E.ON Climate & Renewables

Analysis of Marine Ecology Monitoring Plan Data from the Robin Rigg Offshore Wind Farm, Scotland (Operational Year 3)

Technical Report

Appendix 1: Non-Migratory Fish

Report: 1029455
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Classification COMMERCIAL IN CONFIDENCE

Distribution E.ON Climate & Renewables

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This report is prepared by us, THE NATURAL POWER CONSULTANTS LIMITED, ("NATURAL POWER") for E.ON Climate & Renewables (the "Client") to assist the Client in analysing ecological data in connection with the Robin Rigg Offshore Wind Farm. It has been prepared to provide general information to assist the Client in its decision, and to outline some of the issues, which should be considered by the Client. It is not a substitute for the Client's own investigation and analysis. No final decision should be taken based on the content of this report alone.

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We have been asked to comment on analysis of ecological data collected as part of the MEMP, in accordance with the Client's instructions as to the scope of this report. We have not commented on any other matter and exclude all Liability for any matters out with the said scope of this report. If you feel there are any matters on which you require additional or more detailed advice, we shall be glad to assist.

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Revision History

Issue	Date	Changes
A	28/08/2013	First Issue to E.ON
B	18/09/2013	Draft 1 released to RRMG for comments

A1. NON MIGRATORY FISH APPENDIX

A1.1. Species Lists

Table A1.1. Total fish catch recorded through all non-migratory fish surveys conducted as part of the MEMP.

Common Name	Latin Name	Number of Individuals
Plaice	*Pleuronectes platessa*	21399
Dab	*Limanda limanda*	20681
Whiting	*Merlangius merlangus*	10975
Lesser weever	*Trachinus vipera*	4623
Solenette	*Buglossidium luteum*	3255
Pogge	*Agonus cataphractus*	2718
Sprat	*Sprattus sprattus*	1661
Sand goby	*Potatoschistus minitus*	1342
Sole	*Solea solea*	980
Scald fish	*Arnoglossus laterna*	822
Seasnail	*Liparis liparis*	261
Pipefish	*Syngnathus acus*	221
Dragonet	*Callionymus lyra*	125
Bib	*Trisopterus luscus*	123
Grey gurnard	*Eutrigla gurnardus*	112
Red gurnard	*Aspitriglia cuculus*	97
Lesser Sand eels	*Ammodytes tobianus*	85
Lesser spotted dogfish	*Scyliorhinus canicula*	81
Poor cod	*Trisopterus minutus*	78
Thornback	*Raia clavata*	64
Transparent Goby	*Aphia minuta*	60
Common goby	*Pomatoschistus microps*	49
Five barbed Rockling	*Ciliata mustela*	37
Tub Gurnard	*Trigla lucerna*	35
Cod	*Gadus morhua*	33
Flounder	*Platichthys flesus*	23
Sand eel	*Hyperoplus lanceolatus*	18
Brill	*Scophthalmus rhombus*	17
Three-bearded rockling	*Gaidropsarus vulgaris*	10
Lesser Pipefish	*Syngnathus rostellatus*	5
Turbot	*Scophthalmus maximus*	4
Butterfish	*Pholis gunnellus*	3
Bull rout	*Myoxocephalus scorpius*	2
Long-spined Sea Scorpion	*Taurulus bubalis*	2
Common Skate	*Raja batis*	2
Shore rockling	*Gaidropsarus mediterraneus*	1
Sea stickleback	*Spinachia spinachia*	1
Blonde ray	*Raja brachyura*	1

Table A1.2. Total epifaunal invertebrate catch recorded through all non-migratory fish surveys conducted as part of the MEMP.

Common Name	Latin Name	Number of Individuals
Brown shrimp	*Crangon crangon*	98197
Brittlestar	*Ophiura ophiura*	31908
Serpent's table brittlestar	*Ophiura albida*	9872
Hermit crab	*Pagurus bernhardus*	2567
Swimming crab	*Liocarcinus spp.*	2023
Common starfish	*Asterias rubens*	837
Pink shrimp	*Pandalus montagui*	406
Masked crab	*Corystes cassivelaunus*	365
Baltic prawn	*Palaemon adspersus*	293
Plumose anemone	*Metridium senile*	281
Sand star	*Astropecten irregularis*	154
Shrimp	*Philocheras trispinosus*	136
Sea mouse	*Aphrodita aculeata*	108
Bivalve	*Mactridae sp.*	98
Decapod	*Eualus gaimardii*	98
Isopod crustacean	*Idotea linearis*	82
Pennant's Swimming Crab	*Portumnus latipes*	66
Acorn barnacle	*Elimnius modestus*	51
Cuttlefish	*Sepiola atlantica*	49
European common squid	*Alloteuthis subulata*	44
Shore crab	*Carcinus maenas*	43
Ragworm	*Nereis diversicolor*	42
Common whelk	*Buccinum undatum*	41
Green sea urchin	*Psammechinus miliaris*	37
Razor shell	*Ensis ensis*	35
Spider crab	*Macropodia spp.*	34
Sea potato	*Echinocardium cordatum*	28
Amphipod	*Chaetogammarus merinus*	28
Banded wedge shell	*Donax vittatus*	27
Acorn barnacle	*Semibalanus balanus*	19
Gammarid crustacea	*Gammaridae sp.*	16
Great spider crab	*Hyas araneus*	16
Flat top shell	*Gibbula umbilicalis*	14
Razor Shell	*Phaxas pellucidus*	14
Blue mussel	*Mytilus edulis*	10
Sand mason worm	*Lanice conchilega*	10
Tube worms	*Pomatostegus polytrema*	10
Hornedwrack	*Flustra foliacea*	10
Queen Scallop	*Aequipecten opercularis*	9
Alder's necklace shell	*Polinices polianus*	7
Acorn barnacle	*Balanus hameri*	6
Anemone	*Sagartia elegans*	6
Blunt gaper	*Mya truncata*	6

Acorn barnacle	*Balanus balanus*	5
Sea squirt	*Ascidiella scabra*	5
Velvet swimming crab	*Necora puber*	4
Dahlia Anemone	*Urticina felina*	4
Hydroid	*Plumularia setacea*	4
White shrimp	*Pasiphaea sivado*	4
Thin Tellin	*Angulus tenuis*	3
Pea crab	*Pinnorteres pisum*	2
Baltic tellin	*Macoma balthica*	2
Parchment worm	*Chaetopterus variopedatus*	2
Edible crab	*Cancer pagurus*	1
Sunset Shell	*Gari depressa*	1
Lobe shell	*Phillene aperta*	1
Dead men's figures	*Alcyonium digitatum*	1
Encrusting sponge	*Hemimycale columella*	1

A1.2. SIMPER Analysis Outputs

SIMPER Analysis PRIMER outputs – Comparisons of fish assemblage between construction periods during winter months.

Group Baseline

Average similarity: 49.89

Species	Av.Abund	Av.Sim	Sim/SD	Contrib%	Cum.%
Pleuronectes platessa	2.47	16.12	2.04	32.31	32.31
Limanda limanda	2.12	12.94	1.53	25.94	58.25
Echiichthys vipera	1.08	5.74	0.73	11.51	69.76
Agonus cataphractus	1.02	4.41	0.75	8.84	78.6
Merlangius merlangus	0.85	3.91	0.69	7.83	86.43
Pomatoschistus spp.	0.86	3.41	0.64	6.83	93.26

Group Construction

Average similarity: 37.74

Species	Av.Abund	Av.Sim	Sim/SD	Contrib%	Cum.%
Limanda limanda	1.33	11.24	0.96	29.77	29.77
Pleuronectes platessa	1.24	9.81	0.99	26	55.77
Merlangius merlangus	0.77	4.84	0.65	12.82	68.59
Pomatoschistus spp.	0.7	4.08	0.6	10.81	79.4
Echiichthys vipera	0.58	2.88	0.46	7.62	87.02
Agonus cataphractus	0.54	2.24	0.41	5.94	92.96

Group Operation

Average similarity: 45.74

Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%
Merlangius merlangus	1.69	13.18	1.51	28.82	28.82
Limanda limanda	1.5	9.44	1.12	20.64	49.46
Pleuronectes platessa	1.23	8.4	0.96	18.36	67.82
Pomatoschistus spp.	0.72	3.94	0.57	8.6	76.42
Agonus cataphractus	0.85	3.37	0.59	7.36	83.78
Buglossidium luteum	0.85	3.21	0.47	7.02	90.8

Groups Baseline & Construction

Average dissimilarity = 59.04

	Group Baseline	Group Construction				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
Pleuronectes platessa	2.47	1.24	10.36	1.18	17.55	17.55
Limanda limanda	2.12	1.33	9.18	1.15	15.54	33.09
Echiichthys vipera	1.08	0.58	6.82	0.91	11.55	44.64
Agonus cataphractus	1.02	0.54	5.9	1.06	9.98	54.63

Pomatoschistus spp.	0.86	0.7	5.34	1.05	9.04	63.67
Merlangius merlangus	0.85	0.77	5.25	1.02	8.89	72.56
Buglossidium luteum	0.58	0.37	4.63	0.76	7.84	80.4
Sprattus sprattus	0.33	0.36	3.29	0.76	5.57	85.97
Arnoglossus laterna	0.22	0.17	1.99	0.6	3.37	89.34
Liparis liparis	0.2	0.05	1.3	0.5	2.2	91.54

Groups Baseline & Operation

Average dissimilarity = 55.79

	Group Baseline	Group Operation				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
Pleuronectes platessa	2.47	1.23	8.63	1.25	15.47	15.47
Limanda limanda	2.12	1.5	7.82	1.25	14.02	29.48
Merlangius merlangus	0.85	1.69	6.61	1.2	11.86	41.34
Echiichthys vipera	1.08	0.69	5.95	1.02	10.66	52
Agonus cataphractus	1.02	0.85	5.45	1.15	9.77	61.77
Buglossidium luteum	0.58	0.85	5.43	0.93	9.74	71.51
Pomatoschistus spp.	0.86	0.72	4.71	1.04	8.45	79.96
Sprattus sprattus	0.33	0.25	2.52	0.72	4.52	84.48
Arnoglossus laterna	0.22	0.23	1.9	0.65	3.41	87.89
Syngnathus acus	0.2	0.17	1.67	0.55	3	90.89

Groups Construction & Operation

Average dissimilarity = 60.62

	Group Construction	Group Operation				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
Merlangius merlangus	0.77	1.69	8.83	1.18	14.57	14.57
Limanda limanda	1.33	1.5	8.18	1.17	13.5	28.07
Pleuronectes platessa	1.24	1.23	7.31	1.03	12.05	40.13
Buglossidium luteum	0.37	0.85	6.35	0.86	10.48	50.61
Echiichthys vipera	0.58	0.69	5.91	0.88	9.74	60.35
Agonus cataphractus	0.54	0.85	5.86	1.03	9.67	70.02
Pomatoschistus spp.	0.7	0.72	5.53	0.96	9.11	79.14
Sprattus sprattus	0.36	0.25	3.18	0.69	5.24	84.38
Arnoglossus laterna	0.17	0.23	2.16	0.58	3.56	87.93
Syngnathus acus	0.04	0.17	1.38	0.39	2.27	90.2

SIMPER Analysis – Comparisons of invertebrate assemblages between construction periods during winter months.

Group Baseline
Average similarity: 56.32

Species	Av.Abund	Av.Sim	Sim/SD	Contrib%	Cum.%
Crangon crangon	3.66	52.56	2.23	93.32	93.32

Group Construction
Average similarity: 50.22

Species	Av.Abund	Av.Sim	Sim/SD	Contrib%	Cum.%
Crangon crangon	2.6	45.96	1.79	91.52	91.52

Group Operation
Average similarity: 48.35

Species	Av.Abund	Av.Sim	Sim/SD	Contrib%	Cum.%
Crangon crangon	2.81	33.02	2.19	68.29	68.29
Pagurus bernhardus	1	8.09	0.9	16.73	85.02
Ophiura ophiura	1.07	2.83	0.4	5.85	90.87

Groups Baseline & Construction
Average dissimilarity = 48.81

	Group Baseline	Group Construction				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
Crangon crangon	3.66	2.6	18.45	0.96	37.79	37.79
Liocarcinus	0.57	0.33	5.91	0.84	12.11	49.9
Pagurus bernhardus	0.48	0.39	5.54	0.82	11.35	61.25
Ophiura ophiura	0.39	0.39	4.36	0.53	8.94	70.19
Pandalus montagui	0.21	0.09	2.25	0.47	4.61	74.8
Philocheras trispinus	0.15	0.08	2.02	0.43	4.13	78.94
Asterias rubens	0.19	0.11	1.95	0.44	3.99	82.93
Carcinus maenas	0.11	0.05	1.28	0.35	2.62	85.55
Aphrodita aculeata	0.06	0.07	0.79	0.32	1.62	87.17
Corystes cassivelaunus	0.09	0.05	0.79	0.31	1.61	88.78
Metridium senile	0.08	0.02	0.74	0.21	1.52	90.3

Groups Baseline & Operation

Average dissimilarity = 53.46

	Group Baseline	Group Operation				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
Crangon crangon	3.66	2.81	12.13	0.92	22.69	22.69
Ophiura ophiura	0.39	1.07	7.58	0.75	14.18	36.86
Pagurus bernhardus	0.48	1	7.44	1.22	13.92	50.78
Liocarcinus spp.	0.57	0.56	5.6	0.9	10.47	61.25
Palaemon adspersus	0	0.51	4.08	0.6	7.62	68.88
Asterias rubens	0.19	0.19	1.94	0.5	3.63	72.5
Astropecten irregularis	0	0.26	1.76	0.4	3.29	75.79
Pandalus montagui	0.21	0.07	1.71	0.42	3.2	79
Corystes cassivelaunus	0.09	0.21	1.65	0.44	3.09	82.09

Philocheras trispinus	0.15	0	1.2	0.36	2.25	84.34
Carcinus maenas	0.11	0.07	1.19	0.37	2.23	86.57
Metridium senile	0.08	0.07	0.87	0.27	1.62	88.2
Eualus gaimardii	0.02	0.08	0.71	0.24	1.34	89.53
Aphrodita aculeata	0.06	0.04	0.49	0.28	0.92	90.45

Groups Construction & Operation
Average dissimilarity = 54.99

	Group Construction	Group Operation				
Species	Av.Abund	Av.Abund	Av.Diss	Diss/SD	Contrib%	Cum.%
Crangon crangon	2.6	2.81	13.05	0.91	23.74	23.74
Ophiura ophiura	0.39	1.07	8.9	0.77	16.19	39.92
Pagurus bernhardus	0.39	1	8.28	1.16	15.06	54.98
Liocarcinus spp.	0.33	0.56	5.58	0.84	10.14	65.12
Palaemon adspersus	0	0.51	4.75	0.6	8.63	73.76
Asterias rubens	0.11	0.19	2.06	0.47	3.74	77.49
Astropecten irregularis	0	0.26	2.02	0.4	3.68	81.17
Corystes cassivelaunus	0.05	0.21	1.77	0.4	3.22	84.4
Pandalus montagui	0.09	0.07	1.1	0.3	2.01	86.41
Carcinus maenas	0.05	0.07	1.01	0.31	1.83	88.24
Eualus gaimardii	0	0.08	0.72	0.21	1.3	89.54
Aphrodita aculeata	0.07	0.04	0.63	0.28	1.14	90.68