	37	74	185	370	925	1,850	3,700

Table 5.90: Operations and maintenance phase cumulative razorbill mortality following displacement from offshore wind farms in the non-breeding season.

		Mortality level (% of displaced birds at risk of mortality)						
		1%	2%	5%	10%	25%	50%	100%
Displacement level (% at risk of displacement)	10%	6	12	31	62	155	310	620
	20%	12	25	62	124	310	620	1,239
	30%	19	37	93	186	465	929	1,859
	40%	25	50	124	248	620	1,239	2,478
	50%	31	62	155	310	774	1,549	3,098
	60%	37	74	186	372	929	1,859	3,717
	70%	43	87	217	434	1,084	2,168	4,337
	80%	50	99	248	496	1,239	2,478	4,956
	90%	56	112	279	558	1,394	2,788	5,576
	100%	62	124	310	620	1,549	3,098	6,195

MONA OFFSHORE WIND PROJECT

Table 5.91: Operations and maintenance phase cumulative razorbill mortality following displacement from offshore wind farms annually.

		Mortality level (% of displaced birds at risk of mortality)						
		1%	2%	5%	10%	25%	50%	100%
Displacement level (% at risk of displacement)	10%	15	31	77	153	383	765	1,531
	20%	31	61	153	306	765	1,531	3,061
	30%	46	92	230	459	1,148	2,296	4,592
	40%	61	122	306	612	1,531	3,061	6,122
	50%	77	153	383	765	1,913	3,827	7,653
	60%	92	184	459	918	2,296	4,592	9,184
	70%	107	214	536	1,071	2,679	5,357	10,714
	80%	122	245	612	1,224	3,061	6,122	12,245
	90%	138	276	689	1,378	3,444	6,888	13,775
	100%	153	306	765	1,531	3,827	7,653	15,306

MONA OFFSHORE WIND PROJECT
Table 5.92: Qualitative assessment of projects considered cumulatively with the Mona Offshore Wind Project for which quantitative consideration of displacement impacts was not undertaken in project-specific documentation for razorbill.

Project	Reason for estimates being unavailable	Qualitative assessment	Final conclusion
Tier 1			
Burbo Bank Offshore Wind Farm (Seascope Energy Ltd., 2002)	Disturbance impacts considered qualitatively	<p>Surveys of the project comprised aerial and boat-based surveys both of which were undertaken during winter months (aerial = November to April and boat-based = December and February). Aerial surveys covered a large area encompassing the Liverpool Bay SPA with boat-based surveys covering the project area. The surveys were undertaken to provide abundance and distribution data for those species considered to be of most importance, namely common scoter and red-throated diver.</p> <p>Razorbill was not identified during aerial surveys however, it is likely that any razorbill present were recorded as auk species with this group recorded in all months during which aerial surveys were undertaken. There is however, no information on the numbers recorded within the wind farm. During boat-based surveys, only three razorbill were seen.</p>	Low levels of disturbance were predicted resulting in a conclusion of a negligible magnitude and a very low significance.
Gwynt y Môr Offshore Wind Farm (RWE Group and Npower Renewables, 2005)	Disturbance impacts considered qualitatively	<p>Site-specific surveys undertaken in support of the project included boat-based surveys undertaken between February 2003 and March 2005. Surveys between February 2003 and February 2004 covered a large area along the Welsh coast incorporating the project area with surveys between March 2004 and March 2005 more focussed on the project area. The assessment also used data from aerial surveys undertaken between 2000 2005 which were targeted at recording common scoter.</p> <p>The number of razorbill recorded during surveys was lower than the number of guillemot recorded. The greatest numbers recorded during boat-based surveys was between October and March with only three observations in the wind farm area between June and September with all in September.</p>	It was considered that displacement (termed avoidance of turbines in the assessments conducted) would result in an impact of low significance for auk species.

MONA OFFSHORE WIND PROJECT

Project	Reason for estimates being unavailable	Qualitative assessment	Final conclusion
Ormonde Wind Farm (Ecology Consulting, 2005)	Disturbance impacts considered qualitatively	<p>Site-specific surveys included boat-based surveys undertaken monthly between May 2004 and April 2005. In addition, three aerial surveys were conducted during the summer of 2004 with four further aerial surveys in the winter of 2004/5.</p> <p>The peak population of razorbill recorded in the wind farm plus a 2 km buffer during boat-based surveys was 85 birds. During aerial surveys the equivalent population was 0, although 1,086 auk species were recorded. Peak numbers occurred in autumn months (November).</p> <p>The species was considered to be regionally important in the context of the assessments conducted.</p>	The magnitude of the effect for razorbill was considered to be low with a low significance.
Robin Rigg Offshore Wind Farm (Natural Power, 2002)	Disturbance impacts considered qualitatively	<p>The project utilised site-specific boat-based surveys to characterise the baseline environment. Two surveys were completed in each month from May 2001 for one year. In addition, aerial surveys were undertaken from November 2001 on a monthly basis through winter and spring to verify the distribution and abundance of seabirds.</p> <p>The mean count of razorbill during boat-based surveys in the wind farm was 2.0 (and 0.4 for auk species) birds with a peak of 18 birds (three for auk species). Razorbill was considered to be of local importance based on the populations recorded in the wind farm. Aerial surveys undertaken in the non-breeding season recorded a maximum of two auks.</p>	The magnitude of the effect was considered to be low with a low significance.
Rhyl Flats Offshore Wind Farm (Ecology Consulting, 2002)	Disturbance impacts considered qualitatively	<p>Surveys of the project comprised aerial and boat-based surveys. Aerial surveys were undertaken between December 2001 and January 2002 and targeted common scoter, with non-target species not uniformly reported upon. Boat-based surveys were undertaken between January and March 2002 to record movements of common scoter and the flight height of birds.</p> <p>Few auks were recorded in the wind farm area. It was considered that the wind farm area represented an area of negligible importance for foraging for razorbill from the Puffin Island, Anglesey and moderate importance for razorbill from the Great Ormes Head SSSI.</p>	Wind farm area not considered to be importance for seabirds and significant effects were considered unlikely.

MONA OFFSHORE WIND PROJECT

Project	Reason for estimates being unavailable	Qualitative assessment	Final conclusion
Walney 1 & 2 Offshore Wind Farms (RPS, 2006)	Disturbance impacts considered qualitatively	<p>Site-specific surveys included boat-based surveys undertaken across an area of 512 km² in the vicinity of the project between May 2004 and September 2005. The project also utilised survey data collected by regional aerial surveys, undertaken across their aerial survey area between 2002 and 2006 and radar survey data collected between 1st October and 29th October 2005.</p> <p>The peak population of razorbill recorded in the project area plus 2 km buffer during aerial surveys was two birds with a peak count of 391 auk species in the same area. In boat-based surveys the equivalent populations were 292 razorbill and 65 auk species.</p>	<p>It was considered that the wind farm area did not represent a favoured foraging habitat and the magnitude of any impact was considered to be low. The species was considered to be of medium sensitivity.</p> <p>The overall significance of impacts associated with the project was considered to be low.</p>

MONA OFFSHORE WIND PROJECT

- 5.9.2.68 During the spring migration (pre-breeding) season the displacement from operation when using the displacement of 50% (range of 30 to 70%) and a mortality rate of 1% (range of 1 to 10%), results in an additional loss of 21 (12 to 291) individuals (Table 5.87). The regional seas UK Western Waters BDMPs population of razorbill in the spring migration period is estimated to be 606,914 individuals (Table 5.14). Assuming an average baseline mortality rate of 0.172 (Table 5.15), background mortality during spring migration is 104,389 individuals. The addition of 21 (12 to 291) individual mortalities, due to cumulative displacement from the presence of infrastructure would increase the mortality relative to the baseline mortality by 0.020% (0.012 to 0.278%). Zero mortalities were estimated for underwater collision.
- 5.9.2.69 During the breeding season, displacement from operation results in the loss of six (four to ~~8488~~) individuals from the breeding population (Table 5.87). The regional seas UK Western Waters BDMPs population of razorbill within the breeding season is estimated to be 198,969 individuals (Table 5.14). Assuming an average baseline mortality rate of 0.172, background mortality in the breeding season is 34,223 individuals. The addition of six (four to ~~8488~~) individual mortalities due to cumulative displacement from the presence of infrastructure, plus the additional 11.7 mortalities from collision with underwater turbines would increase the mortality relative to the baseline mortality by ~~0.052-0.53%~~ (0.04545% to 0.279%)-292%).
- 5.9.2.70 During the autumn migration season (post-breeding), displacement from operation results in a loss of 19 (11 to 259) individuals from the migratory population (Table 5.89). The regional seas UK Western Waters BDMPs population of razorbill during the autumn migration period is estimated to be 606,914 individuals (Table 5.14). Assuming an average baseline mortality rate of 0.172, background mortality during autumn migration is 104,389 individuals. The addition of 19 (11 to 259) individual mortalities due to cumulative displacement from the presence of infrastructure would increase the mortality relative to the baseline mortality by 0.018 % (0.011 to 0.428%). Zero mortalities were estimated for underwater collision.
- 5.9.2.71 During the non-breeding season (winter season), displacement from operation results in a loss of 31 (19 to 434) individuals from the non-breeding population (Table 5.90). The regional seas UK Western Waters BDMPs population of razorbill within the non-breeding season is estimated to be 341,422 individuals (Table 5.14). Assuming an average baseline mortality rate of 0.172, background mortality in the breeding season is 58,724 individuals. The addition of 31 (19 to 434) individual mortalities due to cumulative displacement from the presence of infrastructure, plus the additional 12 mortalities from collision with underwater turbines would increase the mortality relative to the baseline mortality by 0.073% (0.052 to 0.759%).
- 5.9.2.72 The annual estimated mortality resulting from displacement during construction is 77 (46 to 1,071 individuals) (Table 5.91). Using the largest BDMPs population of 606,914 individuals and, using the average baseline mortality rate of 0.172, the background predicted mortality would be 104,389. The addition of 77 (46 to 1,071 individuals) mortalities, plus the additional 24.7 mortalities from collision with underwater turbines would increase the baseline mortality rate by 0.097% (0.068 to 1.050%). The annual predicted mortality from the most extreme scenario cumulative assessment (70% displacement, 10% mortality) is marginally above the 1% threshold increase in baseline mortality.
- 5.9.2.73 However, recent evidence suggests that 70% displacement and 10% mortality is overly cautious and that razorbill continued to use the area around a windfarm (MacArthur Green, 2023). Taking a more realistic 50% displacement and considering a precautionary mortality rate of 5%, the increase in baseline mortality would be 0.390%, which is below the 1% threshold for further investigation.

MONA OFFSHORE WIND PROJECT

5.9.2.74 The cumulative effect is predicted to be of national spatial extent, long term duration, continuous and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**.

Atlantic puffin

5.9.2.75 The estimated cumulative abundance of Atlantic puffin from the relevant projects is presented in Table 5.93. There are a number of projects for which there are no, or limited, data on the number of Atlantic puffin predicted to be displaced, in particular, for some of the earlier developments discussed in Table 5.97.

Table 5.93: Atlantic puffin cumulative abundances for offshore wind projects for disturbance and displacement assessment during the operations and maintenance phase.

Project	Annual Abundance	Breeding Season Abundance	Non-breeding Season Abundance
Tier 1			
Awel y Môr Offshore Wind Farm	8	8	0
Burbo Bank Offshore Wind Farm	0	Unavailable	Unavailable
Burbo Bank Extension Offshore Wind Farm	10	10	0
Erebus Floating Wind Demo	1,576	1,416	160
Gwynt y Môr Offshore Wind Farm	0	Unavailable	Unavailable
TwinHub (Wave Hub Floating Wind Farm)	0	0	0
Ormonde Wind Farm	1	1	0
Robin Rigg Offshore Wind Farm	0	0	0
Rhyl Flats Offshore Wind Farm	0	Unavailable	Unavailable
Walney 1 & 2 Offshore Wind Farms	0	Unavailable	Unavailable
Walney (3 & 4) Extension Offshore Wind Farm	172	53	119
West of Duddon Sands Offshore Windfarm	96	61	35
West of Orkney Windfarm	6,449	5,272	1,177
White Cross Offshore Wind Farm	80	49	31
Tier 2			
Morecambe Offshore Windfarm Generation Assets	67	57	10

MONA OFFSHORE WIND PROJECT

Project	Annual Abundance	Breeding Season Abundance	Non-breeding Season Abundance
Morgan Offshore Wind Project Generation Assets	18	18	0
Total (minus the Mona Offshore Wind Project)	8,477	6,946945	1,532
Mona Offshore Wind Project	37	15	22
Cumulative total (all projects)	8,514	6,960	1,554

Collision impacts

Tier 1

Holyhead Deep – Tidal Energy	0	Unavailable	Unavailable
West Anglesey Demonstration Zone tidal site	0.9	0.9	0

5.9.2.76 The following displacement matrices provide the estimated cumulative mortality of Atlantic puffin predicted to occur due to displacement, as determined by the relevant specified rates of displacement and mortality (Table 5.94 to Table 5.96). The approach used for the cumulative displacement assessment follows that of the project alone displacement assessment Volume 6, Annex 5.2: Offshore ornithology displacement technical report of the Environmental Statement (Document reference F6.5.2).

Table 5.94: Operations and maintenance phase cumulative Atlantic puffin mortality following displacement from offshore wind farms in the breeding season.

Mortality level (% of displaced birds at risk of mortality)		1%	2%	5%	10%	25%	50%	100%
Displacement level (% at risk of displacement)	10%	7	14	35	70	174	348	696
	20%	14	28	70	139	348	696	1,392
	30%	21	42	104	209	522	1,044	2,088
	40%	28	56	139	278	696	1,392	2,784
	50%	35	70	174	348	870	1,740	3,480
	60%	42	84	209	418	1,044	2,088	4,176
	70%	49	97	244	487	1,218	2,436	4,872
	80%	56	111	278	557	1,392	2,784	5,568
	90%	63	125	313	626	1,566	3,132	6,264
	100%	70	139	348	696	1,740	3,480	6,960

MONA OFFSHORE WIND PROJECT

Table 5.95: Operations and maintenance phase cumulative Atlantic puffin mortality following displacement from offshore wind farms in the non-breeding season.

		Mortality level (% of displaced birds at risk of mortality)						
		1%	2%	5%	10%	25%	50%	100%
Displacement level (% at risk of displacement)	10%	2	3	8	16	39	78	155
	20%	3	6	16	31	78	155	311
	30%	5	9	23	47	117	233	466
	40%	6	12	31	62	155	311	622
	50%	8	16	39	78	194	389	777
	60%	9	19	47	93	233	466	932
	70%	11	22	54	109	272	544	1,088
	80%	12	25	62	124	311	622	1,243
	90%	14	28	70	140	350	699	1,399
	100%	16	31	78	155	389	777	1,554

Table 5.96: Operations and maintenance phase cumulative Atlantic puffin mortality following displacement from offshore wind farms annually.

		Mortality level (% of displaced birds at risk of mortality)						
		1%	2%	5%	10%	25%	50%	100%
Displacement level (% at risk of displacement)	10%	9	17	43	85	213	426	851
	20%	17	34	85	170	426	851	1,703
	30%	26	51	128	255	639	1,277	2,554
	40%	34	68	170	341	851	1,703	3,406
	50%	43	85	213	426	1,064	2,129	4,257
	60%	51	102	255	511	1,277	2,554	5,108
	70%	60	119	298	596	1,490	2,980	5,960
	80%	68	136	341	681	1,703	3,406	6,811
	90%	77	153	383	766	1,916	3,831	7,663
	100%	85	170	426	851	2,129	4,257	8,514

MONA OFFSHORE WIND PROJECT
Table 5.97: Qualitative assessment of projects considered cumulatively with the Mona Offshore Wind Project for which quantitative consideration of displacement impacts was not undertaken in project-specific documentation for Atlantic puffin.

Project	Reason for estimates being unavailable	Qualitative assessment	Final conclusion
Tier 1			
Burbo Bank Offshore Wind Farm (Seascope Energy Ltd., 2002)	Disturbance impacts considered qualitatively	Surveys of the project comprised aerial and boat-based surveys both of which were undertaken during winter months (aerial = November to April and boat-based = December and February). Aerial surveys covered a large area encompassing the Liverpool Bay SPA with boat-based surveys covering the project area. The surveys were undertaken to provide abundance and distribution data for those species considered to be of most importance, namely common scoter and red-throated diver. Atlantic puffin was not identified during aerial surveys.	No impact and no significance.
Gwynt y Môr Offshore Wind Farm (RWE Group and Npower Renewables, 2005)	Disturbance impacts considered qualitatively	Site-specific surveys undertaken in support of the project included boat-based surveys undertaken between February 2003 and March 2005. Surveys between February 2003 and February 2004 covered a large area along the Welsh coast incorporating the project area with surveys between March 2004 and March 2005 more focussed on the project area. The assessment also used data from aerial surveys undertaken between 2000 2005 which were targeted at recording common scoter. Atlantic puffin was not identified during aerial surveys.	No impact and no significance.
Robin Rigg Offshore Wind Farm (Natural Power, 2002)	Disturbance impacts considered qualitatively	The project utilised site-specific boat-based surveys to characterise the baseline environment. Two surveys were completed in each month from May 2001 for one year. In addition, aerial surveys were undertaken from November 2001 on a monthly basis through winter and spring to verify the distribution and abundance of seaduck. The mean count of puffin during boat-based surveys in the wind farm zero (and 0.4 for auk species) birds with a peak of 10 birds observed across the full study site. Aerial surveys undertaken in the non-breeding season recorded no puffins	The magnitude of the effect was considered to be negligible with a negligible significance.

MONA OFFSHORE WIND PROJECT

Project	Reason for estimates being unavailable	Qualitative assessment	Final conclusion
Rhyl Flats Offshore Wind Farm (Ecology Consulting, 2002)	Disturbance impacts considered qualitatively	Surveys of the project comprised aerial and boat-based surveys. Aerial surveys were undertaken between December 2001 and January 2002 and targeted common scoter, with non-target species not uniformly reported upon. Boat-based surveys were undertaken between January and March 2002 to record movements of common scoter and the flight height of birds. Atlantic puffin was not identified during surveys.	No impact and no significance.
Walney 1 & 2 Offshore Wind Farms (RPS, 2006)	Disturbance impacts considered qualitatively	Site-specific surveys included boat-based surveys undertaken across an area of 512 km ² in the vicinity of the project between May 2004 and September 2005. The project also utilised survey data collected by regional aerial surveys, undertaken across their aerial survey area between 2002 and 2006 and radar survey data collected between 1 st October and 29 th October 2005. The population of puffin recorded in the project area plus 2 km buffer during aerial surveys was 11 birds	It was considered that the wind farm area did not represent a favoured foraging habitat and the magnitude of any impact was considered to be negligible.

MONA OFFSHORE WIND PROJECT

- 5.9.2.77 During the breeding season, the displacement from operation when using the displacement rate of 50% (range of 30 to 70%) and a mortality rate of 1% (range of 1 to 10%), results in an additional loss of 35 (21 to 487) individuals from the breeding population (Table 5.94). The regional seas UK Western Waters BDMPS population of Atlantic puffin within the breeding season is estimated to be 1,482,791 individuals (Table 5.14). Assuming an average baseline mortality rate of 0.176 (Table 5.15), background mortality in the breeding season is 260,971 individuals. The addition of 35 (21 to 487) individual mortalities due to cumulative displacement from the presence of infrastructure, plus the additional 0.9 mortalities from underwater collision would increase the mortality relative to the baseline mortality by 0.014 % (0.008 to 0.187%).
- 5.9.2.78 During the non-breeding season, the displacement from operation results in an additional loss of eight (five to 109) individual from the non-breeding population (Table 5.95). The regional seas UK Western Waters BDMPS population of common guillemots within the non-breeding season is estimated to be 304,557 individuals (Table 5.14). Assuming an average baseline mortality rate of 0.176, background mortality in the non-breeding season is 53,602 individuals. The addition of eight (five to 109) individual mortalities due to cumulative displacement from the presence of infrastructure would increase the mortality relative to the baseline mortality by 0.014% (0.009 to 0.203%). Zero mortalities were estimated for underwater collision.
- 5.9.2.79 The annual estimated mortality resulting from displacement during operation is 43 (26 to 596) individuals (Table 5.96). Using the largest UK Western Waters BDMPS population of 1,482,791 Atlantic puffin and, using the average baseline mortality rate of 0.176, the background predicted mortality would be 260,971 individuals. The addition of 43 (26 to 596) mortalities, plus the additional 0.9 mortalities from underwater collision would increase the baseline mortality rate by 0.017% (0.010% to 0.229%). The annual predicted mortality from the cumulative assessment is below the 1% threshold increase in baseline mortality.
- 5.9.2.80 The cumulative effect is predicted to be of national spatial extent, long term duration, continuous and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **negligible**.

Northern gannet

- 5.9.2.81 The estimated cumulative abundance of northern gannet from the relevant projects is presented in Table 5.98. There are a number of projects for which there are no, or limited, data on the number of northern gannet predicted to be displaced, in particular, for some of the earlier developments which are discussed in.

Table 5.98: Northern gannet cumulative abundances for offshore wind projects for disturbance and displacement assessment during the operations and maintenance phase.

Project	Annual Abundance	Pre-breeding Season	Breeding Season Abundance	Post-breeding Season Abundance
Tier 1				
Awel y Môr Offshore Wind Farm	529	0	328	201
Burbo Bank Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable

MONA OFFSHORE WIND PROJECT

Project	Annual Abundance	Pre-breeding Season	Breeding Season Abundance	Post-breeding Season Abundance
Burbo Bank Extension Offshore Wind Farm	695	25	648	22
Erebus Floating Wind Demo	658	100	224	334
Gwynt y Môr Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable
TwinHub (Wave Hub Floating Wind Farm)	397	Unavailable	244	153
Ormonde Wind Farm	199	Unavailable	Unavailable 199	Unavailable
Robin Rigg Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable
Rhyl Flats Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable
Walney 1 & 2 Offshore Wind Farms	Unavailable	Unavailable	Unavailable	Unavailable
Walney (3 & 4) Extension Offshore Wind Farm	433	24	150	259
West of Duddon Sands Offshore Wind Farm	431	Unavailable	431	Unavailable
West of Orkney Windfarm	2,188	59	958	1,171
White Cross Offshore Windfarm	456	141	239	76

Tier 2

Morecambe Offshore Windfarm Generation Assets	912	0	748	164
Morgan Offshore Wind Project Generation Assets	454	53	209	192
Total (minus the Mona Offshore Wind Project)	7,352	402	4,179378	2,572
Mona Offshore Wind Project	337	28	251	58
Cumulative total (all projects)	7,689	430	4,430629	2,630

Collision impacts
Tier 1

Holyhead Deep – Tidal Energy	8	Unavailable	Unavailable	Unavailable
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MONA OFFSHORE WIND PROJECT

Project	Annual Abundance	Pre-breeding Season	Breeding Season Abundance	Post-breeding Season Abundance
West Anglesey Demonstration Zone tidal site	46.1	grouped into breeding	38	8.1

5.9.2.82 The following displacement matrices provide the estimated cumulative mortality of northern gannet predicted to occur due to displacement, as determined by the relevant specified rates of displacement and mortality (Table 5.99 to Table 5.102). The approach used for the cumulative displacement assessment follows that of the project alone displacement assessment Volume 6, Annex 5.2: Offshore ornithology displacement technical report of the Environmental Statement (Document reference F6.5.2).

Table 5.99: Operations and maintenance phase cumulative northern gannet mortality following displacement from offshore wind farms in the pre-breeding season.

		Mortality level (% of displaced birds at risk of mortality)						
		1%	2%	5%	10%	25%	50%	100%
Displacement level (% at risk of displacement)	10%	0	1	2	4	11	22	43
	20%	1	2	4	9	22	43	86
	30%	1	3	6	13	32	65	129
	40%	2	3	9	17	43	86	172
	50%	2	4	11	22	54	108	215
	60%	3	5	13	26	65	129	258
	70%	3	6	15	30	75	151	301
	80%	3	7	17	34	86	172	344
	90%	4	8	19	39	97	194	387
	100%	4	9	22	43	108	215	430

MONA OFFSHORE WIND PROJECT

Table 5.100: Operations and maintenance phase cumulative northern gannet mortality following displacement from offshore wind farms in the breeding season.

		Mortality level (% of displaced birds at risk of mortality)						
		1%	2%	5%	10%	25%	50%	100%
Displacement level (% at risk of displacement)	10%	45	9	2223	4446	111116	222231	443463
	20%	9	1819	4446	8993	222231	443463	886926
	30%	1314	2728	6669	133139	332347	665694	1,329389
	40%	1819	3537	8993	177185	443463	886926	1,772852
	50%	2223	4446	111116	222231	554579	1,408157	2,215315
	60%	2728	5356	133139	266278	665694	1,329389	2,658777
	70%	3132	6265	155162	310324	775810	1,551620	3,101240
	80%	3537	7174	177185	354370	886926	1,772852	3,544703
	90%	4042	8083	199208	399417	9971,042	1,9942,083	3,9874,166
	100%	4446	8993	222231	443463	1,408157	2,215315	4,430629

Table 5.101: Operations and maintenance phase cumulative northern gannet mortality following displacement from offshore wind farms in the post-breeding season.

		Mortality level (% of displaced birds at risk of mortality)						
		1%	2%	5%	10%	25%	50%	100%
Displacement level (% at risk of displacement)	10%	3	5	13	26	66	132	263
	20%	5	11	26	53	132	263	526
	30%	8	16	39	79	197	395	789
	40%	11	21	53	105	263	526	1,052
	50%	13	26	66	132	329	658	1,315
	60%	16	32	79	158	395	789	1,578
	70%	18	37	92	184	460	921	1,841
	80%	21	42	105	210	526	1,052	2,104
	90%	24	47	118	237	592	1,184	2,367
	100%	26	53	132	263	658	1,315	2,630

MONA OFFSHORE WIND PROJECT

Table 5.102: Operations and maintenance phase cumulative northern gannet mortality following displacement from offshore wind farms annually.

		Mortality level (% of displaced birds at risk of mortality)						
		1%	2%	5%	10%	25%	50%	100%
Displacement level (% at risk of displacement)	10%	8	15	38	77	192	384	769
	20%	15	31	77	154	384	769	1,538
	30%	23	46	115	231	577	1,153	2,307
	40%	31	62	154	308	769	1,538	3,076
	50%	38	77	192	384	961	1,922	3,845
	60%	46	92	231	461	1,153	2,307	4,613
	70%	54	108	269	538	1,346	2,691	5,382
	80%	62	123	308	615	1,538	3,076	6,151
	90%	69	138	346	692	1,730	3,460	6,920
	100%	77	154	384	769	1,922	3,845	7,689

MONA OFFSHORE WIND PROJECT

Table 5.103: Qualitative assessment of projects considered cumulatively with the Mona Offshore Wind Project for which quantitative consideration of displacement impacts was not undertaken in project-specific documentation for northern gannet.

Project	Reason for estimates being unavailable	Qualitative assessment	Final conclusion
Tier 1			
<p>Burbo Bank Offshore Wind Farm (Seascope Energy Ltd., 2002)</p>	<p>Disturbance impacts considered qualitatively</p>	<p>Surveys of the project comprised aerial and boat-based surveys both of which were undertaken during winter months (aerial = November to April and boat-based = December and February). Aerial surveys covered a large area encompassing the Liverpool Bay SPA with boat-based surveys covering the project area. The surveys were undertaken to provide abundance and distribution data for those species considered to be of most importance, namely common scoter and red-throated diver.</p> <p>Gannet was not recorded during boat-based surveys with relatively low numbers recorded during aerial surveys.</p>	<p>Gannet was not considered to be a species of International or National importance in the context of the assessments undertaken.</p> <p>Although gannet was not specifically assessed due to the species being considered of limited importance, low levels of disturbance were predicted for other species with conclusions of a negligible magnitude and very low significance reached.</p>
<p>Gwynt y Môr Offshore Wind Farm (RWE Group and Npower Renewables, 2005)</p>	<p>Disturbance impacts considered qualitatively</p>	<p>Site-specific surveys undertaken in support of the project included boat-based surveys undertaken between February 2003 and March 2005. Surveys between February 2003 and February 2004 covered a large area along the Welsh coast incorporating the project area with surveys between March 2004 and March 2005 more focussed on the project area. The assessment also used data from aerial surveys undertaken between 2000 2005 which were targeted at recording common scoter.</p> <p>Very few gannet were recorded during boat-based surveys between October and March. More birds were present in summer months with a large proportion on the sea surface.</p>	<p>It was considered that displacement (termed avoidance of turbines in the assessments conducted) would result in an impact of low significance for gannet due to the very extensive areas across which the species forages and the limited importance of the project area for the species.</p>

MONA OFFSHORE WIND PROJECT

Project	Reason for estimates being unavailable	Qualitative assessment	Final conclusion
Ormonde Wind Farm (Ecology Consulting, 2005)	Disturbance impacts considered qualitatively	<p>Site-specific surveys included boat-based surveys undertaken monthly between May 2004 and April 2005. In addition, three aerial surveys were conducted during the summer of 2004 with four further aerial surveys in the winter of 2004/5.</p> <p>The peak population of gannet recorded in the wind farm plus a 2 km buffer during boat-based surveys was 199 birds. During aerial surveys the equivalent population was 15 birds. The species was primarily recorded in summer months especially May and September.</p> <p>The species was considered to be regionally important in the context of the assessments conducted.</p>	The magnitude of the effect for gannet was considered to be low with a low significance.
Robin Rigg Offshore Wind Farm (Natural Power, 2002)	Disturbance impacts considered qualitatively	<p>The project utilised site-specific boat-based surveys to characterise the baseline environment. Two surveys were completed in each month from May 2001 for one year. In addition, aerial surveys were undertaken from November 2001 on a monthly basis through winter and spring to verify the distribution and abundance of seaduck.</p> <p>The mean count of gannet during boat-based surveys in the wind farm was 0.4 birds with a peak of 4 birds. Gannet was considered to be of local importance based on the populations recorded in the wind farm.</p>	The magnitude of the effect was considered to be negligible with a very low significance.
Rhyl Flats Offshore Wind Farm (Ecology Consulting, 2002)	Disturbance impacts considered qualitatively	<p>Surveys of the project comprised aerial and boat-based surveys. Aerial surveys were undertaken between November 2001 and January 2002 and targeted common scoter, with non-target species not uniformly reported upon. Boat-based surveys were undertaken between January and March 2002 to record movements of common scoter and the flight height of birds.</p> <p>Gannet were only recorded in one of the aerial surveys with 52 birds recorded in November 2001.</p>	Wind farm area not considered to be importance for seabirds and significant effects were considered unlikely

MONA OFFSHORE WIND PROJECT

Project	Reason for estimates being unavailable	Qualitative assessment	Final conclusion
Walney 1 & 2 Offshore Wind Farms (RPS, 2006)	Disturbance impacts considered qualitatively	<p>Site-specific surveys included boat-based surveys undertaken across an area of 512 km² in the vicinity of the project between May 2004 and September 2005. The project also utilised survey data collected by regional aerial surveys, undertaken across their aerial survey area between 2002 and 2006 and radar survey data collected between 1st October and 29th October 2005.</p> <p>The peak population of gannet recorded in the project area plus 2 km buffer during aerial surveys was 52 birds. In boat-based surveys the equivalent population was 332 birds. The proportion of flying gannets recorded above 15 m was 21.5 % across all boat-based surveys within the boat-based survey area.</p> <p>Gannet was deemed to be a species of medium importance due to SPA connectivity (termed sensitivity in the Walney 1&2 assessments).</p>	<p>It was considered that the wind farm area did not represent a favoured foraging habitat and the magnitude of any impact was considered to be low. The species was considered to be of medium sensitivity.</p> <p>The overall significance of impacts associated with the project was considered to be low.</p>
West of Duddon Sands Offshore Wind Farm (RPS, 2006)	Disturbance impacts considered qualitatively	<p>Site-specific surveys included boat-based surveys undertaken across an area of 512 km² in the vicinity of the project between May 2004 and September 2005. The project also utilised survey data collected by regional aerial surveys, undertaken across their aerial survey area between 2002 and 2006 and radar survey data collected between 1st October and 29th October 2005.</p> <p>The peak population of gannet recorded in the project area plus 2 km buffer during aerial surveys was 57 birds. In boat-based surveys the equivalent population was 431 birds.</p> <p>Gannet was deemed to be a species of medium importance due to SPA connectivity (termed sensitivity in the West of Duddon Sands assessments).</p>	<p>The magnitude of impacts was considered to be low. Gannet was considered to be of medium importance (termed sensitivity in the assessments for the project). The significance of all impacts was considered to be low.</p>

MONA OFFSHORE WIND PROJECT

5.9.2.83 During the spring migration (pre-breeding) season the displacement from operation when using the displacement rate of 70% (range of 60 to 80%) and a mortality rate of 1% (range of 1 to 10%), results in an additional loss of three (three to 34) individuals (Table 5.99). The regional seas UK Western Waters BDMPS population of northern gannet in the spring migration period is estimated to be 661,888 individuals (Table 5.14). Assuming an average baseline mortality rate of 0.193 (Table 5.15), background mortality during spring migration is 127,744 individuals. The addition of three (three to 34) individual mortalities due to cumulative displacement from the presence of infrastructure would increase the mortality relative to the baseline mortality by 0.002% (0.002 to 0.027%). Zero mortalities were estimated from underwater collision.

During the breeding season, displacement from operation results in the loss of ~~31~~ 32 (28 to 354370) individuals from the breeding population {

MONA OFFSHORE WIND PROJECT

- 5.9.2.84 ~~Table 5.100).~~(Table 5.100). The regional seas UK Western Waters BDMPS population of northern gannet within the breeding season is estimated to be 522,888 individuals (Table 5.14). Assuming an average baseline mortality rate of 0.193, background mortality in the breeding season is 100,917 individuals. The addition of ~~31~~32 (~~28~~28 to ~~354~~370) individual mortalities due to cumulative displacement from the presence of infrastructure, plus the additional 38 mortalities from underwater collision would increase the mortality relative to the baseline mortality by ~~0.068~~0.032% (~~0.064~~0.028 to ~~0.389~~0.367%)~~.~~
- 5.9.2.85 During the autumn migration season (post-breeding), displacement from operation results in a loss of 18 (16 to 210) individuals from the migratory population (Table 5.101). The regional seas UK Western Waters BDMPS population of northern gannet during the autumn migration period is estimated to be 545,954 individuals (Table 5.14). Assuming an average baseline mortality rate of 0.193, background mortality during autumn migration is 105,369 individuals. The addition of 18 (16 to 210) individual mortalities due to cumulative displacement from the presence of infrastructure, plus the additional 8.1 mortalities from underwater collision would increase the mortality relative to the baseline mortality by 0.025 % (0.023 to 0.207%).
- 5.9.2.86 The annual estimated mortality resulting from displacement during construction is 54 (46 to 615) individuals (Table 5.102). Using the largest UK Western Waters BDMPS population of 661,888 individuals, with an average baseline mortality rate of 0.193, the background predicted mortality would be 127,744. The addition of 54 (46 to 615) mortalities, plus the additional 54.1 mortalities from underwater collision would increase the baseline mortality rate by 0.084% (0.078% to 0.524%). The annual predicted mortality from the cumulative assessment is below the 1% threshold increase in baseline mortality.
- 5.9.2.87 The cumulative effect is predicted to be of national spatial extent, long term duration, continuous and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **negligible**.

Black-legged kittiwake

- 5.9.2.88 The estimated cumulative abundance of black-legged kittiwake from the relevant projects is presented in Table 5.104. There are several projects for which there are no, or limited, data on the number of black-legged kittiwake predicted to be displaced, in particular, for some of the earlier developments which are discussed in Table.

MONA OFFSHORE WIND PROJECT
Table 5.104: Black-legged kittiwake cumulative abundances for offshore wind projects for disturbance and displacement assessment during the operations and maintenance phase.

Project	Annual Abundance	Pre-breeding Abundance	Breeding Season Abundance	Post-breeding Abundance
Tier 1				
Awel y Môr Offshore Wind Farm	467	298	87	82
Burbo Bank Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable
Burbo Bank Extension Offshore Wind Farm	707	Unavailable	Unavailable 707	Unavailable
Erebus Floating Wind Demo	2,532	2	2,022	508
Gwynt y Môr Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable
TwinHub (Wave Hub Floating Wind Farm)	249	56	4	189
Ormonde Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable
Rampion Offshore Wind Farm	2,112	831	1,059	222
Robin Rigg Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable
Rhyl Flats Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable
Walney 1 & 2 Offshore Wind Farms	Unavailable	Unavailable	Unavailable	Unavailable
Walney (3 & 4) Extension Offshore Wind Farm	2,900	1,467	319	1,114
West of Duddon Sands Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable
West of Orkney Windfarm	2,706	1,217	690	799
White Cross Offshore Windfarm	914	698	44	172
Tier 2				
Morecambe Offshore Windfarm Generation Assets	9,106	1,161	3,899	4,046
Morgan Offshore Wind Project Generation Assets	2,724	645	460	1,619

MONA OFFSHORE WIND PROJECT

Project	Annual Abundance	Pre-breeding Abundance	Breeding Season Abundance	Post-breeding Abundance
Rampion 2 (Rampion Extension) Offshore Wind Farm	388	286	5	97
Total (minus the Mona Offshore Wind Project)	24,805	6,661	8,5899,296	8,848
Mona Offshore Wind Project	1,860	574	726	560
Cumulative total (all projects)	26,665	7,235	9,31510,022	9,408

5.9.2.89 The following displacement matrices provide the estimated cumulative mortality of black-legged kittiwake predicted to occur due to displacement, as determined by the relevant specified rates of displacement and mortality (Table 5.105 to Table 5.108). The approach used for the cumulative displacement assessment follows that presented in Volume 6, Annex 5.2: Offshore ornithology displacement technical report of the Environmental Statement (Document reference F6.5.2).

Table 5.105: Operations and maintenance phase cumulative black-legged kittiwake mortality following displacement from offshore wind farms in the pre-breeding season.

Mortality level (% of displaced birds at risk of mortality)		1%	2%	5%	10%	25%	50%	100%
Displacement level (% at risk of displacement)	10%	7	14	36	72	181	362	724
	20%	14	29	72	145	362	724	1,447
	30%	22	43	109	217	543	1,085	2,171
	40%	29	58	145	289	724	1,447	2,894
	50%	36	72	181	362	904	1,809	3,618
	60%	43	87	217	434	1,085	2,171	4,341
	70%	51	101	253	506	1,266	2,532	5,065
	80%	58	116	289	579	1,447	2,894	5,788
	90%	65	130	326	651	1,628	3,256	6,512
	100%	72	145	362	724	1,809	3,618	7,235

MONA OFFSHORE WIND PROJECT
Table 5.106: Operations and maintenance phase cumulative black-legged kittiwake mortality following displacement from offshore wind farms in the breeding season.

		Mortality level (% of displaced birds at risk of mortality)						
		1%	2%	5%	10%	25%	50%	100%
Displacement level (% at risk of displacement)	10%	<u>910</u>	<u>4920</u>	<u>4750</u>	<u>93100</u>	<u>233251</u>	<u>466501</u>	<u>9321,002</u>
	20%	<u>4920</u>	<u>3740</u>	<u>93100</u>	<u>486200</u>	<u>466501</u>	<u>9321,002</u>	<u>4,8632,004</u>
	30%	<u>2830</u>	<u>5660</u>	<u>440150</u>	<u>279301</u>	<u>699752</u>	<u>1,397503</u>	<u>2,7953,007</u>
	40%	<u>3740</u>	<u>7580</u>	<u>486200</u>	<u>373401</u>	<u>9321,002</u>	<u>4,8632,004</u>	<u>3,7264,009</u>
	50%	<u>4750</u>	<u>93100</u>	<u>233251</u>	<u>466501</u>	<u>1,464253</u>	<u>2,329506</u>	<u>4,6585,011</u>
	60%	<u>5660</u>	<u>442120</u>	<u>279301</u>	<u>559601</u>	<u>1,397503</u>	<u>2,7953,007</u>	<u>5,5896,013</u>
	70%	<u>6570</u>	<u>430140</u>	<u>326351</u>	<u>652702</u>	<u>1,630754</u>	<u>3,260508</u>	<u>6,5247,015</u>
	80%	<u>7580</u>	<u>449160</u>	<u>373401</u>	<u>745802</u>	<u>4,8632,004</u>	<u>3,7264,009</u>	<u>7,4528,018</u>
	90%	<u>8490</u>	<u>468180</u>	<u>449451</u>	<u>838902</u>	<u>2,096255</u>	<u>4,492510</u>	<u>8,3849,020</u>
	100%	<u>93100</u>	<u>486200</u>	<u>466501</u>	<u>9321,002</u>	<u>2,329506</u>	<u>4,6585,011</u>	<u>9,31510,022</u>

Table 5.107: Operations and maintenance phase cumulative black-legged kittiwake mortality following displacement from offshore wind farms in the post-breeding season.

		Mortality level (% of displaced birds at risk of mortality)						
		1%	2%	5%	10%	25%	50%	100%
Displacement level (% at risk of displacement)	10%	9	19	47	94	235	470	941
	20%	19	38	94	188	470	941	1,882
	30%	28	56	141	282	706	1,411	2,822
	40%	38	75	188	376	941	1,882	3,763
	50%	47	94	235	470	1,176	2,352	4,704
	60%	56	113	282	564	1,411	2,822	5,645
	70%	66	132	329	659	1,646	3,293	6,586
	80%	75	151	376	753	1,882	3,763	7,526
	90%	85	169	423	847	2,117	4,234	8,467
	100%	94	188	470	941	2,352	4,704	9,408

MONA OFFSHORE WIND PROJECT

Table 5.108: Operations and maintenance phase cumulative black-legged kittiwake mortality following displacement from offshore wind farms annually.

		Mortality level (% of displaced birds at risk of mortality)						
		1%	2%	5%	10%	25%	50%	100%
Displacement level (% at risk of displacement)	10%	27	53	133	267	667	1,333	2,667
	20%	53	107	267	533	1,333	2,667	5,333
	30%	80	160	400	800	2,000	4,000	8,000
	40%	107	213	533	1,067	2,667	5,333	10,666
	50%	133	267	667	1,333	3,333	6,666	13,333
	60%	160	320	800	1,600	4,000	8,000	15,999
	70%	187	373	933	1,867	4,666	9,333	18,666
	80%	213	427	1,067	2,133	5,333	10,666	21,332
	90%	240	480	1,200	2,400	6,000	11,999	23,999
	100%	267	533	1,333	2,667	6,666	13,333	26,665

MONA OFFSHORE WIND PROJECT

Table 5.109: Qualitative assessment of projects considered cumulatively with the Mona Offshore Wind Project for which quantitative consideration of displacement impacts was not undertaken in project-specific documentation for black-legged kittiwake.

Project	Reason for estimates being unavailable	Qualitative assessment	Final conclusion
Tier 1			
<p>Burbo Bank Offshore Wind Farm (Seascope Energy Ltd., 2002)</p>	<p>Disturbance impacts considered qualitatively</p>	<p>Surveys of the project comprised aerial and boat-based surveys both of which were undertaken during winter months (aerial = November to April and boat-based = December and February). Aerial surveys covered a large area encompassing the Liverpool Bay SPA with boat-based surveys covering the project area. The surveys were undertaken to provide abundance and distribution data for those species considered to be of most importance, namely common scoter and red-throated diver.</p> <p>Low numbers of kittiwake were recorded during boat-based surveys with relatively low numbers also recorded during aerial surveys.</p>	<p>Kittiwake was not considered to be a species of International or National importance in the context of the assessments undertaken.</p> <p>Although kittiwake was not specifically assessed due to the species being considered of limited importance, low levels of disturbance were predicted for other species with conclusions of a negligible magnitude and very low significance reached.</p>
<p>Gwynt y Môr Offshore Wind Farm (RWE Group and Npower Renewables, 2005)</p>	<p>Disturbance impacts considered qualitatively</p>	<p>Site-specific surveys undertaken in support of the project included boat-based surveys undertaken between February 2003 and March 2005. Surveys between February 2003 and February 2004 covered a large area along the Welsh coast incorporating the project area with surveys between March 2004 and March 2005 more focussed on the project area. The assessment also used data from aerial surveys undertaken between 2000 and 2005 which were targeted at recording common scoter.</p> <p>The highest populations of kittiwake were recorded between March and May.</p>	<p>It was considered that displacement (termed avoidance of turbines in the assessments conducted) would result in an impact of negligible to low significance for kittiwake due to the low densities of kittiwake present at the project.</p>

MONA OFFSHORE WIND PROJECT

Project	Reason for estimates being unavailable	Qualitative assessment	Final conclusion
Ormonde Wind Farm (Ecology Consulting, 2005)	Disturbance impacts considered qualitatively	<p>Site-specific surveys included boat-based surveys undertaken monthly between May 2004 and April 2005. In addition, three aerial surveys were conducted during the summer of 2004 with four further aerial surveys in the winter of 2004/5.</p> <p>The peak population of kittiwake recorded in the wind farm plus a 2 km buffer during boat-based surveys was 60 birds. During aerial surveys the equivalent population was two birds. The species was recorded throughout the year during boat-based surveys with the highest numbers in April. Numbers in aerial surveys peaked in October with no records in the mid-winter period.</p> <p>The species was considered to be regionally important in the context of the assessments conducted.</p>	The magnitude of the effect for kittiwake was considered to be negligible with a very low significance.
Rhyl Flats Offshore Wind Farm (Ecology Consulting, 2002)	Disturbance impacts considered qualitatively	<p>Surveys of the project comprised aerial and boat-based surveys. Aerial surveys were undertaken between November 2001 and January 2002 and targeted common scoter, with non-target species not uniformly reported upon. Boat-based surveys were undertaken between January and March 2002 to record movements of common scoter and the flight height of birds.</p> <p>Kittiwake was recorded in all three aerial surveys with a peak count of 148 birds in November 2001.</p>	Wind farm area not considered to be importance for seabirds and significant effects were considered unlikely.
Robin Rigg Offshore Wind Farm (Natural Power, 2002)	Disturbance impacts considered qualitatively	<p>The project utilised site-specific boat-based surveys to characterise the baseline environment. Two surveys were completed in each month from May 2001 for one year. In addition, aerial surveys were undertaken from November 2001 on a monthly basis through winter and spring to verify the distribution and abundance of seaduck.</p> <p>The mean count of kittiwake during boat-based surveys in the wind farm was 4.5 birds with a peak of 46 birds. Kittiwake was considered to be of local importance based on the populations recorded in the wind farm.</p>	The magnitude of the effect was considered to be low with a low significance.

MONA OFFSHORE WIND PROJECT

Project	Reason for estimates being unavailable	Qualitative assessment	Final conclusion
Walney 1 & 2 Offshore Wind Farms (RPS, 2006)	Disturbance impacts considered qualitatively	<p>Site-specific surveys included boat-based surveys undertaken across an area of 512 km² in the vicinity of the project between May 2004 and September 2005. The project also utilised survey data collected by regional aerial surveys, undertaken across their aerial survey area between 2002 and 2006 and radar survey data collected between 1st October and 29th October 2005.</p> <p>The peak population of kittiwake recorded in the project area plus 2 km buffer during aerial surveys was 44 birds. In boat-based surveys the equivalent population was 205 birds.</p> <p>Kittiwake was deemed to be a species of low importance (termed sensitivity in the Walney 1&2 assessments).</p>	<p>It was considered that the wind farm area did not represent a favoured foraging habitat and the magnitude of any impact was considered to be negligible. The species was considered to be of low sensitivity.</p> <p>The overall significance of impacts associated with the project was considered to be very low.</p>
West of Duddon Sands Offshore Wind Farm (RPS, 2006)	Disturbance impacts considered qualitatively	<p>Site-specific surveys included boat-based surveys undertaken across an area of 512 km² in the vicinity of the project between May 2004 and September 2005. The project also utilised survey data collected by regional aerial surveys, undertaken across their aerial survey area between 2002 and 2006 and radar survey data collected between 1st October and 29th October 2005.</p> <p>The peak population of kittiwake recorded in the project area plus 2 km buffer during aerial surveys was 14 birds. In boat-based surveys the equivalent population was 454 birds.</p> <p>Kittiwake was deemed to be a species of low importance (termed sensitivity in the West of Duddon Sands assessments).</p>	<p>The magnitude of impacts was considered to be negligible. Kittiwake was considered to be of low importance (termed sensitivity in the assessments for the project). The significance of all impacts was considered to be very low.</p>

MONA OFFSHORE WIND PROJECT

- 5.9.2.90 During the spring migration (pre-breeding) season the displacement from operation when using the displacement rate of 50% (range of 30 to 70%) and a mortality rate of 1% (range of 1 to 10%), results in an additional loss of 36 (22 to 506) individuals (Table 5.105). The regional seas UK Western Waters & Channel BDMPS population of black-legged kittiwake in the spring migration period is estimated to be 691,526 individuals (Table 5.14). Assuming an average baseline mortality rate of 0.156 (Table 5.15), background mortality during spring migration is 107,878 individuals. The addition of 36 (22 to 506) individual mortalities due to cumulative displacement from the presence of infrastructure would increase the mortality relative to the baseline mortality by 0.035 % (0.021 to 0.490%).
- 5.9.2.91 During the breeding season the displacement from operation results in a loss of ~~47 (28 to 50)~~ 30 to 652702 individuals from the migratory population (Table 5.106). The regional seas UK Western Waters & Channel BDMPS population of black-legged kittiwake within the breeding season is estimated to be 245,234 individuals (Table 5.14). Assuming an average baseline mortality rate of 0.156, background mortality in the breeding season is 38,256 individuals. The addition of ~~47 (28 to 50)~~ 30 to 652702 individual mortalities due to cumulative displacement from the presence of infrastructure would increase the mortality relative to the baseline mortality by ~~0.422131%~~ 0.073078 to 1.704835%. The breeding season predicted mortality from the most extreme scenario cumulative assessment (70% displacement, 10% mortality) is above the 1% threshold increase in baseline mortality.
- 5.9.2.92 However, recent evidence suggests that 70% displacement and 10% mortality is overly cautious and that kittiwake continued to use the area around a windfarm (Leopold *et al.* 2011; Vanermen, 2013; Furness, 2013; Peschko, 2020; NatureScot, 2023). Taking a more realistic 50% displacement and considering a precautionary mortality rate of 5%, the increase in baseline mortality would be ~~0.609656%~~, which is below the 1% threshold for further investigation.
- 5.9.2.93 During the autumn migration season (post-breeding), displacement from operation results in a loss of 47 (28 to 659) individuals from the migratory population (Table 5.107). The regional seas UK Western Waters & Channel BDMPS population of black-legged kittiwake during the autumn migration period is estimated to be 911,586 individuals (Table 5.14). Assuming an average baseline mortality rate of 0.156, background mortality during autumn migration is 142,207 individuals. The addition of 47 (28 to 659) individual mortalities due to cumulative displacement from construction activities would increase the mortality relative to the baseline mortality by 0.033 % (0.020 to 0.463%).
- 5.9.2.94 The annual estimated mortality resulting from displacement during construction is 133 (78 to 1,867) individuals (Table 5.108). Using the largest UK Western Waters & Channel BDMPS population of 911,586 individuals, with an average baseline mortality rate of 0.156, the background predicted mortality would be 142,207. The addition of 133 (78 to 1,867) mortalities would increase the baseline mortality rate by 0.094% (0.055% to 1.313%). The annual predicted mortality from the cumulative assessment is above the 1% threshold increase in baseline mortality.
- 5.9.2.95 However, recent evidence suggests that 70% displacement and 10% mortality is overly cautious and that kittiwake continued to use the area around a windfarm (MacArthur Green, 2023). Leopold *et al.* 2011; Vanermen, 2013; Furness, 2013; Peschko, 2020; NatureScot, 2023). Taking a more realistic 50% displacement and even considering a precautionary mortality rate of 5%, the increase in baseline mortality would be 0.469%, which is below the 1% threshold for further investigation.

MONA OFFSHORE WIND PROJECT

5.9.2.96 The cumulative effect is predicted to be of national spatial extent, long term duration, continuous and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **negligible**.

Manx shearwater

5.9.2.97 The estimated cumulative abundance of Manx shearwater from the relevant projects is presented in Table 5.110. There are a number of projects for which there are no, or limited, data on the number of Manx shearwater predicted to be displaced. In particular this is the case for some of the earlier developments which are discussed in.

Table 5.110: Manx shearwater cumulative abundances for offshore wind projects for disturbance and displacement assessment during the operations and maintenance phase.

Project	Annual Abundance	Pre-breeding Abundance	Breeding Season Abundance	Post-breeding Abundance
Tier 1				
Awel y Môr Offshore Wind Farm	417	177	26	214
Burbo Bank Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable
Burbo Bank Extension Offshore Wind Farm	443	Unavailable	443	Unavailable
Erebus Floating Wind Demo	2,115	18	1,540	557
Gwynt y Môr Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable
TwinHub (Wave Hub Floating Wind Farm)	1,274	Unavailable	1,270	3
Ormonde Wind Farm	1,001	Unavailable	Unavailable 1,001	Unavailable
Rampion Offshore Wind Farm	33	0	33	0
Robin Rigg Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable
Rhyl Flats Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable
Walney 1 & 2 Offshore Wind Farms	Unavailable	Unavailable	Unavailable	Unavailable
Walney (3 & 4) Extension Offshore Wind Farm	912	Unavailable	588	324
West of Duddon Sands Offshore Wind Farm	544	Unavailable	544	Unavailable
West of Orkney Windfarm	10	0	8	3
White Cross Offshore Windfarm	12,181	12,126	33	22

MONA OFFSHORE WIND PROJECT

Project	Annual Abundance	Pre-breeding Abundance	Breeding Season Abundance	Post-breeding Abundance
Tier 2				
Morecambe Offshore Windfarm Generation Assets	7,583	0	7,577	6
Morgan Offshore Wind Project Generation Assets	993	59	467	467
Rampion 2 (Rampion Extension) Offshore Wind Farm	0	0	0	0
TOTAL (minus the Mona Offshore Wind Project)	27,560,506	12,380	12,529,13,530	1,596
Mona Offshore Wind Project	1,274,268	3	1,249	16
TOTAL (all projects)	28,834,774	12,383	13,778,14,779	1,612

5.9.2.98 The following displacement matrices provide the estimated cumulative mortality of Manx shearwater predicted to occur due to displacement, as determined by the relevant specified rates of displacement and mortality (Table 5.111 to Table 5.114). The approach used for the cumulative displacement assessment follows that presented in Volume 6, Annex 5.2: Offshore ornithology displacement assessment of the Environmental Statement (Document reference F6.5.2).

Table 5.111: Operations and maintenance phase cumulative Manx shearwater mortality following displacement from offshore wind farms in the pre-breeding season.

		Mortality level (% of displaced birds at risk of mortality)						
		1%	2%	5%	10%	25%	50%	100%
Displacement level (% at risk of displacement)	10%	12	25	62	124	310	619	1,238
	20%	25	50	124	248	619	1,238	2,477
	30%	37	74	186	371	929	1,857	3,715
	40%	50	99	248	495	1,238	2,477	4,953
	50%	62	124	310	619	1,548	3,096	6,192
	60%	74	149	371	743	1,857	3,715	7,430
	70%	87	173	433	867	2,167	4,334	8,668
	80%	99	198	495	991	2,477	4,953	9,906
	90%	111	223	557	1,114	2,786	5,572	11,145
	100%	124	248	619	1,238	3,096	6,192	12,383

MONA OFFSHORE WIND PROJECT

Table 5.112: Operations and maintenance phase cumulative Manx shearwater mortality following displacement from offshore wind farms in the breeding season.

Mortality level (% of displaced birds at risk of mortality)		1%	2%	5%	10%	25%	50%	100%
Displacement level (% at risk of displacement)	10%	4415	2830	6974	138148	344369	689739	1,378478
	20%	2830	5559	138148	276296	689739	1,378478	2,756956
	30%	4444	8389	207222	413443	1,033108	2,067217	4,133434
	40%	5559	110118	276296	551591	1,378478	2,756956	5,511912
	50%	6974	138118	344369	689739	1,722847	3,445695	6,8897,390
	60%	8389	166177	413443	827887	2,067217	4,133434	8,267867
	70%	96103	193207	482517	9641,035	2,411586	4,8225,173	9,64510,345
	80%	110118	220236	551591	1,102182	2,756956	5,511912	11,022823
	90%	124133	248266	620665	1,240330	3,400325	6,200651	12,40013,301
	100%	138148	276296	689739	1,378478	3,445695	6,8897,390	13,77814,779

Table 5.113: Operations and maintenance phase cumulative Manx shearwater mortality following displacement from offshore wind farms in the post-breeding season.

Mortality level (% of displaced birds at risk of mortality)		1%	2%	5%	10%	25%	50%	100%
Displacement level (% at risk of displacement)	10%	2	3	8	16	40	81	161
	20%	3	6	16	32	81	161	322
	30%	5	10	24	48	121	242	484
	40%	6	13	32	64	161	322	645
	50%	8	16	40	81	202	403	806
	60%	10	19	48	97	242	484	967
	70%	11	23	56	113	282	564	1,128
	80%	13	26	64	129	322	645	1,290
	90%	15	29	73	145	363	725	1,451
	100%	16	32	81	161	403	806	1,612

MONA OFFSHORE WIND PROJECT

Table 5.114: Operations and maintenance phase cumulative Manx shearwater mortality following displacement from offshore wind farms annually.

		Mortality level (% of displaced birds at risk of mortality)						
		1%	2%	5%	10%	25%	50%	100%
Displacement level (% at risk of displacement)	10%	29	58	144	288	724719	1,442439	2,883877
	20%	58	115	288	577575	1,442439	2,883877	5,766755
	30%	86	173	432	865863	2,462158	4,325316	8,649632
	40%	115	234230	577575	1,453151	2,883877	5,766755	11,532510
	50%	144	288	724719	1,442439	3,604597	7,208194	14,416387
	60%	173	346345	865863	1,730726	4,325316	8,649632	17,299264
	70%	202201	404403	1,009007	2,018014	5,045035	10,091007	20,182142
	80%	234230	464460	1,453151	2,306302	5,766755	11,532510	23,065019
	90%	259	519518	1,297295	2,595590	6,487474	12,974948	25,948897
	100%	288	577575	1,442439	2,883877	7,208194	14,416387	28,834774

MONA OFFSHORE WIND PROJECT

Table 5.115: Qualitative assessment of projects considered cumulatively with the Mona Offshore Wind Project for which quantitative consideration of displacement impacts was not undertaken in project-specific documentation for manx shearwater

Project	Reason for estimates being unavailable	Qualitative assessment	Final conclusion
Tier 1			
<p>Burbo Bank Offshore Wind Farm (Seascope Energy Ltd., 2002)</p>	<p>Disturbance impacts considered qualitatively</p>	<p>Surveys of the project comprised aerial and boat-based surveys both of which were undertaken during winter months (aerial = November to April and boat-based = December and February). Aerial surveys covered a large area encompassing the Liverpool Bay SPA with boat-based surveys covering the project area. The surveys were undertaken to provide abundance and distribution data for those species considered to be of most importance, namely common scoter and red-throated diver.</p> <p>Manx shearwater was not considered to be a species of International or National importance in the context of the assessments undertaken. It does not appear that the species was recorded during site-specific surveys, with no mention of the species in project-specific documentation.</p>	<p>Although Manx shearwater was not specifically assessed due to the species being considered of limited importance, low levels of disturbance were predicted for other species with conclusions of a negligible magnitude and very low significance reached.</p>
<p>Gwynt y Môr Offshore Wind Farm (RWE Group and Npower Renewables, 2005)</p>	<p>Disturbance impacts considered qualitatively</p>	<p>Site-specific surveys undertaken in support of the project included boat-based surveys undertaken between February 2003 and March 2005. Surveys between February 2003 and February 2004 covered a large area along the Welsh coast incorporating the project area with surveys between March 2004 and March 2005 more focussed on the project area. The assessment also used data from aerial surveys undertaken between 2000 2005 which were targeted at recording common scoter.</p> <p>Manx shearwaters were recorded during boat-based surveys particularly in April and May 2004. In other months only single birds or small flocks were recorded.</p>	<p>It was considered that displacement (termed avoidance of turbines in the assessments conducted) would result in an impact of low significance for Manx shearwater due to the very extensive areas across which the species forages and the limited importance of the project area for the species.</p>

MONA OFFSHORE WIND PROJECT

Project	Reason for estimates being unavailable	Qualitative assessment	Final conclusion
Ormonde Wind Farm (Ecology Consulting, 2005)	Disturbance impacts considered qualitatively	<p>Site-specific surveys included boat-based surveys undertaken monthly between May 2004 and April 2005. In addition, three aerial surveys were conducted during the summer of 2004 with four further aerial surveys in the winter of 2004/5.</p> <p>The peak population of Manx shearwater recorded in the wind farm plus a 2 km buffer during boat-based surveys was 1,001 birds. During aerial surveys the equivalent population was zero birds. Peak numbers were recorded in August, although the majority of birds were outside of the wind farm area in deeper waters to the west of the study area.</p> <p>The species was considered to be of high importance (termed sensitivity) in the context of the assessments conducted.</p>	The magnitude of the effect for Manx shearwater was considered to be negligible with a low significance.
Robin Rigg Offshore Wind Farm (Natural Power, 2002)	Disturbance impacts considered qualitatively	<p>The project utilised site-specific boat-based surveys to characterise the baseline environment. Two surveys were completed in each month from May 2001 for one year. In addition, aerial surveys were undertaken from November 2001 on a monthly basis through winter and spring to verify the distribution and abundance of seaduck.</p> <p>The mean count of Manx shearwater during boat-based surveys in the wind farm was three birds with a peak of 39 birds. Manx shearwater was considered to be present in the wind farm area in regionally important numbers.</p>	The magnitude of the effect was considered to be negligible with a very low significance.
Rhyl Flats Offshore Wind Farm (Ecology Consulting, 2002)	Disturbance impacts considered qualitatively	<p>Surveys of the project comprised aerial and boat-based surveys. Aerial surveys were undertaken between November 2001 and January 2002 and targeted common scoter, with non-target species not uniformly reported upon. Boat-based surveys were undertaken between January and March 2002 to record movements of common scoter and the flight height of birds.</p> <p>Manx shearwater are not present in UK waters during the non-breeding season and therefore were not recorded during site-specific surveys.</p>	Wind farm area not considered to be importance for seabirds and significant effects were considered unlikely

MONA OFFSHORE WIND PROJECT

Project	Reason for estimates being unavailable	Qualitative assessment	Final conclusion
Walney 1 & 2 Offshore Wind Farms (RPS, 2006)	Disturbance impacts considered qualitatively	<p>Site-specific surveys included boat-based surveys undertaken across an area of 512 km² in the vicinity of the project between May 2004 and September 2005. The project also utilised survey data collected by regional aerial surveys, undertaken across their aerial survey area between 2002 and 2006 and radar survey data collected between 1st October and 29th October 2005.</p> <p>The peak population of Manx shearwater recorded in the project area plus 2 km buffer during aerial surveys was 135 birds. In boat-based surveys the equivalent population was 3,673 birds.</p> <p>Manx shearwater was deemed to be a species of high importance (termed sensitivity in the Walney 1&2 assessments).</p>	<p>With no evidence for the likely sensitivity of Manx shearwater to displacement impacts when the assessments for Walney 1+2 were undertaken the assessment assumed that Manx shearwater would avoid the wind farm area. However, although it was assumed that displacement effects would be high it was considered that this would lead to a high impact magnitude due to the short temporal period during which Manx shearwaters would be present in the wind farm area, the low importance of the wind farm area for the species and the large foraging range of the species leading to a conclusion of low magnitude.</p> <p>The overall significance of impacts associated with the project was considered to be low.</p>
West of Duddon Sands Offshore Wind Farm (RPS, 2006)	Disturbance impacts considered qualitatively	<p>Site-specific surveys included boat-based surveys undertaken across an area of 512 km² in the vicinity of the project between May 2004 and September 2005. The project also utilised survey data collected by regional aerial surveys, undertaken across their aerial survey area between 2002 and 2006 and radar survey data collected between 1st October and 29th October 2005.</p> <p>The peak population of Manx shearwater recorded in the project area plus 2 km buffer during aerial surveys was 104 birds. In boat-based surveys the equivalent population was 544 birds.</p> <p>Manx shearwater was deemed to be a species of high importance (termed sensitivity in the West of Duddon Sands assessments).</p>	<p>With no evidence for the likely sensitivity of Manx shearwater to displacement impacts when the assessments for West of Duddon Sands were undertaken the assessment assumed that Manx shearwater would avoid the wind farm area. However, although it was assumed that displacement effects would be high it was considered that this would lead to a high impact magnitude due to the short temporal period during which Manx shearwaters would be present in the wind farm area, the low importance of the wind farm area for the species and the large foraging range of the species leading to a conclusion of low magnitude.</p> <p>The overall significance of impacts associated with the project was considered to be low.</p>

MONA OFFSHORE WIND PROJECT

- 5.9.2.99 During the spring migration (pre-breeding) season the displacement from operation when using the displacement rate of 50% (range of 30 to 70%) and a mortality rate of 1% (range of 1 to 10%), results in an additional loss of 62 (37 to 867) individuals (Table 5.111). The regional seas UK Western Waters & Channel BDMPS population of Manx shearwater in the spring migration period is estimated to be 1,580,895 individuals (Table 5.14). Assuming an average baseline mortality rate of 0.130 (Table 5.15), background mortality during spring migration is 205,516 individuals. The addition of 62 (37 to 867) individual mortalities due to cumulative displacement from the presence of infrastructure would increase the mortality relative to the baseline mortality by 0.030 % (0.018 to 0.422%).
- 5.9.2.100 During the breeding season the displacement from operation results in a loss of ~~69 (41 74 (44 to 9641,035))~~ individuals from the migratory population (Table 5.112). The regional seas UK Western Waters & Channel BDMPS population of Manx shearwater within the breeding season is estimated to be 1,821,544 individuals (Table 5.14). Assuming an average baseline mortality rate of 0.130, background mortality in the breeding season is 236,801 individuals. The addition of ~~69 (4174 (44 to 964) 1,035)~~ individual mortalities due to cumulative displacement from construction activities would increase the mortality relative to the baseline mortality by ~~0.029 031 % (0.017019 to 0.407437 %)~~.
- 5.9.2.101 During the autumn migration season (post-breeding), displacement from operation results in a loss of eight (five to 113) individuals from the migratory population (Table 5.113). The regional seas UK Western Waters & Channel BDMPS population of Manx shearwater during the autumn migration period is estimated to be 1,580,895 individuals (Table 5.14). Assuming an average baseline mortality rate of 0.130, background mortality during autumn migration is 205,516 individuals. The addition of eight (five to 113) individual mortalities due to cumulative displacement from the presence of infrastructure would increase the mortality relative to the baseline mortality by 0.004% (0.002 to 0.055%).
- 5.9.2.102 The annual estimated mortality resulting from displacement during construction is 144 (86 to 2, ~~018014~~) individuals (Table 5.114). Using the largest population of 1,821,544 individuals, with an average baseline mortality rate of 0.130, the background predicted mortality would be 236,801. The addition of 144 (86 to 2, ~~018014~~) mortalities would increase the baseline mortality rate by 0.061% (0.036 to 0. ~~852850~~ %). The annual predicted mortality from the cumulative assessment is below the 1% threshold increase in baseline mortality.
- 5.9.2.103 The cumulative effect is predicted to be of national spatial extent, long term duration, continuous and medium reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **negligible**.

Sensitivity of the receptor

Common guillemot

- 5.9.2.104 Evidence of guillemot sensitivity to displacement from offshore wind farms is summarised from paragraph 5.9.2.56 onwards. Common guillemot is deemed to be of medium vulnerability, medium recoverability and medium value. Overall, based on evidence from post-construction studies and reviews, guillemot is deemed to be of medium vulnerability, medium recoverability and high value. The sensitivity of the receptor is therefore, considered to be **medium**.

MONA OFFSHORE WIND PROJECT

Razorbill

- 5.9.2.105 Evidence of razorbill sensitivity to displacement from offshore wind farms is summarised from paragraph 5.9.2.66 onwards. Overall, based on evidence from post-construction studies and reviews, razorbill is deemed to be of medium vulnerability, medium recoverability and medium value. The sensitivity of the receptor is therefore, considered to be **medium**.

Atlantic puffin

- 5.9.2.106 Evidence of Atlantic puffin sensitivity to displacement from offshore wind farms is summarised from paragraph 5.9.2.75 onwards. Overall, based on evidence from post-construction studies and reviews, Atlantic puffin is deemed to be of medium vulnerability, low recoverability and high value. The sensitivity of the receptor is therefore, considered to be **high**.

Northern gannet

- 5.9.2.107 Evidence of northern gannet sensitivity to displacement from offshore wind farms is summarised from paragraph 5.9.2.81 onwards. Based on evidence from operational wind farms demonstrating that northern gannet show a high avoidance of offshore wind farms, northern gannet is deemed to be of high vulnerability, medium recoverability and medium value. The sensitivity of the receptor is therefore, considered to be **medium**.

Black-legged kittiwake

- 5.9.2.108 Evidence of black-legged kittiwake sensitivity to displacement from offshore wind farms is summarised from paragraph 5.9.2.88 onwards. For kittiwake, there is evidence from other operating offshore wind farm projects that displacement is not likely to occur to any significant level. However, due to low reproductive rates, black-legged kittiwake is deemed to be of low vulnerability, low recoverability and medium value. The sensitivity of the receptor is therefore, considered to be **medium**.

Manx shearwater

- 5.9.2.109 For Manx shearwater, there is evidence from other operating offshore wind farm projects that displacement is not likely to occur to any significant level. However, due to low reproductive rates, Manx shearwater is deemed to be of low vulnerability, low recoverability and medium value. The sensitivity of the receptor is therefore, considered to be **medium**.

Significance of effect

- 5.9.2.110 Table 5.116 summarises the significance of effect cumulative on the species susceptible to disturbance and displacement impacts. All impacts are considered non-significant in EIA terms.

Table 5.116: Table summarising the cumulative significance of effect during operation.

Species	Magnitude of impact	Sensitivity of receptor	Significance of effect
Common guillemot	Low	Medium	Minor adverse, not significant in EIA terms
Razorbill	Low	Medium	Minor adverse, not significant in EIA terms

MONA OFFSHORE WIND PROJECT

Species	Magnitude of impact	Sensitivity of receptor	Significance of effect
Atlantic puffin	Negligible	High	Negligible, not significant in EIA terms
Northern gannet	Negligible	Medium	Negligible, not significant in EIA terms
Black-legged kittiwake	Negligible	Medium	Negligible, not significant in EIA terms
Manx shearwater	Negligible	Medium	Negligible, not significant in EIA terms

Decommissioning phase

5.9.2.111 During the decommissioning phase, cumulative disturbance and displacement of red-throated divers, guillemots and razorbills would only occur if these activities occurred at the same time across offshore wind farms. Disturbance effects during the decommissioning phase are anticipated to be like construction if the decommissioning schedule of the Mona Offshore Wind Project will overlap with that for the other offshore wind farms within the CEA study area. The magnitude of impact would be negligible, with significance ranging from **negligible** to **minor** depending on the species, which is not significant in EIA terms.

5.9.3 Collision risk

Tier 1 and Tier 2

Operations and maintenance phase

5.9.3.1 The Mona Offshore Wind Project, together with other offshore wind farms in the Irish Sea, may contribute to cumulative collision risk, in the event the operations and maintenance phases of different projects overlap. Seabirds and migratory birds are highly mobile; therefore they can encounter different offshore wind farms, and be at risk of collisions, across large areas.

5.9.3.2 As stated, data used within the assessing cumulative collision risk is based on published information produced by the respective project developers. As such, the input parameters (e.g. ~~avoidance rates~~ species biometrics) and the collision risk model used (e.g. deterministic) may vary from those put forward in this chapter. All of the impacts from other projects have been corrected to the latest avoidance rates (Ozsanlav-Harris *et al.*, 2015) therefore Band Option 2 outputs have taken from other projects to allow this correction to occur.

5.9.3.3 The expected annual collision mortality for seabirds has been compiled from relevant offshore wind farms and is shown in Table 5.117.

5.9.3.4 The expected annual collision mortality for migratory birds has been compiled from relevant offshore wind farms and is shown in Table 5.130 to Table 5.135. Due to the number of species considered within the migratory bird section the tables are broken down as follows:

- Table 5.130 contains Bewick's swan, whooper swan, Greenland white-fronted goose, light-bellied brent goose (Canadian population), shelduck, wigeon, gadwall, teal, mallard and pintail
- Table 5.131 contains pochard, tufted duck, scaup, long-tailed duck, common scoter, goldeneye, red-breasted merganser, great northern diver and European storm petrel

MONA OFFSHORE WIND PROJECT

- Table 5.132 contains Leach's storm petrel, bittern, great crested grebe, Slavonian grebe, hen harrier, osprey, merlin, corncrake and oystercatcher (breeding and non-breeding)

Table 5.133 contains ringed plover (breeding and non-breeding), dotterel, golden plover (breeding and non-breeding), grey plover, lapwing, knot, sanderling and purple sandpiper

- Table 5.134 contains dunlin, ruff, snipe, black-tailed godwit, bar-tailed godwit, whimbrel, curlew (breeding and non-breeding) and greenshank
- Table 5.135 contains wood sandpiper, redshank (breeding and non-breeding), turnstone, great skua, pomarine skua, long-tailed skua, black-headed gull and short-eared owl.

5.9.3.5 Any sections marked "Unavailable" in the tables from Table 5.117 to Table 5.129 are due to a lack of assessment or no available published data for the relevant species. Where this occurs, these offshore wind farms have been assessed qualitatively. Where a range of collision risks was provided, the worst-case scenario figure was used in this cumulative assessment.

Magnitude of impact

Black-legged kittiwake

5.9.3.6 The expected mean seasonal and annual collision mortality for kittiwake has been compiled for relevant offshore wind farms and is shown in Table 5.117, with estimates based on the species-group advocated avoidance rate of 99.28.

Table 5.117: Expected annual collision mortality across relevant offshore wind farms for black-legged kittiwake (avoidance rate 99.28)

Project	Annual	Pre-breeding Season	Breeding Season	Post-breeding Season
Tier 1				
Awel y Môr Offshore Wind Farm	35.25	15.30	11.66	8.29
Burbo Bank Offshore Wind Farm	unavailable	unavailable	unavailable	unavailable
Burbo Bank Extension Offshore Wind Farm	23.04	unavailable	unavailable	unavailable
Erebus Floating Wind Demo	37.65	12.51	0.50	24.64
Gwynt y Môr Offshore Wind Farm	unavailable	unavailable	unavailable	unavailable
TwinHub (Wave Hub Floating Wind Farm)	9.9072	unavailable	unavailable	unavailable
Ormonde Wind Farm	3.27	unavailable	unavailable	unavailable
Rampion Offshore Wind Farm	426.72128.16	41.76	70.56	15.84
Robin Rigg Offshore Wind Farm	unavailable	unavailable	unavailable	unavailable

MONA OFFSHORE WIND PROJECT

Project	Annual	Pre-breeding Season	Breeding Season	Post-breeding Season
Rhyl Flats Offshore Wind Farm	unavailable	unavailable	unavailable	unavailable
Walney 1 & 2 Offshore Wind Farms	unavailable	unavailable	unavailable	unavailable
Walney (3 & 4) Extension Offshore Wind Farm	120.37	15.19	18.79	86.40
West of Duddon Sands Offshore Wind Farm	unavailable	unavailable	unavailable	unavailable
West of Orkney Windfarm	54.49	20.99	17.06	16.44
White Cross Offshore Windfarm	14.81	9.26	3.70	1.85
Tier 2				
Morecambe Offshore Windfarm Generation Assets	32.00	5.34	15.03	11.63
Morgan Offshore Wind Project Generation Assets	39.81	13.18	5.00	21.63
Rampion 2 (Rampion Extension) Offshore Wind Farm	28.00	17.00	1.00	10.00
Total (minus the Mona Offshore Wind Project)	525.34 526.57	150.52	143.3	196.72
Mona Offshore Wind Project	32.67	8.74	15.52	8.41
Cumulative total (all projects)	557.98 559.24	159.26 159.62	158.82	205.13

5.9.3.7 There are a number of Tier 1 projects for which collision risk estimates are unavailable. This is due to various factors including species not being included in CRM or projects not having conducted CRM. To ensure these projects are considered in this assessment project-specific documents have been reviewed to provide a qualitative assessment of collision for each project. This process is summarised in Table 5.118

MONA OFFSHORE WIND PROJECT

Table 5.118: Qualitative assessment of projects considered cumulatively with the Mona Offshore Wind Project for which quantitative consideration of collision risk was not undertaken in project-specific documentation for kittiwake.

Project	Reason for estimates being unavailable	Qualitative assessment	Final conclusion
Tier 1			
Burbo Bank Offshore Wind Farm (Seascope Energy Ltd., 2002)	Species not included in CRM	<p>The assessment of collision risk was undertaken on a qualitative basis by investigating flight heights of birds at the project site and was undertaken for species considered to be of International or National importance in the context of the assessments undertaken for the project. Kittiwake was not considered to be a species of International or National importance.</p> <p>Surveys of the project comprised aerial and boat-based surveys both of which were undertaken during winter months (aerial = November to April and boat-based = December and February). Aerial surveys covered a large area encompassing the Liverpool Bay SPA with boat-based surveys covering the project area. The surveys were undertaken to provide abundance and distribution data for those species considered to be of most importance, namely common scoter and red-throated diver. Low numbers of kittiwake were recorded during boat-based surveys with relatively low numbers also recorded during aerial surveys.</p>	No assessment was conducted for kittiwake in relation to collision risk impacts however, kittiwake was not considered to be a species of International or National importance in the context of the assessments undertaken.
Walney 1 & 2 Offshore Wind Farms (RPS, 2006)	Species not included in CRM	<p>Site-specific surveys included boat-based surveys undertaken across an area of 512 km² in the vicinity of the project between May 2004 and September 2005. The project also utilised survey data collected by regional aerial surveys, undertaken across their aerial survey area between 2002 and 2006 and radar survey data collected between 1st October and 29th October 2005.</p> <p>Kittiwake was not included in CRM and it was considered that, due to the very low numbers of birds recorded at rotor height, that the magnitude of collision was negligible.</p>	Very low significance

MONA OFFSHORE WIND PROJECT

Project	Reason for estimates being unavailable	Qualitative assessment	Final conclusion
West of Duddon Sands Offshore Wind Farm (RSKENSr, 2006)	Species not included in CRM	<p>Site-specific surveys included boat-based surveys undertaken across an area of 512 km² in the vicinity of the project between May 2004 and September 2005. The project also utilised survey data collected by regional aerial surveys, undertaken across their aerial survey area between 2002 and 2006 and radar survey data collected between 1st October and 29th October 2005.</p> <p>The peak population of kittiwake recorded in the project area plus 2 km buffer during aerial surveys was 14 birds. In boat-based surveys the equivalent population was 454 birds. The proportion of flying kittiwake recorded above 15 m was 15.5 % across all boat-based surveys within the boat-based survey area.</p> <p>Kittiwake was deemed to be a species of low importance (termed sensitivity in the West of Duddon Sands assessments).</p>	Very low significance
Gwynt y Môr Offshore Wind Farm (RWE Group and Npower Renewables, 2005)	Species not included in CRM	<p>Site-specific surveys undertaken in support of the project included boat-based surveys undertaken between February 2003 and March 2005. Surveys between February 2003 and February 2004 covered a large area along the Welsh coast incorporating the project area with surveys between March 2004 and March 2005 more focussed on the project area. The assessment also used data from aerial surveys undertaken between 2000 2005 which were targeted at recording common scoter.</p> <p>The highest populations of kittiwake were recorded between March and May.</p> <p>During boat-based surveys used to characterise the project undertaken between 2004 to 2005, covering an area considered by the project assessment to better represent the behaviour of birds than the area associated with boat-based surveys undertaken in 2003-04, 8,900 observations were obtained with only 22 flights recorded at a height of greater than 20 m. In 2004-05 surveys, 603 kittiwake were recorded in flight with only 0.2% of these flying above 20 m.</p>	Low significance due to low proportion of flight heights recorded at collision height

MONA OFFSHORE WIND PROJECT

Project	Reason for estimates being unavailable	Qualitative assessment	Final conclusion
Rhyl Flats Offshore Wind Farm (Ecology Consulting, 2002)	Species not included in CRM	<p>Surveys of the project comprised aerial and boat-based surveys. Aerial surveys were undertaken between December 2001 and January 2002 and targeted common scoter, with non-target species not uniformly reported upon. Boat-based surveys were undertaken between January and March 2002 to record movements of common scoter and the flight height of birds.</p> <p>A qualitative assessment was undertaken for 'other seabirds' (a category that included gulls) and it was considered that collision rates would be negligible.</p>	Very low significance
Robin Rigg Offshore Wind Farm (Natural Power, 2002)	Species not included in CRM	<p>The project utilised site-specific boat-based surveys to characterise the baseline environment. Two surveys were completed in each month from May 2001 for one year. In addition, aerial surveys were undertaken from November 2001 on a monthly basis through winter and spring to verify the distribution and abundance of seabirds.</p> <p>The mean count of kittiwake during boat-based surveys in the wind farm was 4.5 birds with a peak of 46 birds. Kittiwake was considered to be of local importance based on the populations recorded in the wind farm. The proportion of kittiwake flying above 20 m during boat-based surveys across the entire study area was less than 1%.</p> <p>A qualitative assessment was undertaken for 'other seabirds' (a category that included gulls) and it was considered that collision rates would be low/negligible.</p>	Low/Very low significance

MONA OFFSHORE WIND PROJECT

- 5.9.3.8 The estimated cumulative collision mortality of black-legged kittiwake from the relevant projects with available data is ~~557.98~~559.24 per year (Table 5.117). Using the largest population of 911,586 individuals (during the post-breeding/autumn migration), with an average baseline mortality rate of 0.156 (Table 5.15), the background predicted mortality would be 142,207. The addition of ~~557.98~~559.24 mortalities would increase the baseline mortality rate by 0.~~392~~393%. The annual predicted mortality from the cumulative collision risk assessment is below the 1% threshold increase in baseline mortality.
- 5.9.3.9 The cumulative effect is predicted to be of national spatial extent, long term duration, continuous and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**.

Great black-backed gull

- 5.9.3.10 The expected mean seasonal and annual collision mortality for great black-backed gull has been compiled for relevant offshore wind farms and is shown in Table 5.119 using the species-group avoidance rate of 99.39. Additionally, within Table 5.120 avoidance rates have been corrected to account for the species-specific avoidance rate of 99.91 calculated by Ozsanlav-Harris *et al.* (2023) which is considered more appropriate for this species, with species-specific estimates based on sufficient sample size.

Table 5.119: Expected annual collision mortality across relevant offshore wind farms for great black-backed gull (avoidance rate 99.39)

Project	Annual	Breeding Season	Non-breeding Season
Tier 1			
Awel y Môr Offshore Wind Farm	5.94	5.32	0.62
Burbo Bank Offshore Wind Farm	unavailable	unavailable	unavailable
Burbo Bank Extension Offshore Wind Farm	unavailable	unavailable	unavailable
Erebus Floating Wind Demo	0.82	0.00	0.82
Gwynt y Môr Offshore Wind Farm	unavailable	unavailable	unavailable
TwinHub (Wave Hub Floating Wind Farm)	7.24 <u>15.74</u>	unavailable	unavailable
Ormonde Wind Farm	0.29	unavailable	unavailable
Rampion Offshore Wind Farm	38.06	4.76	33.31
Robin Rigg Offshore Wind Farm	unavailable	unavailable	unavailable
Rhyl Flats Offshore Wind Farm	unavailable	unavailable	unavailable
Walney 1 & 2 Offshore Wind Farms	unavailable	unavailable	unavailable
Walney (3 & 4) Extension Offshore Wind Farm	25.96	5.89	20.07

MONA OFFSHORE WIND PROJECT

Project	Annual	Breeding Season	Non-breeding Season
West of Duddon Sands Offshore Wind Farm	unavailable	unavailable	unavailable
West of Orkney Windfarm	13.18	unavailable	unavailable
White Cross Offshore Windfarm	0.93	0.93	0
Tier 2			
Morecambe Offshore Windfarm Generation Assets	0.98	0.53	0.45
Morgan Offshore Wind Project Generation Assets	2.81	2.10	0.71
Rampion 2 (Rampion Extension) Offshore Wind Farm	19.84	6.25	13.59
Total (minus the Mona Offshore Wind Project)	116.04 <u>124.53</u>	25.77	69.56
Mona Offshore Wind Project	4.83	1.67	3.16
Cumulative total (all projects)	120.84 <u>129.36</u>	27.44	72.72

Table 5.120: Expected annual collision mortality across relevant offshore wind farms for great black-backed gull (avoidance rate 99.91)

Project	Annual	Breeding Season	Non-breeding Season
Tier 1			
Awel y Môr Offshore Wind Farm	0.87	0.78	0.09
Burbo Bank Offshore Wind Farm	unavailable	unavailable	unavailable
Burbo Bank Extension Offshore Wind Farm	unavailable	unavailable	unavailable
Erebus Floating Wind Demo	0.12	0.00	0.12
Gwynt y Môr Offshore Wind Farm	unavailable	unavailable	unavailable
TwinHub (Wave Hub Floating Wind Farm)	1.06 <u>2.32</u>	unavailable	unavailable
Ormonde Wind Farm	0.04	unavailable	unavailable
Rampion Offshore Wind Farm	5.62	0.70	4.91
Robin Rigg Offshore Wind Farm	unavailable	unavailable	unavailable
Rhyl Flats Offshore Wind Farm	unavailable	unavailable	unavailable
Walney 1 & 2 Offshore Wind Farm	unavailable	unavailable	unavailable
Walney (3 & 4) Extension Offshore Wind Farm	unavailable	unavailable	unavailable
West of Duddon Sands Offshore Wind Farm	3.83	0.87	2.96

MONA OFFSHORE WIND PROJECT

Project	Annual	Breeding Season	Non-breeding Season
West of Orkney Windfarm	1.94	unavailable	unavailable
White Cross Offshore Windfarm	0.14	0.14	0.00
Tier 2			
Morecambe Offshore Windfarm Generation Assets	0.14	0.08	0.07
Morgan Offshore Wind Project Generation Assets	0.41	0.31	0.10
Rampion 2 (Rampion Extension) Offshore Wind Farm	2.93	0.92	2.01
Total (minus the Mona Offshore Wind Project)	17.12 18.37	3.80	10.26
Mona Offshore Wind Project	0.72	0.25	0.47
Cumulative total (all projects)	17.83 19.09	4.05	10.73

5.9.3.11 There are a number of projects for which collision risk estimates are unavailable. This is due to various factors including species not being included in CRM or projects not having conducted CRM. To ensure these projects are considered in this assessment project-specific documents have been reviewed to provide a qualitative assessment of collision for each project. This process is summarised in Table 5.121.

MONA OFFSHORE WIND PROJECT

Table 5.121: Qualitative assessment of projects considered cumulatively with the Mona Offshore Wind Project for which quantitative consideration of collision risk was not undertaken in project-specific documentation for great black-backed gull.

Project	Reason for estimates being unavailable	Qualitative assessment	Final conclusion
Tier 1			
Burbo Bank Offshore Wind Farm (Seascope Energy Ltd., 2002)	Species not included in CRM	<p>The assessment of collision risk was undertaken on a qualitative basis by investigating flight heights of birds at the project site and was undertaken for species considered to be of International or National importance in the context of the assessments undertaken for the project. Great black-backed gull was not considered to be a species of International or National importance.</p> <p>Surveys of the project comprised aerial and boat-based surveys both of which were undertaken during winter months (aerial = November to April and boat-based = December and February). Aerial surveys covered a large area encompassing the Liverpool Bay SPA with boat-based surveys covering the project area. The surveys were undertaken to provide abundance and distribution data for those species considered to be of most importance, namely common scoter and red-throated diver. Great black-backed gull was not recorded during boat-based surveys with relatively low numbers recorded during aerial surveys.</p>	No assessment was conducted for great black-backed gull in relation to collision risk impacts however, for great black-backed gull was not considered to be a species of International or National importance in the context of the assessments undertaken.
Burbo Bank Extension Offshore Wind Farm (DONG Energy, 2013)	Species not included in CRM	<p>CRM was undertaken however great black-backed gull was not included. Site-specific data consisted of six boat-based surveys undertaken between April and September 2011 and six aerial surveys undertaken between November 2010 and April 2011.</p> <p>The peak population of great black-backed gull recorded during boat-based surveys was 18 birds with an average of eight birds. During aerial surveys, great black-backed gulls were recorded in all but one but in small numbers (peak population of 90 birds). The species was considered to be of regional/local importance in the context of the assessment for the project.</p>	No assessment was conducted for great black-backed gull in relation to collision risk impacts.

MONA OFFSHORE WIND PROJECT

Project	Reason for estimates being unavailable	Qualitative assessment	Final conclusion
<p>Walney 1 & 2 Offshore Wind Farms (RPS, 2006)</p>	<p>Species not included in CRM</p>	<p>Site-specific surveys included boat-based surveys undertaken across an area of 512 km² in the vicinity of the project between May 2004 and September 2005. The project also utilised survey data collected by regional aerial surveys, undertaken across their aerial survey area between 2002 and 2006 and radar survey data collected between 1st October and 29th October 2005.</p> <p>The peak population of great black-backed gull recorded in the project area plus 2 km buffer during aerial surveys was 43 birds. In boat-based surveys the equivalent population was 65 birds. The proportion of flying great black-backed gulls recorded above 15 m was 28.7 % across all boat-based surveys, although the total number of flying birds was low (108 records).</p> <p>Great black-backed gull was deemed to be a species of medium importance (termed sensitivity in the Walney 1&2 assessments).</p> <p>Great black-backed gull was not included in CRM, and it was considered that, due to the very low numbers of birds recorded at rotor height, that the magnitude of collision was negligible.</p>	<p>Very low significance.</p>

MONA OFFSHORE WIND PROJECT

Project	Reason for estimates being unavailable	Qualitative assessment	Final conclusion
West of Duddon Sands Offshore Wind Farm (RSKENSr, 2006)	Species not included in CRM	<p>Site-specific surveys included boat-based surveys undertaken across an area of 512 km² in the vicinity of the project between May 2004 and September 2005. The project also utilised survey data collected by regional aerial surveys, undertaken across their aerial survey area between 2002 and 2006 and radar survey data collected between 1st October and 29th October 2005.</p> <p>The peak population of great black-backed gull recorded in the project area plus 2 km buffer during aerial surveys was 2 birds. In boat-based surveys the equivalent population was 661 birds. The proportion of flying great black-backed gulls recorded above 15 m was 28.7 % across all boat-based surveys, although the total number of flying birds was low (108 records).</p> <p>Great black-backed gull was deemed to be a species of medium importance (termed sensitivity in the West of Duddon Sands assessments).</p>	Very low significance.
Gwynt y Môr Offshore Wind Farm (RWE Group and Npower Renewables, 2005)	Species not included in CRM	<p>Site-specific surveys undertaken in support of the project included boat-based surveys undertaken between February 2003 and March 2005. Surveys between February 2003 and February 2004 covered a large area along the Welsh coast incorporating the project area with surveys between March 2004 and March 2005 more focussed on the project area. The assessment also used data from aerial surveys undertaken between 2000 2005 which were targeted at recording common scoter.</p> <p>During boat-based surveys used to characterise the project undertaken between 2004 to 2005, covering an area considered by the project assessment to better represent the behaviour of birds than in 2003-04, 8,900 observations were obtained with only 22 flights recorded at a height of greater than 20 m. In 2004-05 surveys, 70 great black-backed gull were recorded in flight with only 2.9% of these flying above 20 m.</p>	Low significance due to low proportion of flight heights recorded at collision height.

MONA OFFSHORE WIND PROJECT

Project	Reason for estimates being unavailable	Qualitative assessment	Final conclusion
Rhyl Flats Offshore Wind Farm (Ecology Consulting, 2002)	Species not included in CRM	<p>Surveys of the project comprised aerial and boat-based surveys. Aerial surveys were undertaken between December 2001 and January 2002 and targeted common scoter, with non-target species not uniformly reported upon. Boat-based surveys were undertaken between January and March 2002 to record movements of common scoter and the flight height of birds.</p> <p>A qualitative assessment was undertaken for 'other seabirds' (a category that included gulls) and it was considered that collision rates would be negligible.</p>	Very low significance.
Robin Rigg Offshore Wind Farm (Natural Power, 2002)	Species not included in CRM	<p>The project utilised site-specific boat-based surveys to characterise the baseline environment. Two surveys were completed in each month from May 2001 for one year. In addition, aerial surveys were undertaken from November 2001 on a monthly basis through winter and spring to verify the distribution and abundance of seaduck.</p> <p>The mean count of great black-backed gull during boat-based surveys in the wind farm was 0.1 birds with a peak of one bird. Great black-backed gull was not assigned an importance rating. The proportion of great black-backed gull flying above 20 m during boat-based surveys across the entire study area was 16%.</p> <p>A qualitative assessment was undertaken for 'other seabirds' (a category that included gulls) and it was considered that collision rates would be low/negligible.</p>	Low/Very low significance.

MONA OFFSHORE WIND PROJECT

5.9.3.12 The estimated annual cumulative collision mortality of great black-backed gull from the relevant projects with available data, using species-specific (0.9991) and species-group (0.9939) avoidance rates used in the CRM for cumulative projects is ~~17.83~~19.09 per year and ~~120.84~~129.36 per year, respectively (Table 5.117).

5.9.3.13 Using the largest population (during the breeding season) of 44,753 individuals, with an average baseline mortality rate of 0.095 (Table 5.15), the background predicted mortality would be 4,251. The addition of these mortalities to the baseline mortality rate results in an increase of 0.419% and 2.842% for avoidance rates of 0.9991 and 0.9939, respectively.

~~5.9.3.14 In the non-breeding/winter season, with a population of 17,742 individuals, and an average baseline mortality rate of 0.095 (Table 5.15), the background predicted mortality would be 1,685. The estimated cumulative collision mortality during the non-breeding/winter season for great black-backed gull for species-specific and group-specific avoidance rates is 10.73 and 72.72, respectively. The addition of these mortalities to the baseline mortality rate results in an increase of 0.673% and 4.314% for avoidance rates of 0.9991 and 0.9939.~~

~~5.9.3.15~~5.9.3.14 As the predicted increase in baseline mortality of the population for great black-backed gull exceeds an increase of 1% when considering an avoidance rate of 0.9939 in the non-breeding season and annually, as a first step to understand if further mitigation is required, impacts were assessed in Volume 6, Annex 5.6: Offshore ornithology population viability analysis technical report of the Environmental Statement (Document reference F6.5.6).

~~5.9.3.16~~5.9.3.15 The PVA revealed that the addition of great black-backed gull collision impacts from cumulative offshore wind farms would result in the population being 1.6% to 10.1% smaller under the two impact scenarios (species-group avoidance rate (0.9939) or species-specific avoidance rate (0.9991)) after 35 years (in 2065), than a non-impacted population. The predicted growth rate under the two impact scenarios and the unimpacted baseline scenario would continue to be positive, including when considering the lower and upper 95% confidence intervals. The counterfactual of growth rate is 1.000 (i.e. no change) when considering the species-specific avoidance rate (0.9991) or 0.997 when considering the species-group avoidance rate (0.9939).

~~5.9.3.17 The same results were also predicted when considering the non-breeding population and the predicted impact during this bio-season. The non-breeding population is predicted to increase in size under the unimpacted baseline scenario and the two impact scenarios. Similarly, the counterfactual of growth rate is 1.000 (i.e. no change) when considering the species-specific avoidance rate (0.9991) or 0.997 when considering the species-group avoidance rate (0.9939).~~

~~5.9.3.18~~5.9.3.16 Due to the minimal level of change to baseline conditions, the cumulative effect is predicted to be of national spatial extent, long term duration, continuous and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**.

Herring gull

~~5.9.3.19~~5.9.3.17 The expected mean seasonal and annual collision mortality for herring gull has been compiled for relevant offshore wind farms and is shown in Table 5.122 using the species-group avoidance rate of 99.39. Additionally, within Table 5.120 avoidance rates have been corrected to account for the species-specific avoidance rate of 99.52 calculated by Ozsanlav-Harris *et al.* (2023) which are considered more appropriate for this species, with species-specific estimates based on sufficient sample size.

MONA OFFSHORE WIND PROJECT
Table 5.122: Expected annual collision mortality across relevant offshore wind farms for herring gull (avoidance rate 99.39)

Project	Annual	Breeding Season	Non-breeding Season
Tier 1			
Awel y Môr Offshore Wind Farm	3.61	2.03	1.59
Burbo Bank Offshore Wind Farm	unavailable	unavailable	unavailable
Burbo Bank Extension Offshore Wind Farm	13.17	unavailable	unavailable
Erebus Floating Wind Demo	0.824.60	0.002.83	0.821.77
Gwynt y Môr Offshore Wind Farm	unavailable	unavailable	unavailable
TwinHub (Wave Hub Floating Wind Farm)	12.7533.55	unavailable	unavailable
Ormonde Wind Farm	0.44	unavailable	unavailable
Robin Rigg Offshore Wind Farm	unavailable	unavailable	unavailable
Rhyl Flats Offshore Wind Farm	unavailable	unavailable	unavailable
Walney 1 & 2 Offshore Wind Farms	unavailable	unavailable	unavailable
Walney (3 & 4) Extension Offshore Wind Farm	75.64	46.36	29.28
West of Duddon Sands Offshore Wind Farm	unavailable	unavailable	unavailable
West of Orkney Windfarm	0	0	0
White Cross Offshore Windfarm	0.30	0.30	0
Tier 2			
Morecambe Offshore Windfarm Generation Assets	3.42	0.93	2.49
Morgan Offshore Wind Project Generation Assets	11.82	2.57	9.25
Total (minus the Mona Offshore Wind Project)	121.98 146.56	52.19 55.02	43.42 44.38
Mona Offshore Wind Project	1.51	0.03	1.48
Cumulative total (all projects)	123.51 148.07	52.22 55.05	44.93 45.86

MONA OFFSHORE WIND PROJECT

Table 5.123: Expected annual collision mortality across relevant offshore wind farms for herring gull (avoidance rate 99.52)

Project	Annual	Breeding Season	Non-breeding Season
Tier 1			
Awel y Môr Offshore Wind Farm	2.84	1.59	1.25
Burbo Bank Offshore Wind Farm	-unavailable	unavailable	unavailable
Burbo Bank Extension Offshore Wind Farm	10.36	unavailable	unavailable
Erebus Floating Wind Demo	0.64 <u>3.62</u>	0.00 <u>2.23</u>	0.64 <u>1.39</u>
Gwynt y Môr Offshore Wind Farm	unavailable	unavailable	unavailable
TwinHub (Wave Hub Floating Wind Farm)	10.04 <u>26.40</u>	unavailable	unavailable
Ormonde Wind Farm	0.35	unavailable	unavailable
Robin Rigg Offshore Wind Farm	unavailable	unavailable	unavailable
Rhyl Flats Offshore Wind Farm	unavailable	unavailable	unavailable
Walney 1 & 2 Offshore Wind Farms	unavailable	unavailable	unavailable
Walney (3 & 4) Extension Offshore Wind Farm	59.52	36.48	23.04
West of Duddon Sands Offshore Wind Farm	unavailable	unavailable	unavailable
West of Orkney Windfarm	0	0	0
White Cross Offshore Windfarm	0.24	0.24	0.00
Tier 2			
Morecambe Offshore Windfarm Generation Assets	2.69	0.73	1.96
Morgan Offshore Wind Project Generation Assets	9.30	2.02	7.28
Total (minus the Mona Offshore Wind Project)	95.98 <u>115.32</u>	41.07 <u>43.29</u>	34.17 <u>92</u>
Mona Offshore Wind Project	1.24 <u>19</u>	0.02	1.48 <u>16</u>
Cumulative total (all projects)	97.19 <u>116.51</u>	41.09 <u>43.31</u>	35.35 <u>36.08</u>

MONA OFFSHORE WIND PROJECT

5.9.3.205.9.3.18 There are a number of projects for which collision risk estimates are unavailable. This is due to various factors including species not being included in CRM or projects not having conducted CRM. To ensure these projects are considered in this assessment project-specific documents have been reviewed to provide a qualitative assessment of collision for each project. This process is summarised in Table 5.124.

MONA OFFSHORE WIND PROJECT

Table 5.124: Qualitative assessment of projects considered cumulatively with the Mona Offshore Wind Project for which quantitative consideration of collision risk was not undertaken in project-specific documentation for herring gull

Project	Reason for estimates being unavailable	Qualitative assessment	Final conclusion
Tier 1			
Burbo Bank Offshore Wind Farm (Seascope Energy Ltd., 2002)	Species not included in CRM	<p>The assessment of collision risk was undertaken on a qualitative basis by investigating flight heights of birds at the project site and was undertaken for species considered to be of International or National importance in the context of the assessments undertaken for the project. Herring gull was not considered to be a species of International or National importance.</p> <p>Surveys of the project comprised aerial and boat-based surveys both of which were undertaken during winter months (aerial = November to April and boat-based = December and February). Aerial surveys covered a large area encompassing the Liverpool Bay SPA with boat-based surveys covering the project area. The surveys were undertaken to provide abundance and distribution data for those species considered to be of most importance, namely common scoter and red-throated diver. Herring gull was not recorded during boat-based surveys with relatively low numbers recorded during aerial surveys.</p>	No assessment was conducted for herring gull in relation to collision risk impacts however, for herring gull was not considered to be a species of International or National importance in the context of the assessments undertaken.

MONA OFFSHORE WIND PROJECT

Project	Reason for estimates being unavailable	Qualitative assessment	Final conclusion
Walney 1 & 2 Offshore Wind Farms (RPS, 2006)	Species not included in CRM	<p>Site-specific surveys included boat-based surveys undertaken across an area of 512 km² in the vicinity of the project between May 2004 and September 2005. The project also utilised survey data collected by regional aerial surveys, undertaken across their aerial survey area between 2002 and 2006 and radar survey data collected between 1st October and 29th October 2005.</p> <p>The peak population of herring gull recorded in the project area plus 2 km buffer during aerial surveys was 47 birds. In boat-based surveys the equivalent population was 78 birds. The proportion of flying herring gulls recorded above 15 m was 21.1 % across all boat-based surveys, although the total number of flying birds was low (90 records).</p> <p>Herring gull was deemed to be a species of very high importance due to SPA connectivity (termed sensitivity in the Walney 1&2 assessments).</p> <p>Herring gull was not included in CRM, and it was considered that, due to the very low numbers of birds recorded at rotor height, that the magnitude of collision was negligible.</p>	Low significance.

MONA OFFSHORE WIND PROJECT

Project	Reason for estimates being unavailable	Qualitative assessment	Final conclusion
<p>West of Duddon Sands Offshore Wind Farm (RSKENSr, 2006)</p>	<p>Species not included in CRM</p>	<p>Site-specific surveys included boat-based surveys undertaken across an area of 512 km² in the vicinity of the project between May 2004 and September 2005. The project also utilised survey data collected by regional aerial surveys, undertaken across their aerial survey area between 2002 and 2006 and radar survey data collected between 1st October and 29th October 2005.</p> <p>The peak population of herring gull recorded in the project area plus 2 km buffer during aerial surveys was 6 birds. In boat-based surveys the equivalent population was 1,562 birds. The proportion of flying herring gulls recorded above 15 m was 21.1 % across all boat-based surveys, although the total number of flying birds was low (90 records).</p> <p>Herring gull was deemed to be a species of very high importance due to SPA connectivity (termed sensitivity in the West of Duddon Sands assessments).</p> <p>Herring gull was not included in CRM, and it was considered that, due to the very low numbers of birds recorded at rotor height, that the magnitude of collision was negligible.</p>	<p>Low significance.</p>

MONA OFFSHORE WIND PROJECT

Project	Reason for estimates being unavailable	Qualitative assessment	Final conclusion
<p>Gwynt y Môr Offshore Wind Farm (RWE Group and Npower Renewables, 2005)</p>	<p>Species not included in CRM</p>	<p>Site-specific surveys undertaken in support of the project included boat-based surveys undertaken between February 2003 and March 2005. Surveys between February 2003 and February 2004 covered a large area along the Welsh coast incorporating the project area with surveys between March 2004 and March 2005 more focussed on the project area. The assessment also used data from aerial surveys undertaken between 2000-2005 which were targeted at recording common scoter.</p> <p>During boat-based surveys used to characterise the project undertaken between 2004-05, covering an area considered by the project assessment to better represent the behaviour of birds than in 2003-04, 8,900 observations were obtained with only 22 flights recorded at a height of greater than 20 m. In 2004-05 surveys, 225 herring gulls were recorded in flight with only 1.3% of these flying above 20 m.</p>	<p>Low significance due to low proportion of flight heights recorded at collision height.</p>
<p>Rhyl Flats Offshore Wind Farm (Ecology Consulting, 2002)</p>	<p>Species not included in CRM</p>	<p>Surveys of the project comprised aerial and boat-based surveys. Aerial surveys were undertaken between December 2001 and January 2002 and targeted common scoter, with non-target species not uniformly reported upon. Boat-based surveys were undertaken between January and March 2002 to record movements of common scoter and the flight height of birds.</p> <p>A qualitative assessment was undertaken for 'other seabirds' (a category that included gulls) and it was considered that collision rates would be negligible.</p>	<p>Very low significance.</p>

MONA OFFSHORE WIND PROJECT

Project	Reason for estimates being unavailable	Qualitative assessment	Final conclusion
<p>Robin Rigg Offshore Wind Farm (Natural Power, 2002)</p>	<p>Species not included in CRM</p>	<p>The project utilised site-specific boat-based surveys to characterise the baseline environment. Two surveys were completed in each month from May 2001 for one year. In addition, aerial surveys were undertaken from November 2001 on a monthly basis through winter and spring to verify the distribution and abundance of seaduck.</p> <p>The mean count of herring gull during boat-based surveys in the wind farm was 0.9 birds with a peak of three birds. Herring gull was considered to be of local importance based on the populations recorded in the wind farm. The proportion of herring gull flying above 20 m during boat-based surveys across the entire study area was 8%.</p> <p>A qualitative assessment was undertaken for 'other seabirds' (a category that included gulls) and it was considered that collision rates would be low/negligible.</p>	<p>Low/Very low significance</p>

MONA OFFSHORE WIND PROJECT

5.9.3-215.9.3.19 The estimated annual cumulative collision mortality of herring gull from the relevant projects with available data, using species-specific (0.9952) and species-group (0.9939) avoidance rates used in the CRM for cumulative projects is ~~97.19~~ 116.51 per year and ~~123.54~~ 148.07 per year, respectively.

5.9.3-225.9.3.20 Using the largest population (during the breeding season) of 217,167 individuals, with an average baseline mortality rate of 0.171 (Table 5.15), the background predicted mortality would be 37,136. The addition of ~~97.19~~ 116.51 mortalities per year when considering the species-specific avoidance rate (0.9952) or ~~123.54~~ 148.07 mortalities per year when considering the species-group avoidance rate (0.9939) would increase the baseline mortality rate by 0.262314% or 0.333399%, respectively. The annual predicted mortality from the cumulative collision risk assessment is below the 1% threshold increase in baseline mortality.

5.9.3-235.9.3.21 The cumulative effect is predicted to be of national spatial extent, long term duration, continuous and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**.

Lesser black-backed gull

5.9.3-245.9.3.22 The expected mean seasonal and annual collision mortality for lesser black-backed gull has been compiled for relevant offshore wind farms and is shown in Table 5.125, using the species-group avoidance rate of 99.39. Additionally, within Table 5.120 avoidance rates have been corrected to account for the species-specific avoidance rate of 99.54 calculated by Ozsanlav-Harris *et al.* (2023) which are considered more appropriate for this species, with species-specific estimates based on sufficient sample size.

Table 5.125: Expected annual collision mortality across relevant offshore wind farms for lesser black-backed gull (avoidance rate 99.39)

Project	Annual	Pre-breeding season	Breeding season	Post-breeding season	Non-breeding Season
Tier 1					
Awel y Môr Offshore Wind Farm	0.00	0.00	0.00	0.00	unavailable
Burbo Bank Offshore Wind Farm	unavailable	unavailable	unavailable	unavailable	unavailable
Burbo Bank Extension Offshore Wind Farm	53.68	unavailable	unavailable	unavailable	unavailable
Erebus Floating Wind Demo	8.21	0.00	7.61	0.60	Grouped as post-breeding
Gwynt y Môr Offshore Wind Farm	5.00	unavailable	unavailable	unavailable	unavailable
TwinHub (Wave Hub Floating Wind Farm)	3.3377	unavailable	unavailable	unavailable	unavailable
Ormonde Wind Farm	26.96	unavailable	unavailable	unavailable	unavailable

MONA OFFSHORE WIND PROJECT

Project	Annual	Pre-breeding season	Breeding season	Post-breeding season	Non-breeding Season
Robin Rigg Offshore Wind Farm	unavailable	unavailable	unavailable	unavailable	unavailable
Rhyl Flats Offshore Wind Farm	1.00	unavailable	unavailable	unavailable	unavailable
Walney 1 & 2 Offshore Wind Farms	69.78	unavailable	unavailable	unavailable	unavailable
Walney (3 & 4) Extension Offshore Wind Farm	35.75	3.17	8.91	7.56	16.10
West of Duddon Sands Offshore Wind Farm	63.93	unavailable	unavailable	unavailable	unavailable
West of Orkney Windfarm	unavailable	unavailable	unavailable	unavailable	unavailable
White Cross Offshore Windfarm	0.41	0.00	0.41	0.00	0.00
Tier 2					
Morecambe Offshore Windfarm Generation Assets	4.36	0.00	2.00	2.03	0.33
Morgan Offshore Wind Project Generation Assets	0.99	0.00	0.00	0.55	Grouped as post-breeding
Total (minus the Mona Offshore Wind Project)	274.09<u>273.84</u>	3.17	18.93	10.74	16.43<u>16.4243</u>
Mona Offshore Wind Project	1.92	0.83	0.33	0.00	0.76
Cumulative total (all projects)	276.01<u>275.76</u>	4.00	19.26	10.74	16.43<u>17.19</u>

MONA OFFSHORE WIND PROJECT

Table 5.126: Expected annual collision mortality across relevant offshore wind farms for lesser black-backed gull (avoidance rate 99.54)

Project	Annual	Pre-breeding season	Breeding Season	Post-breeding season	Non-breeding Season
Tier 1					
Awel y Môr Offshore Wind Farm	0.00	0.00	0.00	0.00	unavailable
Burbo Bank Offshore Wind Farm	unavailable	unavailable	unavailable	unavailable	unavailable
Burbo Bank Extension Offshore Wind Farm	40.48	unavailable	unavailable	unavailable	unavailable
Erebus Floating Wind Demo	6.19	0.00	5.74	0.45	0.00
Gwynt y Môr Offshore Wind Farm	4.60	unavailable	unavailable	unavailable	unavailable
TwinHub (Wave Hub Floating Wind Farm)	2.5484	unavailable	unavailable	unavailable	unavailable
Ormonde Wind Farm	20.33	unavailable	unavailable	unavailable	unavailable
Robin Rigg Offshore Wind Farm	unavailable	unavailable	unavailable	unavailable	unavailable
Rhyl Flats Offshore Wind Farm	0.92	unavailable	unavailable	unavailable	unavailable
Walney 1 & 2 Offshore Wind Farms	52.62	unavailable	unavailable	unavailable	unavailable
Walney (3 & 4) Extension Offshore Wind Farm	26.96	2.39	6.72	5.70	12.14
West of Duddon Sands Offshore Wind Farm	48.21	unavailable	unavailable	unavailable	unavailable
West of Orkney Windfarm	Species not assessed due to low numbers recorded	Species not assessed due to low numbers recorded	Species not assessed due to low numbers recorded	Species not assessed due to low numbers recorded	Species not assessed due to low numbers recorded
White Cross Offshore Windfarm	0.31	0.00	0.31	0.00	0.00

MONA OFFSHORE WIND PROJECT

Project	Annual	Pre-breeding season	Breeding Season	Post-breeding season	Non-breeding Season
Tier 2					
Morecambe Offshore Windfarm Generation Assets	3.29	0.00	1.51	1.53	0.25
Morgan Offshore Wind Project Generation Assets	0.75	0.00	0.00	0.41	0.00
Total (minus the Mona Offshore Wind Project)	208.74207.50	2.39	14.2728	8.1009	11.8212.39
Mona Offshore Wind Project	1.47	0.64	0.26	0.00	0.58
Cumulative total (all projects)	210.19208.97	3.02	14.5254	8.1009	12.3997

5.9.3.255.9.3.23 There are a number of projects for which collision risk estimates are unavailable. This is due to various factors including species not being included in CRM or projects not having conducted CRM. To ensure these projects are considered in this assessment project-specific documents have been reviewed to provide a qualitative assessment of collision for each project. This process is summarised in Table 5.127.

MONA OFFSHORE WIND PROJECT

Table 5.127 Qualitative assessment of projects considered cumulatively with the Mona Offshore Wind Project for which quantitative consideration of collision risk was not undertaken in project-specific documentation for lesser black-backed gull.

Project	Reason for estimates being unavailable	Qualitative assessment	Final conclusion
Tier 1			
Robin Rigg Offshore Wind Farm (Natural Power, 2002)	CRM was not undertaken	<p>The project utilised site-specific boat-based surveys to characterise the baseline environment. Two surveys were completed in each month from May 2001 for one year. In addition, aerial surveys were undertaken from November 2001 on a monthly basis through winter and spring to verify the distribution and abundance of seaduck.</p> <p>The mean count of lesser black-backed gull during boat-based surveys in the wind farm was 0.2 birds with a peak of 3 birds. Lesser black-backed gull was considered to be of local importance based on the populations recorded in the wind farm. The proportion of lesser black-backed gull flying above 20 m during boat-based surveys across the entire study area was 24%</p> <p>A qualitative assessment was undertaken for 'other seabirds' (a category that included gulls) and it was considered that collision rates would be low/negligible.</p>	Low/very low significance
Awel-y-Môr Offshore Wind Farm (RWE Renewables UK, 2022)	Species not included in CRM	<p>Project -specific surveys comprised 24 months of DAS undertaken between March 2019 and February 2021.</p> <p>Lesser black-backed gulls were recorded in only one of the baseline aerial surveys. Eight birds were recorded in July 2020.</p>	Project concluded: <i>“Recorded in negligible numbers, therefore the level of potential impact would be indistinguishable from natural fluctuations in [BDMPS] baseline mortality”</i>

MONA OFFSHORE WIND PROJECT

~~5.9.3.26~~5.9.3.24 The estimated cumulative collision mortality of lesser black-backed gull from the relevant projects with available data is ~~276.04~~275.76 per year using species-group avoidance rate of 99.39% and ~~210.19~~208.97 per year using species-specific rates of 99.54%.

~~5.9.3.27~~5.9.3.25 Using the largest population of 240,750 individuals, with an average baseline mortality rate of 0.121 (Table 5.15), the background predicted mortality would be 29,131 The addition of ~~276.04~~275.76 and ~~210.19~~208.97 mortalities would increase the baseline mortality rate by 0.947% and ~~0.722%~~717% respectively. The annual predicted mortality from the cumulative collision risk assessment is below the 1% threshold increase in baseline mortality.

~~5.9.3.28~~5.9.3.26 The cumulative effect is predicted to be of national spatial extent, long term duration, continuous and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**.

Northern gannet

~~5.9.3.29~~5.9.3.27 The expected mean seasonal and annual collision mortality for northern gannet has been compiled for relevant offshore wind farms and is shown in Table 5.128, using the species-group avoidance rate of 99.28.

Table 5.128: Expected annual collision mortality across relevant offshore wind farms for northern gannet (avoidance rate 99.28)

Project	Annual	Pre-breeding season	Breeding season	Post-breeding season
Tier 1				
Awel y Môr Offshore Wind Farm	13.41	0.00	10.88	2.53
Burbo Bank Offshore Wind Farm	unavailable	unavailable	unavailable	unavailable
Burbo Bank Extension Offshore Wind Farm	12.44	unavailable	unavailable	unavailable
Erebus Floating Wind Demo	4.59	0.61	3.37	0.61
Gwynt y Môr Offshore Wind Farm	unavailable	unavailable	unavailable	unavailable
TwinHub (Wave Hub Floating Wind Farm)	26.48 <u>12</u>	unavailable	unavailable	unavailable
Ormonde Wind Farm	6.72	unavailable	unavailable	unavailable
Robin Rigg Offshore Wind Farm	unavailable	unavailable	unavailable	unavailable
Rhyl Flats Offshore Wind Farm	unavailable	unavailable	unavailable	unavailable
Walney 1 & 2 Offshore Wind Farms	unavailable	unavailable	unavailable	unavailable
Walney (3 & 4) Extension Offshore Wind Farm	33.77	0.92	16.30	16.56

MONA OFFSHORE WIND PROJECT

Project	Annual	Pre-breeding season	Breeding season	Post-breeding season
West of Duddon Sands Offshore Wind Farm	unavailable	unavailable	unavailable	unavailable
West of Orkney Windfarm	48.83	2.10	33.80	12.92
White Cross Offshore Windfarm	6.11	0	4.42	1.69
Tier 2				
Morecambe Offshore Windfarm Generation Assets	0.08	0.00	0.08	0.00
Morgan Offshore Wind Project Generation Assets	2.15	0.22	1.68	0.25
Total (minus the Mona Offshore Wind Project)	159.26 154.22	4.93 3.85	73.29 70.53	35.70 34.56
Mona Offshore Wind Project	5.65	0.41	4.73	0.51
Cumulative total (all projects)	164.91 159.87	5.34 4.26	78.02 75.26	36.21 35.07

5.9.3.305.9.3.28 There are a number of projects for which collision risk estimates are unavailable. This is due to various factors including species not being included in CRM or projects not having conducted CRM. To ensure these projects are considered in this assessment project-specific documents have been reviewed to provide a qualitative assessment of collision for each project. This process is summarised in Table 5.129.

MONA OFFSHORE WIND PROJECT

Table 5.129 Qualitative assessment of projects considered cumulatively with the Mona Offshore Wind Project for which quantitative consideration of collision risk was not undertaken in project-specific documentation for northern gannet

Project	Reason for estimates being unavailable	Qualitative assessment	Final conclusion
Tier 1			
Burbo Bank Offshore Wind Farm (Seascope Energy Ltd., 2002)	Species not included in CRM	<p>The assessment of collision risk was undertaken on a qualitative basis by investigating flight heights of birds at the project site and was undertaken for species considered to be of International or National importance in the context of the assessments undertaken for the project. Gannet was not considered to be a species of International or National importance.</p> <p>Surveys of the project comprised aerial and boat-based surveys both of which were undertaken during winter months (aerial = November to April and boat-based = December and February). Aerial surveys covered a large area encompassing the Liverpool Bay SPA with boat-based surveys covering the project area. The surveys were undertaken to provide abundance and distribution data for those species considered to be of most importance, namely common scoter and red-throated diver. Gannet was not recorded during boat-based surveys with relatively low numbers recorded during aerial surveys.</p>	No assessment was conducted for gannet in relation to collision risk impacts however, for gannet was not considered to be a species of International or National importance in the context of the assessments undertaken.
Walney 1 & 2 Offshore Wind Farms (RPS, 2006)	Species not included in CRM	<p>Site-specific surveys included boat-based surveys undertaken across an area of 512 km² in the vicinity of the project between May 2004 and September 2005. The project also utilised survey data collected by regional aerial surveys, undertaken across their aerial survey area between 2002 and 2006 and radar survey data collected between 1st October and 29th October 2005.</p> <p>The peak population of gannet recorded in the project area plus 2 km buffer during aerial surveys was 52 birds. In boat-based surveys the equivalent population was 332 birds. The proportion of flying gannets recorded above 15 m was 21.5 % across all boat-based surveys within the boat-based survey area.</p> <p>Gannet was deemed to be a species of medium importance due to SPA connectivity (termed sensitivity in the Walney 1&2 assessments).</p>	Low significance.

MONA OFFSHORE WIND PROJECT

Project	Reason for estimates being unavailable	Qualitative assessment	Final conclusion
		<p>Gannet was not included in CRM and it was considered that many gannet would avoid the wind farm area due to alternative foraging habitats being available to this species. It was concluded that there was a low magnitude impact for this species associated with collision.</p>	
<p>West of Duddon Sands Offshore Wind Farm (RSKENSr, 2006)</p>	<p>Species not included in CRM</p>	<p>Site-specific surveys included boat-based surveys undertaken across an area of 512 km² in the vicinity of the project between May 2004 and September 2005. The project also utilised survey data collected by regional aerial surveys, undertaken across their aerial survey area between 2002 and 2006 and radar survey data collected between 1st October and 29th October 2005.</p> <p>The peak population of gannet recorded in the project area plus 2 km buffer during aerial surveys was 57 birds. In boat-based surveys the equivalent population was 431 birds. The proportion of flying gannets recorded above 15 m was 21.5 % across all boat-based surveys within the boat-based survey area.</p> <p>Gannet was deemed to be a species of medium importance due to SPA connectivity (termed sensitivity in the West of Duddon Sands assessments).</p> <p>Gannet was not included in CRM and it was considered that many gannet would avoid the wind farm area due to alternative foraging habitats being available to this species. It was concluded that there was a low magnitude impact for this species associated with collision.</p>	<p>Low significance.</p>
<p>Gwynt y Môr Offshore Wind Farm (RWE Group and Npower Renewables, 2005)</p>	<p>Species not included in CRM</p>	<p>Site-specific surveys undertaken in support of the project included boat-based surveys undertaken between February 2003 and March 2005. Surveys between February 2003 and February 2004 covered a large area along the Welsh coast incorporating the project area with surveys between March 2004 and March 2005 more focussed on the project area. The assessment also used data from aerial surveys undertaken between 2000 and 2005 which were targeted at recording common scoter.</p>	<p>Low significance due to low proportion of flight heights recorded at collision height.</p>

MONA OFFSHORE WIND PROJECT

Project	Reason for estimates being unavailable	Qualitative assessment	Final conclusion
		<p>Very few gannet were recorded during boat-based surveys between October and March. More birds were present in summer months with a large proportion on the sea surface.</p> <p>During boat-based surveys used to characterise the project undertaken between 2004-05, covering an area considered by the project assessment to better represent the behaviour of birds than in 2003-04, 8,900 observations were obtained with only 22 flights recorded at a height of greater than 20 m. In 2004-05 surveys, 583 gannets were recorded in flight with only 0.7% of these flying above 20 m.</p>	
<p>Rhyl Flats Offshore Wind Farm (Ecology Consulting, 2002)</p>	<p>Species not included in CRM</p>	<p>Surveys of the project comprised aerial and boat-based surveys. Aerial surveys were undertaken between November 2001 and January 2002 and targeted common scoter, with non-target species not uniformly reported upon. Boat-based surveys were undertaken between January and March 2002 to record movements of common scoter and the flight height of birds.</p> <p>Gannet were only recorded in one of the aerial surveys with 52 birds recorded in November 2001.</p> <p>Gannet was not considered to be an 'other seabird' species that would occur in sufficient numbers to be at risk of collision impacts.</p>	<p>Very low significance.</p>
<p>Robin Rigg Offshore Wind Farm (Natural Power, 2002)</p>	<p>Species not included in CRM</p>	<p>The project utilised site-specific boat-based surveys to characterise the baseline environment. Two surveys were completed in each month from May 2001 for one year. In addition, aerial surveys were undertaken from November 2001 on a monthly basis through winter and spring to verify the distribution and abundance of seaduck.</p> <p>The mean count of gannet during boat-based surveys in the wind farm was 0.4 birds with a peak of four birds. Gannet was considered to be of local importance based on the populations recorded in the wind farm. The proportion of gannet flying above 20 m during boat-based surveys across the entire study area was 3%</p> <p>Gannet was not considered to be an 'other seabird' species that would occur in sufficient numbers to be at risk of collision impacts.</p>	<p>Low/Very low significance.</p>

MONA OFFSHORE WIND PROJECT

~~5.9.3.31~~5.9.3.29 The estimated cumulative collision mortality of northern gannet from the relevant projects with available data is ~~164.94~~159.87 per year.

~~5.9.3.32~~5.9.3.30 Using the largest population of 661,888 individuals, with an average baseline mortality rate of 0.193 (Table 5.15), the background predicted mortality would be 127,744. The addition of ~~164.94~~159.87 mortalities would increase the baseline mortality rate by 0.~~129~~125%. The annual predicted mortality from the cumulative collision risk assessment is well below the 1% threshold increase in baseline mortality.

~~5.9.3.33~~5.9.3.31 The cumulative effect is predicted to be of national spatial extent, long term duration, continuous and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**.

Migratory birds

~~5.9.3.34~~5.9.3.32 A total of 16 migratory species are estimated to experience a cumulative collision mortality greater than one per year. This includes nine wader species, five duck species and one gull.

~~5.9.3.35~~5.9.3.33 Due to their very large biogeographic population size and migration routes through the Irish sea, wader species were at the greatest risk of collision. Despite this, no increase in annual mortality due to a combined collision risk is anticipated to be greater than 0.09% (dunlin, sub-species *alpina*) for any wader species.

~~5.9.3.36~~5.9.3.34 The annual predicted mortality from the cumulative collision risk assessment is below the 1% threshold increase in baseline mortality for all assessed migratory bird species.

~~5.9.3.37~~5.9.3.35 Due to the minimal level of change to baseline mortality across the migratory bird species, the cumulative effect is predicted to be of national spatial extent, medium to long term duration, continuous and high reversibility. It is predicted that the impact will affect the receptor group directly. The magnitude is therefore, considered to be **low**.

MONA OFFSHORE WIND PROJECT

Table 5.130: Expected annual collision mortality across relevant offshore wind farms for all migratory bird species assessed for collision risk.

Project	Species									
	Bewick's swan	Whooper swan	White-fronted goose	Light-bellied brent goose	Shelduck	Wigeon	Gadwall	Teal	Mallard	Pintail
Tier 1										
Barrow Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Burbo Bank Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Burbo Bank Extension Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	0.00	Unavailable	Unavailable	0.00	Unavailable	0.00
North Hoyle Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Ormonde Wind Farm	Unavailable	0.12	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Walney 1 & 2 Offshore Wind Farms	Unavailable	N/A	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Walney (3 & 4) Extension Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	1.00	2.00	Unavailable	1.00	Unavailable	0.00
West of Duddon Sands Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Gwynt y Môr Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Rhyl Flats Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Robin Rigg Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Arklow Bank Wind Park Phase 1	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Awel y Môr Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Erebus Floating Wind Demo	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable

MONA OFFSHORE WIND PROJECT

Project	Species									
	Bewick's swan	Whooper swan	White-fronted goose	Light-bellied brent goose	Shelduck	Wigeon	Gadwall	Teal	Mallard	Pintail
Tier 2										
Morgan Generation Assets	0.02	0.13	0.06	0.21	0.04	0.18	0.00	0.09	0.09	0.00
Morecambe Offshore Windfarm Generation Assets	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
North Irish Sea Array	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Codling Wind Park	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Dublin Array Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Oriel Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Arklow Bank Wind Park Phase 2	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Shelmalere Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Llyr 1 Floating Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Llyr 2 Floating Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
White Cross Offshore Windfarm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Inis Eagla Marine Energy Park	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Total (minus Mona Offshore Wind Project)	0.00	0.12	0.00	0.00	1.00	2.00	0.00	1.00	0.00	0.00
Mona Offshore Wind Project	0.01	0.40	0.15	0.01	0.22	1.78	0.14	1.60	2.89	0.08
Cumulative total	0.01	0.52	0.15	0.01	1.22	3.78	0.14	2.6	2.89	0.08
Increase in baseline mortality (%)	0.02	0.13	0.06	0.21	0.04	0.18	0.00	0.09	0.09	0.00

MONA OFFSHORE WIND PROJECT

Table 5.131: Expected annual collision mortality across relevant offshore wind farms for all migratory bird species assessed for collision risk.

Project	Species									
	Shoveler	Pochard	Tufted duck	Scaup	Long-tailed duck	Common scoter	Goldeneye	Red-breasted merganser	Great northern diver	European storm petrel
Tier 1										
Barrow Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Burbo Bank Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Burbo Bank Extension Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	2.00	Unavailable	Unavailable	Unavailable	Unavailable
North Hoyle Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Ormonde Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	0.85	Unavailable	Unavailable	Unavailable	Unavailable
Walney 1 & 2 Offshore Wind Farms	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Walney (3 & 4) Extension Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
West of Duddon Sands Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Gwynt y Môr Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Rhyl Flats Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Robin Rigg Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Arklow Bank Wind Park Phase 1	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Awel y Môr Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	0.04	Unavailable	Unavailable
Erebus Floating Wind Demo	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	0.00

MONA OFFSHORE WIND PROJECT

Project	Species									
	Shoveler	Pochard	Tufted duck	Scaup	Long-tailed duck	Common scoter	Goldeneye	Red-breasted merganser	Great northern diver	European storm petrel
Tier 2										
Morgan Generation Assets	0.01	0.09	0.08	0.01	0.01	0.00	0.02	0.01	Unavailable	Unavailable
Morecambe Offshore Windfarm Generation Assets	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
North Irish Sea Array	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Codling Wind Park	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Dublin Array Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Oriel Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Arklow Bank Wind Park Phase 2	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Shelmalere Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Llyr 1 Floating Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Llyr 2 Floating Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
White Cross Offshore Windfarm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Inis Eagla Marine Energy Park	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Total (minus Mona Offshore Wind Project)	0.00	0.00	0.00	0.00	0.00	2.85	0.00	0.04	0.00	0.00
Mona Offshore Wind Project	0.08	0.12	0.54	0.03	0.05	0.04	0.08	0.04	0.02	0.30
Cumulative total	0.08	0.12	0.54	0.03	0.05	2.89	0.08	0.08	0.02	0.30
Increase in baseline mortality (%)	0.001	0.001	0.001	0.001	0.001	0.010	0.002	0.004	0.006	0.008

MONA OFFSHORE WIND PROJECT

Table 5.132: Expected annual collision mortality across relevant offshore wind farms for all migratory bird species assessed for collision risk.

Project	Species									
	Leach's storm petrel	Bittern	Great crested grebe	Slavonian grebe	Hen harrier	Osprey	Merlin	Corncrake	Oystercatcher (breeding)	Oystercatcher (non-breeding)
Tier 1										
Barrow Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Burbo Bank Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Burbo Bank Extension Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	0.00	0.00
North Hoyle Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Ormonde Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Walney 1 & 2 Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Walney (3 & 4) Extension Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	4.00	4.00
West of Duddon Sands Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Gwynt y Môr Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Rhyl Flats Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Robin Rigg Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Arklow Bank Wind Park Phase 1	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Awel y Môr Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	1.11	1.11
Erebus Floating Wind Demo	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable

MONA OFFSHORE WIND PROJECT

Project	Species									
	Leach's storm petrel	Bittern	Great crested grebe	Slavonian grebe	Hen harrier	Osprey	Merlin	Corncrake	Oystercatcher (breeding)	Oystercatcher (non-breeding)
Tier 2										
Morgan Generation Assets	Unavailable	0.01	0.01	0.00	0.00	0.00	0.14	0.01	0.19	0.23
Morecambe Offshore Windfarm Generation Assets	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
North Irish Sea Array	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Codling Wind Park	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Dublin Array Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Oriel Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Arklow Bank Wind Park Phase 2	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Shelmalere Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Llyr 1 Floating Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Llyr 2 Floating Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
White Cross Offshore Windfarm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Inis Eagla Marine Energy Park	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Total (minus Mona Offshore Wind Project)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.11	5.11
Mona Offshore Wind Project	0.75	0.03	0.06	0.00	0.01	0.01	0.01	0.01	0.57	1.82
Cumulative total	0.75	0.03	0.06	0.00	0.01	0.01	0.01	0.01	5.68	6.93
Increase in baseline mortality (%)	0.012	0.013	0.002	0.000	0.010	0.028	0.002	0.001	0.050	0.019

MONA OFFSHORE WIND PROJECT

Table 5.133: Expected annual collision mortality across relevant offshore wind farms for all migratory bird species assessed for collision risk.

Project	Species									
	Ringed plover (breeding)	Ringed plover (non-breeding)	Dotterel	Golden plover (breeding)	Golden plover (non-breeding)	Grey plover	Lapwing	Knot	Sanderling	Purple sandpiper
Tier 1										
Barrow Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Burbo Bank Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Burbo Bank Extension	0.00	0.00	Unavailable	0.00	0.00	0.00	Unavailable	0.00	Unavailable	Unavailable
North Hoyle Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Ormonde Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Walney 1 & 2 Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Walney (3 & 4) Extension Offshore Wind Farm	0.00	0.00	Unavailable	0.00	0.00	0.00	Unavailable	4.00	Unavailable	Unavailable
West of Duddon Sands Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Gwynt y Môr Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Rhyl Flats Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Robin Rigg Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Arklow Bank Wind Park Phase 1	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Awel y Môr Offshore Wind Farm	0.04	0.14	Unavailable	0.87	0.87	Unavailable	Unavailable	0.57	0.09	Unavailable

MONA OFFSHORE WIND PROJECT

Project	Species									
	Ringed plover (breeding)	Ringed plover (non-breeding)	Dotterel	Golden plover (breeding)	Golden plover (non-breeding)	Grey plover	Lapwing	Knot	Sanderling	Purple sandpiper
Erebus Floating Wind Demo	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Tier 2										
Morgan Generation Assets	0.02	0.23	0.00	1.20	0.50	0.02	0.62	0.06	0.02	0.01
Morecambe Offshore Windfarm Generation Assets	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
North Irish Sea Array	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Codling Wind Park	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Dublin Array Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Oriel Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Arklow Bank Wind Park Phase 2	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Shelmalere Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Llyr 1 Floating Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Llyr 2 Floating Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
White Cross Offshore Windfarm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Inis Eagla Marine Energy Park	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Total (minus Mona Offshore Wind Project)	0.04	0.14	0.00	0.87	0.87	0.00	0.00	4.57	0.09	0.00

MONA OFFSHORE WIND PROJECT

Project	Species									
	Ringed plover (breeding)	Ringed plover (non-breeding)	Dotterel	Golden plover (breeding)	Golden plover (non-breeding)	Grey plover	Lapwing	Knot	Sanderling	Purple sandpiper
Mona Offshore Wind Project	0.03	0.24	0.00	0.27	2.22	0.20	3.40	1.55	0.11	0.05
Cumulative total	0.07	0.38	0.00	1.14	3.09	0.20	3.40	6.12	0.20	0.05
Increase in baseline mortality (%)	0.006	0.004	0.000	0.008	0.003	0.004	0.002	0.015	0.006	0.002

Table 5.134: Expected annual collision mortality across relevant offshore wind farms for all migratory bird species assessed for collision risk.

Project	Species									
	Dunlin (sub-species schinzii and arctica)	Dunlin (sub-species alpina)	Ruff	Snipe	Black-tailed godwit (Icelandic race)	Bar-tailed godwit	Whimbrel	Curlew (breeding)	Curlew (non-breeding)	Greenshank
Tier 1										
Barrow Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Burbo Bank Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Burbo Bank Extension	0.00	0.00	Unavailable	Unavailable	0.00	0.00	Unavailable	0.00	0.00	Unavailable

MONA OFFSHORE WIND PROJECT

Project	Species									
	Dunlin (sub-species schinzii and arctica)	Dunlin (sub-species alpina)	Ruff	Snipe	Black-tailed godwit (Icelandic race)	Bar-tailed godwit	Whimbrel	Curlew (breeding)	Curlew (non-breeding)	Greenshank
North Hoyle Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Ormonde Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Walney 1 & 2 Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Walney (3 & 4) Extension Offshore Wind Farm	8.00	8.00	Unavailable	Unavailable	0.00	1.00	Unavailable	1.00	1.00	Unavailable
West of Duddon Sands Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Gwynt y Môr Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Rhyl Flats Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Robin Rigg Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Arklow Bank Wind Park Phase 1	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Awel y Môr Offshore Wind Farm	0.05	0.05	Unavailable	Unavailable	0.28	Unavailable	Unavailable	0.47	0.47	0.01
Erebus Floating Wind Demo	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Tier 2										
Morgan Generation Assets	2.79	0.32	0.01	3.11	0.05	0.07	0.01	0.40	0.20	0.00
Morecambe Offshore Windfarm Generation Assets	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
North Irish Sea Array	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Codling Wind Park	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable

MONA OFFSHORE WIND PROJECT

Project	Species									
	Dunlin (sub-species schinzii and arctica)	Dunlin (sub-species alpina)	Ruff	Snipe	Black-tailed godwit (Icelandic race)	Bar-tailed godwit	Whimbrel	Curlew (breeding)	Curlew (non-breeding)	Greenshank
Dublin Array Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Oriel Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Arklow Bank Wind Park Phase 2	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Shelmalere Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Llyr 1 Floating Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Llyr 2 Floating Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
White Cross Offshore Windfarm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Inis Eagla Marine Energy Park	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Total (minus Mona Offshore Wind Project)	8.05	8.05	0.00	0.00	0.28	1.00	0.00	1.47	1.47	0.01
Mona Offshore Wind Project	1.77	0.24	0.01	6.16	0.26	0.40	0.00	1.13	0.58	0.01
Cumulative total	9.82	8.29	0.01	6.16	0.54	1.40	0.00	2.60	2.05	0.02
Increase in baseline mortality (%)	0.011	0.091	0.003	0.001	0.022	0.009	0.000	0.044	0.016	0.027

MONA OFFSHORE WIND PROJECT

Table 5.135: Expected annual collision mortality across relevant offshore wind farms for all migratory bird species assessed for collision risk.

Project	Species								
	Wood sandpiper	Redshank (breeding)	Redshank (non-breeding)	Turnstone	Great skua	Pomarine skua	Long-tailed skua	Black-headed gull	Short-eared owl
Tier 1									
Barrow Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Burbo Bank Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Burbo Bank Extension Offshore Wind Farm	Unavailable	0.00	0.00	Unavailable	0.00	Unavailable	Unavailable	1.00	Unavailable
North Hoyle Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Ormonde Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Walney 1 & 2 Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Walney (3 & 4) Extension Offshore Wind Farm	Unavailable	1.00	1.00	0.00	0.00	Unavailable	Unavailable	1.00	Unavailable
West of Duddon Sands Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Gwynt y Môr Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Rhyl Flats Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Robin Rigg Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Arklow Bank Wind Park Phase 1	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Awel y Môr Offshore Wind Farm	Unavailable	0.16	1.53	0.11	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Erebus Floating Wind Demo	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Tier 2									
Morgan Generation Assets	0.00	0.11	1.15	0.03	Unavailable	Unavailable	Unavailable	Unavailable	0.05

MONA OFFSHORE WIND PROJECT

Project	Species								
	Wood sandpiper	Redshank (breeding)	Redshank (non-breeding)	Turnstone	Great skua	Pomarine skua	Long-tailed skua	Black-headed gull	Short-eared owl
Morecambe Offshore Windfarm Generation Assets	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
North Irish Sea Array	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Codling Wind Park	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Dublin Array Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Oriel Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Arklow Bank Wind Park Phase 2	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Shelmalere Offshore Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Llyr 1 Floating Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Llyr 2 Floating Wind Farm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
White Cross Offshore Windfarm	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Inis Eagla Marine Energy Park	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable	Unavailable
Total (minus Mona Offshore Wind Project)	0.00	1.16	2.53	0.11	0.00	0.00	0.00	2	0.00
Mona Offshore Wind Project	0.00	0.32	3.26	0.10	0.22	0.03	0.01	0.83	0.03
Cumulative total	0.00	1.48	5.79	0.21	0.22	0.03	0.01	2.83	0.03
Increase in baseline mortality (%)	0.000	0.026	0.022	0.003	0.020	0.013	0.009	0.008	0.004

Sensitivity of the receptor

Black-legged kittiwake

[5.9.3.385.9.3.36](#) Black-legged kittiwake was rated as relatively highly vulnerable to collision impacts by Wade *et al.* (2016), due to the proportion of flights likely to occur at potential risk height and percentage of time in flight.

[5.9.3.395.9.3.37](#) Despite a higher reproductive success (i.e. laying two eggs and breeding until four years old) than most seabird species (Robinson, 2005), the species is deemed to have a low recoverability given the continuing decline in abundance observed between 1986 and 2018 in the UK (JNCC, 2020). During this period, breeding productivity has declined as the result of food shortage, although it has stabilised in recent years (JNCC, 2020).

[5.9.3.405.9.3.38](#) Black-legged kittiwake is a qualifying interest for several SPAs likely to be connected to the Mona Array Area (within the mean-max + SD foraging range), with several non-SPA colonies within range and so the species is considered to be of medium value.

[5.9.3.415.9.3.39](#) Black-legged kittiwake is deemed to be of high vulnerability, low recoverability and medium value. The sensitivity of the receptor is therefore, considered to be **high**.

Great black-backed gull

[5.9.3.425.9.3.40](#) Great black-backed gull was rated as one of the most vulnerable seabird species to collision impacts by Wade *et al.* (2016), due to the proportion of flights likely to occur at potential risk height and percentage of time in flight.

[5.9.3.435.9.3.41](#) The abundance of breeding great black-backed gull in the UK has changed relatively little between census (JNCC, 2020). The species is deemed to have a medium recoverability due to a low reproductive success and the stable trend in breeding abundance.

[5.9.3.445.9.3.42](#) As great black-backed gull is a qualifying feature of interest for several SPAs likely to be connected to the Mona Array Area (within the mean-max + SD foraging range), with a non-SPA colony within range, the species is considered to be of medium value.

[5.9.3.455.9.3.43](#) Great black-backed gull is deemed to be of high vulnerability, medium recoverability and medium value. The sensitivity of the receptor is therefore, considered to be **medium**.

European herring gull

[5.9.3.465.9.3.44](#) European herring gull was rated as one of the most vulnerable seabird species to collision impacts by Wade *et al.* (2016), due to the proportion of flights likely to occur at potential risk height and percentage of time in flight.

[5.9.3.475.9.3.45](#) As European herring gull is a qualifying interest for several SPAs likely to be connected to the Mona Array Area (within the mean-max + SD foraging range) with multiple non-SPA colonies within range, the species is considered to be of medium value.

[5.9.3.485.9.3.46](#) Although European herring gull have a relatively high reproductive success, breeding abundance is declining in the coastal natural nesting population, and this may be indicative of decline in the entire UK breeding population (JNCC, 2020). There is evidence that the urban nesting gull population has increased in recent years, but census of these sites is lacking to derive a UK wide trend that includes both

MONA OFFSHORE WIND PROJECT

the urban and natural populations. The species is therefore deemed to be of medium recoverability.

[5.9.3.495.9.3.47](#) European herring gull is deemed to be of high vulnerability, medium recoverability and medium value. The sensitivity of the receptor is therefore, considered to be **medium**.

Lesser black-backed gull

[5.9.3.505.9.3.48](#) Lesser black-backed gull was rated as one of the most vulnerable seabird species to collision impacts by Wade *et al.* (2016), due to the proportion of flights likely to occur at potential risk height and percentage of time in flight.

[5.9.3.515.9.3.49](#) As lesser black-backed gull is a qualifying interest for several SPAs likely to be connected to the Mona Array Area (within the mean-max + SD foraging range), with multiple non-SPA colonies within range, the species is considered to be of medium value.

[5.9.3.525.9.3.50](#) Although lesser black-backed gull has a relatively high reproductive success, the species breeding abundance has exhibited a downward trend over the last 15-20 years in the UK (JNCC, 2020). It must be noted that this trend excludes urban nesting gulls from the sample and, therefore, may not be representative of trends in the entire UK population. The species is deemed to be of medium recoverability.

[5.9.3.535.9.3.51](#) Lesser black-backed gull is deemed to be of high vulnerability, medium recoverability and medium value. The sensitivity of the receptor is therefore, considered to be **medium**.

Northern gannet

[5.9.3.545.9.3.52](#) Although the latest scientific guidance showed the species to display a high level of macro-avoidance (Peschko *et al.*, 2021), the species is rated as relatively vulnerable to collision impacts by Wade *et al.* (2016).

[5.9.3.555.9.3.53](#) Northern gannet is a qualifying interest for several SPAs likely to be connected to the Mona Array Area (within the mean-max + SD foraging range), with a large non-SPA colony within close proximity (Monreith Cliffs and Scar Rocks), the species is therefore considered to be of medium value.

[5.9.3.565.9.3.54](#) Although northern gannet has a low reproductive success, the species is deemed to have a medium recoverability given the consistent increasing trend in abundance since the 1990s (JNCC, 2020). It is of note that the species has suffered from the outbreak of avian flu during the 2022 breeding season. The species is deemed to be of medium recoverability.

[5.9.3.575.9.3.55](#) Northern gannet is deemed to be of high vulnerability, medium recoverability and medium value. The sensitivity of the receptor is therefore, considered to be **medium**.

Migratory birds

[5.9.3.585.9.3.56](#) Although migratory bird species have not been significantly studied in the offshore environment, vulnerability to collisions is likely to be generally low, since most migration will occur on a broad front and likely above rotor height, although during periods of poor weather this risk may increase.

MONA OFFSHORE WIND PROJECT

5.9.3.59 5.9.3.57 Recoverability of populations of migrants may vary considerably, with smaller wader species with a relatively favourable conservation status (e.g. dunlin) faring better than larger species with lower reproductive rates (e.g. Eurasian curlew).

5.9.3.60 5.9.3.58 Of the assessed migratory species, nine are qualifying features of SPAs, as noted in Table 5.10. These species are Bewick's swan, shelduck, wigeon, grey plover, lapwing, ruff, bar-tailed godwit, whimbrel and turnstone. Therefore, on a precautionary basis and for the purposes of this assessment, migratory birds as a collective group have been assumed to have **medium** sensitivity to a cumulative collision risk.

Significance of the effect

5.9.3.61 5.9.3.59 Overall, the magnitude of the cumulative impact is low for all seabird and migratory species (Table 5.136). Although sensitivity of the receptor varies from medium to high, the effect is expected to be of **minor** adverse significance for all species, which is not significant in EIA terms. For black-legged kittiwake, minor was selected from the minor to moderate range due to the impact not exceeding a 1% increase in baseline mortality and hence, was not regarded as a moderate significance of effect.

Table 5.136: Table summarising the significance of effect of collision from cumulative impacts during the operations and maintenance phase.

Species	Magnitude of impact	Sensitivity of receptor	Significance of effect
Black-legged kittiwake	Low	High	Minor, not significant in EIA terms
Great black-backed gull	Low	Medium	Minor, not significant in EIA terms
European herring gull	Low	Medium	Minor, not significant in EIA terms
Lesser black-backed gull	Low	Medium	Minor, not significant in EIA terms
Northern gannet	Low	Medium	Minor, not significant in EIA terms
Migratory birds	Low	Medium	Minor, not significant in EIA terms

5.9.4 Combined displacement and collision risk

Tier 1 and Tier 2

Operations and maintenance phase

Magnitude of impact

5.9.4.1 For species such as black-legged kittiwake and northern gannet that are both adversely affected by displacement and collision during the operations and maintenance phase, impacts must be combined in order for the true magnitude of impact to be understood.

5.9.4.2 It is recognised that assessing these two potential impacts together could amount to double counting, as birds that are subject to displacement would not be subject to

MONA OFFSHORE WIND PROJECT

potential collision risk as they are already assumed to have not entered the array area. Equally, birds estimated to be subject to collision risk mortality would not be able to be subjected to displacement consequent mortality as well. As a more refined method to consider displacement and collision together whilst reducing any double counting of impacts is not agreed with SNCBs the precautionary and highly unlikely approach is presented in this assessment.

Black-legged kittiwake

5.9.4.3 Outputs from the combined impact from displacement and collision from the Mona Offshore Wind Project, together with other offshore wind farms in the Irish Sea are tabulated and presented in Table 5.137.

Table 5.137: Black-legged kittiwake combined displacement and collision cumulative impacts.

Impact	Pre-breeding/Spring Migration	Breeding	Post-breeding/Autumn Migration	Annual
Predicted displacement impact when considering 50% displacement and 1% mortality	36	47	47	133
Range of predicted displacement impact when considering between 30% displacement and 1% mortality and 70% displacement and 10% mortality	22 to 506	28 to 652	28 to 659	80 to 1,867
Collisions (avoidance rate 99.28)	160	159	205	558 559
Predicted combined impact (considering 50% displacement and 1% mortality)	196	206	252	694 692
Range of combined impacts (considering between 30% displacement and 1% mortality and 70% displacement and 10% mortality)	182 to 666	187 to 811	233 to 864	638 639 to 2,425 426
Predicted increase in baseline mortality (%) (considering 50% displacement and 1% mortality)	0.138%	0.538%	0.177%	0.486 487 %

5.9.4.4 The combined mortality for black-legged kittiwake from displacement and collision for the relevant projects with available data is ~~694~~692 individuals per annum when considering a displacement scenario of 50% displacement and 1% mortality.

5.9.4.5 Using the largest UK Western Waters BDMPS population of 911,586 individuals, with an average baseline mortality rate of 0.156, the background predicted mortality would be 142,207. The addition of ~~694~~692 mortalities would increase the baseline mortality rate by 0.486~~487~~%. The annual predicted mortality from the combined cumulative displacement and collision risk assessment is below the 1% threshold increase in baseline mortality.

5.9.4.6 The combined cumulative effect is predicted to be of national spatial extent, long term duration, continuous and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**.

MONA OFFSHORE WIND PROJECT

Northern gannet

- 5.9.4.7 Outputs from the combined impact from displacement and collision from the Mona Offshore Wind Project, together with other offshore wind farms in the Irish Sea are tabulated and presented in Table 5.138.

MONA OFFSHORE WIND PROJECT

Table 5.138: Northern gannet combined displacement and collision cumulative impacts.

Impact	Pre-breeding/Spring Migration	Breeding	Post-breeding/Autumn Migration	Annual
Predicted displacement impact when considering 70% displacement and 1% mortality	3	31	18	54
Range of predicted displacement impact when considering between 60% displacement and 1% mortality and 80% displacement and 10% mortality.	3 to 34	27 to 354	16 to 210	46 to 615
Collisions (avoidance rate 99.28)	<u>54</u>	<u>7875</u>	<u>3635</u>	<u>465160</u>
Predicted combined impact (considering 70% displacement and 1% mortality)	<u>87</u>	<u>409106</u>	<u>5453</u>	<u>249214</u>
Range of combined impacts (considering between 60% displacement and 1% mortality and 80% displacement and 10% mortality)	<u>67</u> to <u>3738</u>	<u>58102</u> to <u>385429</u>	<u>3451</u> to <u>228245</u>	<u>404206</u> to <u>669775</u>
Predicted increase in baseline mortality (%) (considering 70% displacement and 1% mortality)	<u>0.008005%</u>	<u>0.108105%</u>	<u>0.042050%</u>	<u>0.174168%</u>

5.9.4.8 The combined mortality for northern gannet from displacement and collision for the relevant projects with available data is 249214 individuals per annum.

5.9.4.9 Using the largest UK Western Waters BDMPs population of 661,888 individuals, with an average baseline mortality rate of 0.193 the background predicted mortality would be 127,774. The addition of 249214 mortalities would increase the baseline mortality rate by 0.174168%. The annual predicted mortality from the cumulative collision risk assessment is below the 1% threshold increase in baseline mortality.

5.9.4.10 The cumulative effect is predicted to be of national spatial extent, long term duration, continuous and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**.

Sensitivity of the receptor

Black-legged kittiwake

5.9.4.11 As seen in displacement and collision, black-legged kittiwake is deemed to be of overall medium vulnerability, low recoverability and medium value. The sensitivity of the receptor is therefore, considered to be **medium**.

Northern gannet

5.9.4.12 As seen in displacement and collision, northern gannet is deemed to be overall of medium vulnerability, medium recoverability and medium value. The sensitivity of the receptor is therefore, considered to be **medium**.

Significance of the effect

Black-legged kittiwake

- 5.9.4.13 Overall, the magnitude of the combined displacement and collision cumulative impact is low, and the sensitivity of the receptor is medium. The effect will, therefore, be of **minor** adverse significance, which is not significant in EIA terms.

Northern gannet

- 5.9.4.14 Overall, the magnitude of the combined displacement and collision cumulative impact is low, and the sensitivity of the receptor is considered to be medium. The effect will, therefore, be of **minor** adverse significance, which is not significant in EIA terms.

5.10 Transboundary effects

- 5.10.1.1 A screening of transboundary impacts has been carried out and any potential for significant transboundary effects with regard to offshore ornithology from the Mona Offshore Wind Project upon the interests of other states has been assessed as part of the EIA. The potential transboundary impacts assessed within sections 5.8 and 5.9 of this technical report are summarised below:

- Disturbance and displacement (including impacts on species which may have connectivity to UK SPAs) during the construction, operations and maintenance, and decommissioning phases. Overall, the effect will be of negligible adverse to minor adverse significance, which is not significant in EIA terms
- Indirect disturbance and displacement resulting from changes to prey and habitats (including impacts on species which may have connectivity to UK SPAs) during the construction, operations and maintenance, and decommissioning phases. Overall, the effect will be of minor adverse significance, which is not significant in EIA terms
- Collision risk (including impacts on species which may have connectivity to UK SPAs) during the construction, operations and maintenance, and decommissioning phases. Overall, the effect will be of negligible to minor adverse significance, which is not significant in EIA terms
- Barrier effect (including impacts on species which may have connectivity to UK SPAs) during the construction, operations and maintenance, and decommissioning phases. Overall, the effect will be of negligible adverse significance, which is not significant in EIA terms
- No significant transboundary effects have been identified during the screening process.

5.11 Inter-related effects

- 5.11.1.1 Inter-relationships are considered to be the impacts and associated effects of different aspects of the proposal on the same receptor. These are considered to be:

- Project lifetime effects: Assessment of the scope for effects that occur throughout more than one phase of the Mona Offshore Wind Project (construction, operations and maintenance, and decommissioning), to interact to potentially create a more significant effect on a receptor than if just assessed in isolation in

MONA OFFSHORE WIND PROJECT

these three phases (e.g. subsea noise effects from piling, operational turbines, vessels and decommissioning)

- Receptor-led effects: Assessment of the scope for all effects to interact, spatially and temporally, to create inter-related effects on a receptor. As an example, all effects on offshore ornithology, such as displacement/disturbance, collision and increased SSCs, may interact to produce a different, or greater effect on this receptor than when the effects are considered in isolation. Receptor-led effects may be short term, temporary or transient effects, or incorporate longer term effects.

5.11.1.2 A description of the likely interactive effects arising from the Mona Offshore Wind Project on offshore ornithology is provided in Volume 2, Chapter 11: Inter-related effects - offshore of the Environmental Statement (Document reference F2.11).

5.12 Summary of impacts, mitigation measures and monitoring

5.12.1.1 Information on offshore ornithology within the Offshore Ornithology study areas, as defined in section 5.3.4.1, was collected through review of available literature, other offshore wind farm assessments, UK statutory guidance, detailed analysis of the data collected during the site-specific aerial surveys and intertidal surveys, and consultation with relevant stakeholders.

- Table 5.139 presents a summary of the potential impacts, measures adopted as part of the project and residual effects in respect to offshore ornithology. The impacts assessed include disturbance and displacement from airborne noise, underwater sound, and presence of vessels and infrastructure, indirect impacts from underwater sound affecting prey species, temporary habitat loss/disturbance and increased SSCs, collision risk and barrier to movement. Overall, it is concluded that there will be **no significant effects** arising from the Mona Offshore Wind Project during the construction, operations and maintenance, or decommissioning phases
- Table 5.140 presents a summary of the potential cumulative impacts, mitigation measures and residual effects. The cumulative impacts assessed include disturbance and displacement from airborne noise, underwater sound and presence of vessels and infrastructure and collision risk. Overall, it is concluded that there are **no significant cumulative effects** to any species from the Mona Offshore Wind Project alongside other projects/plans.

5.12.1.2 Potential transboundary impacts have been identified in relation to offshore ornithology. Overall, it is concluded that there will be **no significant transboundary effects** arising from the Mona Offshore Wind Project.

MONA OFFSHORE WIND PROJECT
Table 5.139: Summary of potential environmental effects, mitigation and monitoring.
^a C=construction, O=operations and maintenance, D=decommissioning

Description of impact	Phase ^a			Measures adopted as part of the project	Magnitude of impact	Sensitivity of the receptor	Significance of effect	Further mitigation	Residual effect	Proposed monitoring
	C	O	D							
Disturbance and displacement from airborne noise, underwater sound, and presence of vessels and infrastructure	✓	✓	✓	Offshore EMP that will include measures to minimise disturbance to rafting birds from transiting vessels.	<u>Common guillemot</u> C: Negligible O: low D: Negligible <u>Razorbill</u> C: Negligible O: Negligible D: Negligible <u>Atlantic puffin</u> C: Negligible O: Negligible D: Negligible <u>Northern gannet</u> C: Negligible O: Negligible D: Negligible <u>Black-legged kittiwake</u> C: Negligible O: Negligible D: Negligible <u>Manx shearwater</u> C: Negligible O: Negligible D: Negligible	<u>Common guillemot</u> C: Medium O: Medium D: Medium <u>Razorbill</u> C: Medium O: Medium D: Medium <u>Atlantic puffin</u> C: High O: High D: High <u>Northern gannet</u> C: Medium O: Medium D: Medium <u>Black-legged kittiwake</u> C: Medium O: Medium D: Medium <u>Manx shearwater</u> C: Medium	<u>Common guillemot</u> C: Negligible adverse O: Minor adverse D: Negligible adverse <u>Razorbill</u> C: Negligible adverse O: Negligible adverse D: Negligible adverse <u>Atlantic puffin</u> C: Minor adverse O: Negligible adverse D: Minor adverse <u>Northern gannet</u> C: Negligible adverse O: Negligible adverse D: Negligible adverse	None	<u>Common guillemot</u> C: Negligible adverse O: Minor adverse D: Negligible adverse <u>Razorbill</u> C: Negligible adverse O: Negligible adverse D: Negligible adverse <u>Atlantic puffin</u> C: Minor adverse O: Negligible adverse D: Minor adverse <u>Northern gannet</u> C: Negligible adverse O: Negligible adverse D: Negligible adverse	None

MONA OFFSHORE WIND PROJECT

Description of impact	Phase ^a			Measures adopted as part of the project	Magnitude of impact	Sensitivity of the receptor	Significance of effect	Further mitigation	Residual effect	Proposed monitoring
	C	O	D							
					<u>Common scoter</u> C: Negligible O: Negligible D: Negligible <u>Red-throated diver</u> C: Negligible O: Negligible D: Negligible	O: Medium D: Medium <u>Common scoter</u> C: High O: High D: High <u>Red-throated diver</u> C: High O: High D: High	D: Negligible adverse D: Negligible adverse <u>Black-legged kittiwake</u> C: Negligible adverse C: Negligible adverse C: Negligible adverse O: Negligible adverse D: Negligible adverse D: Negligible adverse <u>Manx shearwater</u> C: Negligible adverse O: Negligible adverse O: Negligible adverse D: Negligible adverse D: Negligible adverse <u>Common scoter</u> C: Minor adverse O: Negligible adverse D: Minor adverse D: Minor adverse <u>Red-throated diver</u> C: Minor adverse C: Minor adverse O: Negligible adverse O: Negligible adverse			

MONA OFFSHORE WIND PROJECT

Description of impact	Phase ^a			Measures adopted as part of the project	Magnitude of impact	Sensitivity of the receptor	Significance of effect	Further mitigation	Residual effect	Proposed monitoring
	C	O	D							
							D: Minor adverse			
Indirect impacts from underwater sound affecting prey species	✓	✓	✗	None	<u>Auk species</u> C: Low D: Low	<u>Auk species</u> C: Medium D: Medium	<u>Auk species</u> C: Minor adverse D: Minor adverse	None	<u>Auk species</u> C: Minor adverse D: Minor adverse	None
Temporary habitat loss/disturbance and increased SSCs	✓	✓	✓	None	<u>All receptors</u> C: Negligible O: Negligible D: Negligible	<u>All receptors</u> C: Medium O: Medium D: Medium	<u>All receptors</u> C: Minor adverse O: Minor adverse D: Minor adverse	None	<u>All receptors</u> C: Minor adverse O: Minor adverse D: Minor adverse	None
Collision risk	✗	✓	✗	Increasing 'minimum air draught to 34 over LAT to reduce bird collision	<u>Black-legged kittiwake</u> O: Negligible <u>Great black-backed gull</u> O: Low <u>European herring gull</u> O: Negligible <u>Lesser black-backed gull</u> O: Negligible	<u>Black-legged kittiwake</u> O: High <u>Great black-backed gull</u> O: Medium <u>European herring gull</u> O: Medium <u>Lesser black-backed gull</u>	<u>Black-legged kittiwake</u> O: Negligible adverse <u>Great black-backed gull</u> O: Minor adverse <u>European herring gull</u> O: Negligible adverse	None	<u>Black-legged kittiwake</u> O: Negligible adverse <u>Great black-backed gull</u> O: Minor adverse <u>European herring gull</u> O: Negligible adverse	None

MONA OFFSHORE WIND PROJECT

Description of impact	Phase ^a			Measures adopted as part of the project	Magnitude of impact	Sensitivity of the receptor	Significance of effect	Further mitigation	Residual effect	Proposed monitoring
	C	O	D							
					<u>Northern gannet</u> O: Negligible <u>Northern fulmar</u> O: Negligible <u>Manx shearwater</u> O: No change <u>Migratory birds (non-seabirds)</u> O: Negligible	O: Medium <u>Northern gannet</u> O: Medium <u>Northern fulmar</u> O: Low <u>Manx shearwater</u> O: Medium <u>Migratory birds (non-seabirds)</u> O: Medium	<u>Lesser black-backed gull</u> O: Negligible adverse <u>Northern gannet</u> O: Negligible adverse <u>Northern fulmar</u> O: Negligible adverse <u>Manx shearwater</u> O: No change <u>Migratory birds (non-seabirds)</u> O: Negligible adverse		<u>Lesser black-backed gull</u> O: Negligible adverse <u>Northern gannet</u> O: Negligible adverse <u>Northern fulmar</u> O: Negligible adverse <u>Manx shearwater</u> O: No change <u>Migratory birds (non-seabirds)</u> O: Negligible adverse	
Barrier to movement	x	✓	x	Offshore EMP that will include measures to minimise disturbance to rafting birds from transiting vessels	<u>All receptors</u> O: Negligible	<u>All receptors</u> O: Medium	<u>All receptors</u> O: Negligible adverse	None	<u>All receptors</u> O: Negligible adverse	None

MONA OFFSHORE WIND PROJECT

Table 5.140: Summary of potential cumulative environmental effects, mitigation and monitoring.

^a C=construction, O=operations and maintenance, D=decommissioning

Description of effect	Phase ^a			Measures adopted as part of the project	Magnitude of impact	Sensitivity of the receptor	Significance of effect	Further mitigation	Significant residual effect	Proposed monitoring
	C	O	D							
Tier 1 and Tier 2										
Disturbance and displacement from airborne noise, underwater sound, and presence of vessels and infrastructure	✓	✓	✓	Offshore EMP that will include measures to minimise disturbance to rafting birds from transiting vessels	Common guillemot	Common guillemot	Common guillemot	None	Common guillemot	None
					C: Negligible	C: Medium	C: Negligible adverse		C: Negligible adverse	
					O: Low	O: Medium	O: Minor adverse		O: Minor adverse	
					D: Negligible	D: Medium	D: Negligible adverse		D: Negligible adverse	
					Razorbill	Razorbill	Razorbill		Razorbill	
					C: Negligible	C: Medium	C: Negligible adverse		C: Negligible adverse	
					O: Negligible	O: Medium	O: Negligible adverse		O: Negligible adverse	
					D: Negligible	D: Medium	D: Negligible adverse		D: Negligible adverse	
					Atlantic puffin	Atlantic puffin	Atlantic puffin		Atlantic puffin	
					C: Negligible	C: High	C: Minor adverse		C: Minor adverse	
					O: Low	O: High	O: Minor adverse		O: Minor adverse	
					D: Negligible	D: High	D: Minor adverse		D: Minor adverse	
					Northern gannet	Northern gannet	Northern gannet		Northern gannet	
					C: Negligible	C: Medium	C: Negligible adverse		C: Negligible adverse	
			O: Negligible	O: Medium	O: Negligible adverse	O: Negligible adverse				
			D: Negligible	D: Medium	D: Negligible adverse	D: Negligible adverse				
			Black-legged kittiwake	Black-legged kittiwake	Black-legged kittiwake	Black-legged kittiwake				
			C: Negligible	C: Medium	C: Negligible adverse	C: Negligible adverse				
			O: Negligible	O: Medium	O: Negligible adverse	O: Negligible adverse				
			D: Negligible	D: Medium	D: Negligible adverse	D: Negligible adverse				

MONA OFFSHORE WIND PROJECT

Description of effect	Phase ^a			Measures adopted as part of the project	Magnitude of impact	Sensitivity of the receptor	Significance of effect	Further mitigation	Significant residual effect	Proposed monitoring
	C	O	D							
Collision Risk	x	✓	x	Increasing minimum air draught to 34 over LAT to reduce bird collision	Black-legged kittiwake O: Low Great black-backed gull O: Medium European herring gull O: Low Lesser black-backed gull O: Low Northern gannet O: Low	Black-legged kittiwake O: High Great black-backed gull O: Medium European herring gull O: Medium Lesser black-backed gull O: Medium Northern gannet O: Medium	Black-legged kittiwake O: Minor adverse Great black-backed gull O: Minor adverse European herring gull O: Minor adverse Lesser black-backed gull O: Minor adverse Northern gannet O: Minor adverse	None	Black-legged kittiwake O: Minor adverse Great black-backed gull O: Minor adverse European herring gull O: Minor adverse Lesser black-backed gull O: Minor adverse Northern gannet O: Minor adverse	None
Combined collision risk and disturbance and displacement from airborne noise, underwater sound, and presence of vessels and infrastructure	x	✓	x	Increasing minimum air draught to 34 over LAT air draught to reduce bird collision	Black-legged kittiwake O: Low Northern gannet O: Low	Black-legged kittiwake O: Medium Northern gannet O: Medium	Black-legged kittiwake O: Minor adverse Northern gannet O: Minor adverse	None	Black-legged kittiwake O: Minor adverse Northern gannet O: Minor adverse	None

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