OYSTER 2 PROJECT

ENVIRONMENTAL IMPACT ASSESSMENT
Marine Wildlife

June 2011

REPORT REFERENCE NUMBER: A30328-S07-REPT-002

CONTENTS

1. INTRODUCTION

This is the marine wildlife impact assessment report prepared in support of the Environmental Statement (ES) which has been submitted alongside applications made by Aquamarine Power Limited (Aquamarine Power) under the Marine (Scotland) Act 2010 and Section 36 of the Electricity Act (1989) for the *second phase* of the Oyster 2 Array wave energy project.

The complete Oyster 2 Array is a project at the European Marine Energy Centre (EMEC) Billia Croo, Orkney, which comprises 3 Oyster wave energy convertors (Oyster 2a, Oyster 2b and Oyster 2c) each rated at 800 kW with a combined project rating of 2.4MW.

Due to the staggered nature of the development of the Oyster 2 Array and following discussions with Marine Scotland and Orkney Islands Council, it was agreed that the project could be phased with three separate applications: Onshore (permanent and temporary) planning applications (permission granted September 2010); Application under Part 2 of the Food and Environment Protection Act 1985 (FEPA) and Section 34 Coastal Protection Act 1949 (CPA) for Oyster 2a and monopile foundations for Oyster 2b and Oyster 2c (Phase 1) (consented March 2011 and October 2010 respectively); and the currently submitted application for Oyster 2b and Oyster 2c (Phase 2) (see Figure 1.1). This impact assessment report also supports a Section 36 application for a combined project rating of 2.4 MW which includes the 800 kW Oyster 2a device previously consented under FEPA and CPA as described above.

Phase 2 of the Oyster 2 Array project includes the following components which are the subject of this marine wildlife impact assessment report:

- Seabed preparation;
- Oyster 2b and Oyster 2c wave energy convertor flaps;
- Rock anchors used to position the wave energy convertors during installation;
- Wave energy convertor latching anchors; and
- Interconnecting pipelines and associated stabilisation anchors.

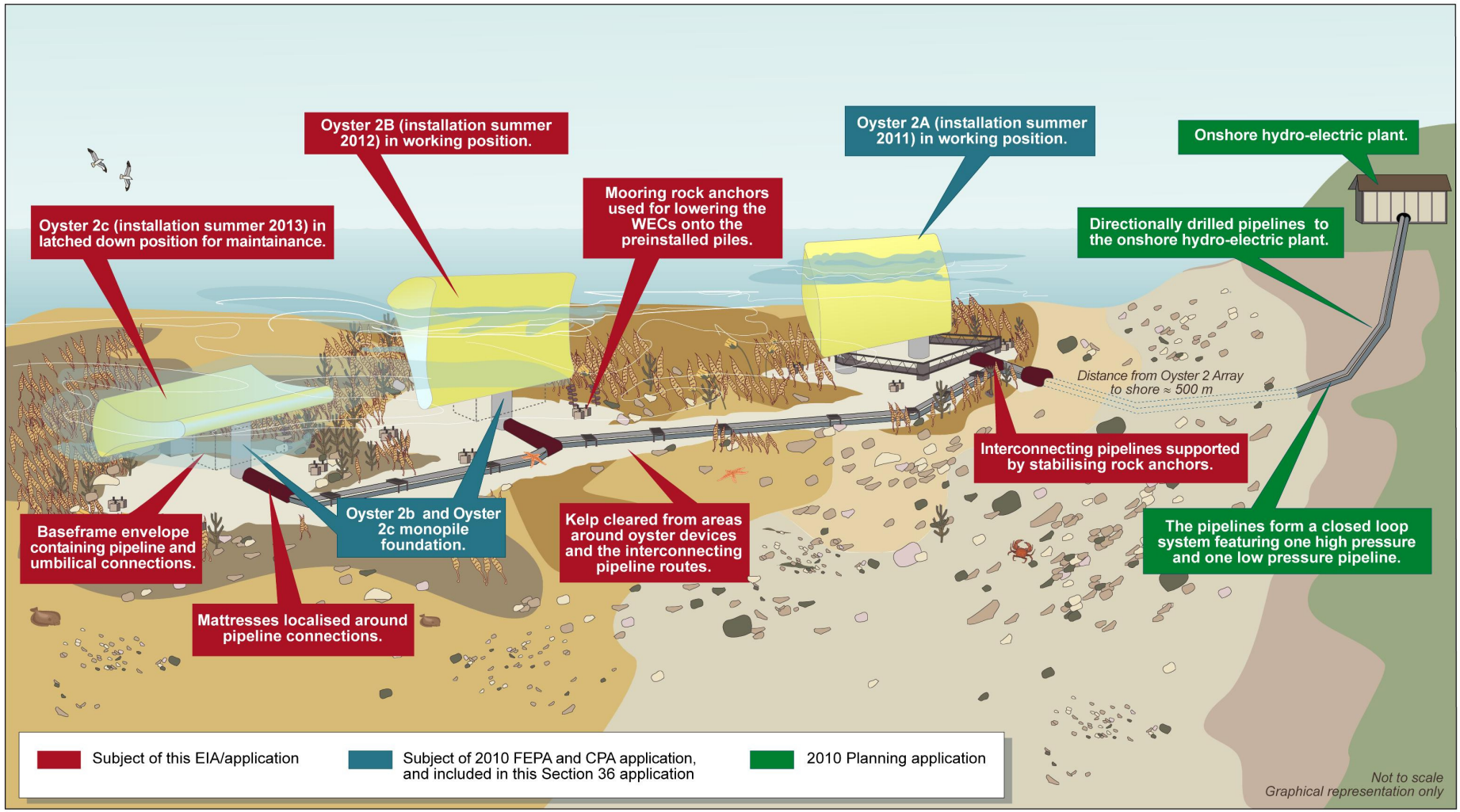

Figure 1.1 **Graphical impression of Oyster 2a, Oyster 2b and Oyster 2c in position on the seabed at the EMEC wave test site**

1.1 Purpose and Scope of this Document

As part of the environmental impact assessment (EIA) process, Aquamarine Power must determine and evaluate the potential impacts that the development of the Oyster 2 Array project may have on the marine wildlife using the proposed deployment location at the EMEC wave test site at Billia Croo, Orkney. This document will review the project description, describe the marine wildlife sensitivities present at the site and assess the potential for any impacts, the possible magnitude of any potential impacts and specify appropriate mitigation measures where necessary.

The assessment will draw upon wildlife monitoring conducted at the Billia Croo wave test site by Aquamarine Power (focussing on the inner bay area of the wave test site) and EMEC (covering the wider offshore wave test site). It places the results of this monitoring in context with a particular focus on protected species, including bird species likely to be connected with Special Protection Areas (SPAs).

There are a number of reports which have contributed to this impact assessment. The table below provides a list of all the supporting reports and documents that have been produced for the Oyster 2 Array project related to the marine wildlife impact assessment, and their location on the CD which accompanies the ES.

Relevant Document	Location on CD Accompanying the ES
Assessment of underwater noise from Oyster 2 installation (Subacoustech, 2010)	INSERT REF ON CD
Underwater noise impact assessment (Xodus, 2010)	INSERT REF ON CD
Assessment of underwater noise from latching anchor drilling (Subacoustech, 2011)	INSERT REF ON CD
Analysis of wildlife monitoring (Craigton Ecological Services, 2011)	INSERT REF ON CD
EMEC wildlife monitoring data summary (Xodus, 2011)	INSERT REF ON CD

Table 1.1 Details of contributing reports for the marine wildlife impact assessment

The following is a list of the sections within this report:

- **Section 1 –** Introduction including overview of the project and relevant legislation
- **Section 2** – Project description
- **Section 3** – Assessment methodology
- **Section 4** – Baseline description
- **Section 5** – Impact assessment
- **Section 6** – Cumulative impacts
- **Section 7** – Proposed monitoring
- **Section 8** – Summary and conclusions
- **Section 9** – References

1.2 Legislative Framework and Regulatory Control

A review of relevant legislation and regulatory frameworks was undertaken as part of the marine wildlife impact assessment; a summary of legislation relevant to marine mammals, fish and seabird species is presented below:

- EC Habitats Directive (92/43/EEC)
- EC Birds Directive (2009/147/EC)
- Nature Conservation (Scotland) Act 2004
- Marine (Scotland) Act 2010
- Offshore Marine Conservation (Natural Habitats, &c.) Regulations 2007
- Wildlife and Countryside Act 1981
- Agreement on the Conservation of Small Cetaceans of the Baltic and North Seas (ASCOBANS)
- Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention)
- The Convention on the Conservation of Migratory Species (Bonn Convention)

In addition to consideration of the relevant legislation the following guidance has been referenced during the EIA:

- Institute of Ecology and Environmental Management (2010). Guidelines for Ecological Impact Assessment in Britain and Ireland. Marine and Coastal.
- Scottish Natural Heritage (2009). A handbook on environmental impact assessment. (Online publication). Guidance for Competent Authorities, Consultees and others involved in the Environmental Impact Assessment Process in Scotland.

2. PROJECT DESCRIPTION

A full description of the Oyster 2 Array project is provided in Section 4 of the Environmental Statement (ES) for this project. A high level description is provided here to set the context for the marine wildlife impact assessment.

2.1.1 Technology

Oyster is a near-shore wave energy device, typically deployed in 10 to 15 metre (m) water depth. The oscillating action of the waves against the wave energy converter (WEC) (or 'flap') drives hydraulic pistons which pump pressurised freshwater back to shore through a closed loop pipeline system. The onshore hydro-electric plant (for which planning permission has already been granted) converts the hydraulic pressure and flow into electrical power via a Pelton wheel turbine which in turn drives electrical generators.

The Oyster technology is continually being developed as lessons are learned from Oyster 1 (pictured right, during testing at the EMEC wave test site) and the design of each generation of the Oyster device is refined. Oyster 2a is 250% more powerful than Oyster 1, simpler to install, easier to maintain and more efficient. The Oyster 2b and Oyster 2c devices will further refine the design of Oyster 2a.

Figure 1.1 in Section 1 is a schematic figure to show the layout of Oyster 2b and Oyster 2c in relation to the seabed, Oyster 2a and the onshore hydroelectric plant.

2.1.2 Components – Oyster 2 Array Project, Phase 2

Phase 2 of the Oyster 2 Array project will comprise two 800 kW wave energy convertor (WECs) plus associated seabed infrastructure.

Oyster 2b and Oyster 2c will each comprise of a flap, baseframe, hydraulic modules and a foundation monopile. The foundation monopiles will be pre-installed in 2011 under FEPA licence 03987/11/4849.

In addition, rock anchors will be installed around the device to assist with securely lowering each Oyster flap onto its foundation pile, and for maintenance operations throughout the life of the project. Latching anchors will also be installed next to each Oyster device on the seaward side to secure the flap in a maintenance position. Interconnecting pipelines will be installed between the Oyster 2c and Oyster 2b devices and between the Oyster 2b and existing Oyster 2a devices. Stabilising rock anchors and mattresses will be used to secure and protect the interconnecting pipelines between the Oyster 2b and Oyster 2c devices.

2.1.3 Project Schedule

Installation of Oyster 2b (and associated seabed infrastructure) is planned to commence in 2012, with Oyster 2c (and associated seabed infrastructure) installed in 2013. If it is possible then Oyster 2b and Oyster 2c and associated seabed infrastructure for both will be installed in 2012.

Installation of the Oyster 2b and Oyster 2c devices will be broken down into several phases. The schedule of activities will be as follows in both 2012 and 2013. If both devices are installed in 2012 the activities will take place from May 2012 to September 2012.

Operation	2012					2013				
	M	J	J	A	S	M	J	J	A	S
Seabed preparation										
Installation of mooring rock anchors										
Installation of latching anchors										
Installation vessel mobilised										
Oyster 2b installation										
Oyster 2c installation										
Installation of Oyster 2b / Oyster 2c umbilical										
Installation of stabilising rock anchors										
Pipeline hook up										
Commissioning										
Oyster 2b operational										
Oyster 2c operational										

Table 2.1 Indicative Installation Programme

2.1.4 Installation

All installation activities utilise a mixture of tugs, multi-cat vessels and dive boats. A sequential list of operations is provided below:

- Seabed preparation – kelp clearance, infilling of gullies and gaps with rock, and installation of rock anchors and latching anchors.
- Oyster 2b/Oyster 2c installation – the Oyster devices will be towed out to the site from a suitable port facility in Orkney, positioned over the monopile foundations using a guide system and lowered over the pile and secured to the pile using grout.

- Installation of interconnecting pipeline/umbilical – installed on the seabed between the device and the directionally drilled pipeline to the onshore hydro-electric plant, using stabilising rock anchors and mattresses for protection.

- Commissioning – hook-up of the pipelines, pressure testing, electrical component testing, visual examinations and functional testing of the mechanical, electrical and instrumentation components, and de-ballasting to allow the flap to rise to its vertical position.

2.1.5 Operation and Maintenance

Oyster 2b and Oyster 2c are expected to be operational within five months of commencing installation. Designed to be compatible with diver-less maintenance, planned inspection and light maintenance activities are likely to take place every six months with an extended maintenance period at every five year mark. Maintenance might involve removal of isolated hydraulic modules, leak testing of pipelines, power-washing biofouling or maintenance of any other component parts.

2.1.6 Decommissioning

A Decommissioning Programme, under the Energy Act 2004, will be submitted and agreed with the Department of Energy and Climate Change (DECC) and decommissioning undertaken in line with the details outlined in the programme and essentially be a reverse of the above described installation procedure.

3. ASSESSMENT METHODOLOGY

3.1 Methodology overview

This marine wildlife impact assessment has included the following:

- Review of relevant legislation and guidance (Section 1)
- EIA scoping and consultation with regulators and key stakeholders (Section 3.2)
- Establishing the marine wildlife sensitivities (cetaceans, seals, fish and birds) relevant to the proposed development (Section 4), drawing on desk based research (Section 3.3) and marine wildlife field studies undertaken by EMEC and Aquamarine Power (Section 3.5)
- Assessment of potential impacts on the different species present at and surrounding the proposed development site (Section 5), using standard significance criteria (Sections 3.5).
- Any difficulties or limitations in the impact assessment have been summarised in Section 3.6.

3.2 Scoping and Consultation

Issues of concern regarding marine wildlife relate mainly to protected species, such as cetaceans, basking sharks and seabirds; however the potential for indirect effects on piscivorous species due to disturbance/displacement of fish was also highlighted. Key issues raised during scoping and ongoing consultation with regulators are outlined in Table 2.2 below. Consideration has also been given to the response provided from SNH to Marine Scotland on the Oyster 2a FEPA application made in 2010.

Organisation	Key Concerns	Comment
Orkney Islands Council (Fish)	Consideration should also be given to how impacts upon fish species in this area are likely to influence other species, e.g. seabirds, otter and seals, which feed on fish.	Potential indirect effects of the development on piscivorous species have been considered (see Sections 5).
SNH (Marine Mammals)	The installation and operation of the Oyster device could potentially result in actions that are listed as offences under the Habitats Regulations in respect of cetaceans, such as noise produced during the installation operations. We advise that it is possible that an EPS license will be required unless appropriate mitigation is put in place. Any license application should consider what impacts might occur, what their magnitude and duration might be and how they could be mitigated.	Subacoustech was commissioned to undertake an assessment of the potential impacts from underwater noise during installation activities (Subacoustech 2010, Subacoustech 2011). Potential impacts from the operation of the Oyster 2b and 2c devices and the proposed mitigation measures are addressed in this impact assessment (see Section 5).

Organisation	Key Concerns	Comment
SNH (Marine Mammals)	Due to the risk of displacement/disturbance to cetaceans, SNH advises that the applicant establishes the distribution and usage (e.g. for feeding, passage, breeding etc) throughout the year of the survey and deployment area, by cetaceans. The survey area should cover the area of likely impact of the development (including installation and decommissioning) which would include the area between the development and the coast.	Aquamarine Power has an ongoing marine wildlife monitoring programme for the Billia Croo inner bay area. The first year of data collected (April 2010 – March 2011) has been analysed to support the marine wildlife impact assessment (see Sections 3.4 and Section 4). This includes coverage of the area between the development and the coast.
SNH (Birds)	A number of bird species are likely to utilise the proposed deployment area, including the Annex I species, red-throated diver (*Gavia stellata*). Consideration needs to be given to the potential impact of the development on birds, including red throated diver, which may be utilising the area.	Aquamarine Power has an ongoing marine wildlife monitoring programme for the Billia Croo inner bay area. The first year of data collected (April 2010 – March 2011) has been analysed to support the marine wildlife impact assessment (see Sections 3.4 and Section 4). This includes reporting the use of the development area by protected bird species. The impact assessment has assessed potential impacts on birds, including red throated diver (see Section 5.4).
SNH (Basking Sharks)	Basking sharks (*Cetorhinus maximus*) are likely to use the area for passage and/or feeding. Basking sharks have full protection from intentional capture or disturbance in British waters (up to 12 miles offshore) under a 1998 listing on Schedule 5 of the Wildlife and Countryside Act (1981)(as amended) and the Nature Conservation (Scotland) Act 2004. They are also listed under CITES Appendix III in UK waters. SNH recommend that distribution and use of the area by basking sharks and seals should be incorporated within the marine mammal and bird surveys.	Aquamarine Power and EMEC's ongoing marine wildlife monitoring at Billia Croo include the recording of basking sharks and seal species (see Section 3.4 and Section 4).

Organisation	Key Concerns	Comment
SNH (Seals)	There is a common seal haul-out site in close proximity to this development. Seals travel substantial distances while foraging for food, utilise the whole water column and are inquisitive animals. It is therefore possible that seals may interact with marine renewable devices in this location. Both species are protected under Annex II and Annex V of the Habitats Directive 1992. SNH advises that the applicant establishes the distribution and usage throughout the year of the proposed deployment area by common and potentially grey seals. In particular, consideration of whether this area is important as a feeding area for either species should be addressed.	Aquamarine Power and EMEC's ongoing marine wildlife monitoring at Billia Croo includes the recording of seal species (see Section 3.4 and Section 4). Subsequent data analysis has been undertaken to establish distribution and usage throughout the year by seals.
RSPB	While we believe that there may be the potential for disturbance and displacement of feeding seabirds by large arrays of wave energy devices, the Billia Croo proposal does not fall into this category. We are content that the Scoping Document adequately covers all the main issues relating to our potential concerns and that the proposal poses no significant threat to biodiversity.	n/a

Table 3.1 Summary of Scoping Issues Related to Marine Wildlife

In addition to the above issues, consultation with SNH has confirmed the need to undertake a Habitats Regulation Appraisal (HRA) for the proposed development in order to establish the need for appropriate assessment. Appropriate Assessment may be required due to potential for impact upon internationally important populations of seabirds (and seabird assemblages) present at designated Special Protection Areas (SPAs). In its response to scoping, SNH identified the need to consider potential impacts on:

- Hoy Special Protection Area (SPA); located approximately 2-3 km south of the site at Billia Croo and qualifies as an SPA for supporting internationally important numbers of seabirds; and
- Marwick Head SPA (also designated for supporting seabird species), situated within 14km of the site.

The proposed Oyster 2 Array project is within the foraging ranges of seabird species from both SPAs. These protected sites and their qualifying interests are detailed further in Section 4.

3.3 Desk Study

To inform this assessment a desk based review of existing data sources was conducted. The aim of this exercise was, in association with significant local experience of the area, to provide advice on the marine wildlife species that may be present at the Oyster 2b and Oyster 2c installation site. Reference was also made to the environmental description of the wave test site (EMEC, 2009). This review has been used as the basis of the summary of key sensitivities provided in the Baseline Description and also to inform the scope of marine wildlife monitoring (Section 4).

Notably, a recently published report regarding the utilisation of Orkney waters by seal species (SMRU Ltd, 2011) was consulted; however the majority of data considered in this study focuses on significant haulout sites and is not specific to the area of interest at Billia Croo. In summary, the study did not identify any grey seal breeding colonies within close proximity to the site, harbour seals have been previously recorded in the inner bay at Billia Croo (data from 2007/2008). Most seals (both harbor and grey) were located around the small isles to the north-east of Orkney mainland, with other main areas if distribution comprising Hoy (especially the SW of Hoy) and Scapa Flow. It is therefore possible that seal species use the site at Billia Croo to a lesser extent than other areas around Orkney. With regards to recent cetacean data, an imminent report (Evans and Baines) which may be of relevance to the site, is not available at the time of writing.

3.4 Field Studies

Two marine wildlife surveys have provided data to inform this marine wildlife impact assessment:

- EMEC commenced marine wildlife monitoring of the wave test site from an observation point at Black Craig in March 2009. Two years of EMEC collected data (April 2009 – March 2011) have been made available to Aquamarine Power for this EIA.
- Aquamarine Power commenced marine wildlife monitoring of the inner bay area of the wave test site in April 2010. One full year of data (April 2010 – March 2011) has been analysed to inform this EIA. Observations of seabirds, marine mammals and marine megafauna are made using a site-specific methodology developed by Dr Nigel Harding of Craigton Ecological Services (Harding, 2010).

Survey coverage of both the Aquamarine and EMEC wildlife monitoring is illustrated in

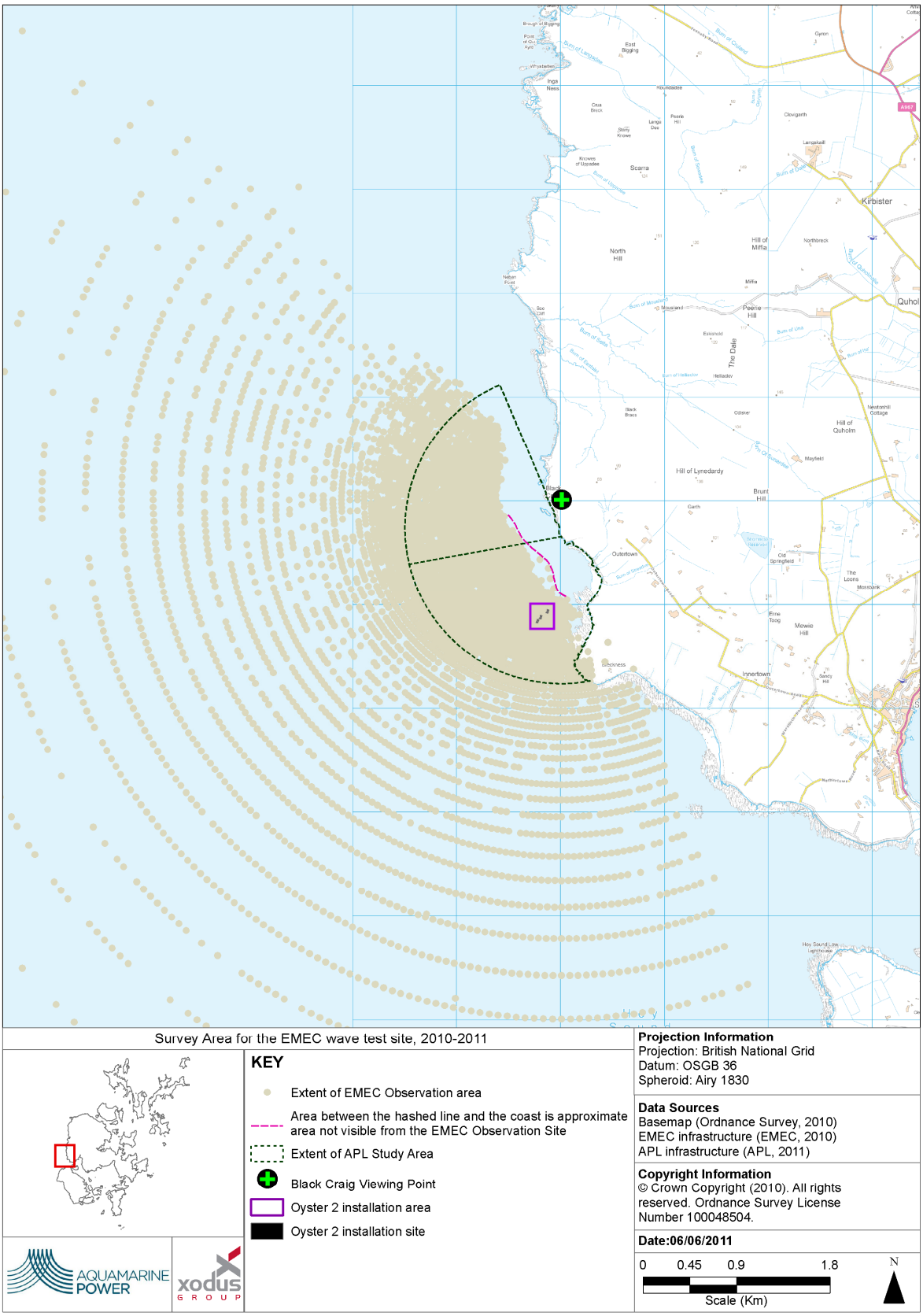

Figure 3.1. Although the EMEC collected data do not cover the entire inner bay area, they cover the immediate location of the Oyster 2 Array project and provide context for the marine wildlife data collected by Aquamarine Power.

It should be noted that at present there is no published guidance on marine wildlife survey methodologies for marine (wave and tidal) energy developments. However, the survey methodology developed for the Oyster 2 Array project at Billia Croo has been presented to and discussed and agreed with Marine Scotland and SNH during the course of the EIA.

The Aquamarine Power commissioned wildlife monitoring at Billia Croo consists of a single vantage point survey to accurately record all marine wildlife sightings. Full details of the core methodology can be found in the core methodology document (Harding, 2010). A total of 16 watches per month are carried out, comprising four, four-hour watches. Each watch consists of three complete scans over the study area, systematically searching all areas within 1.5 km of the vantage point, with wildlife observers accurately recording the location of all sightings. Quantitative analysis of these data has been undertaken. Wildlife monitoring survey data considered in the assessment was collected from April 2010 to March 2011. A revised methodology was applied in November 2010, to extend survey coverage of the site from 1,200 m to 1,500 m. The old methodology will therefore tend to underestimate the number of birds within the southern survey area and within 500 m and 600 m of the proposed device locations. These potential limitations were kept in mind whilst interpreting the results.

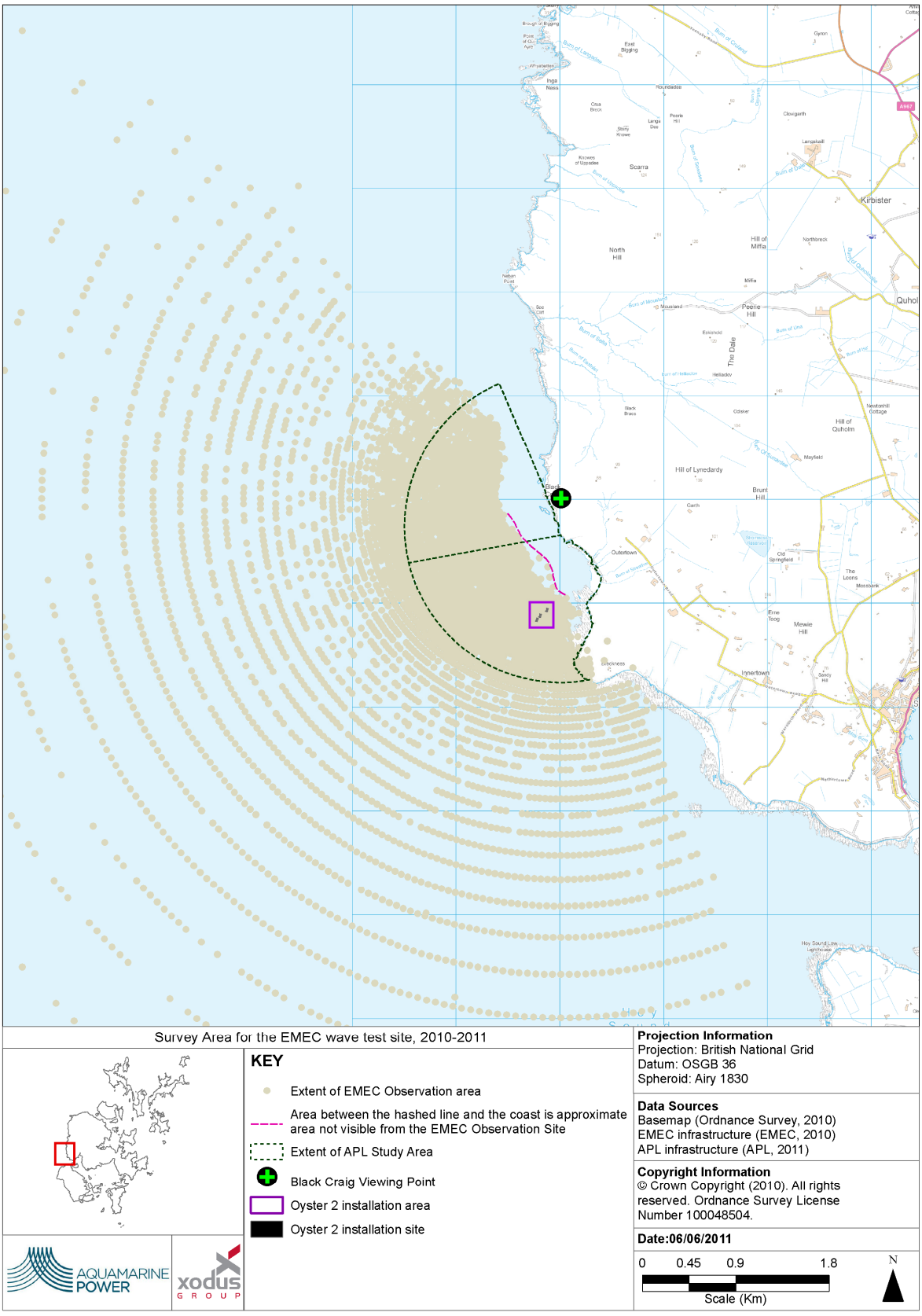

Figure 3.1 Survey area for the EMEC wave test site (Aquamarine Power *and* EMEC observations)

Within the analysis the Aquamarine Power wildlife monitoring data is presented in a tabular format with accompanying figures, showing abundance and distribution of each species during each season. Within each table, the number of scans, hours taken to complete scans and number of observations is presented; with the number of animals per complete scan within a given distance of the development (100 – 600 m), in addition to the southern area ('old methodology') and whole site totals. The number of animals per complete scan is presented as both the mean and maximum, for each month during the wildlife monitoring.

It has not been possible to analyse the EMEC collected data to generate abundance estimates (Harding 2010) therefore these data have been used to provide context for the Aquamarine Power collected and analysed data only. Maps summarising the locations of relevant observations during the EMEC surveys are summarised in the EMEC wildlife monitoring summary report provided on the accompanying CD.

In addition to the Aquamarine Power and EMEC marine wildlife monitoring data, recently obtained aerial data for the Pentland Firth and Orkney Waters (PFOW) (seabirds and marine mammals) collected by APEM are available. However due to the project timeframe (the initial interim report was available at the end of May 2011 only) it has not been possible to consider/use the APEM data to inform this impact assessment.

The marine wildlife data collected by Aquamarine Power includes data obtained from the inner bay area to 1,500 m offshore, supplemented by the EMEC monitoring over the wider wave test site (out to the horizon); therefore survey coverage is deemed to be sufficient and data considered to be of good quality, for use in the impact assessment.

3.5 Significance Criteria

The EIA regulations require that EIA should consider the significance of the effects of the development on the environment; consideration of significance of effects has been undertaken in relation to marine mammals, fish and seabird species. The assessment of the potential significance of effects has been developed in accordance with the principals and guidance provided by SNH in their handbook on EIA (SNH, 2009) and also in accordance with IEEM Guidelines for Ecological Impact Assessment (EcIA), (IEEM, 2010).

The evaluation of impact significance follows the following process:

- Identification of the baseline conditions and the sensitivity of the receptor.
- Identification of the magnitude of change upon the receptor.
- Assessing the consequence of an impact based on regulatory, stakeholder and environmental factors.
- Assessing the likelihood of impact.
- Identification of the impact significance.

With regards to assessing the significance of an impact on an ecological receptor (i.e. marine wildlife species) this is regarded as an impact that is either negative, or positive, with potential to effect the integrity of a protected site and/or the conservation objectives for species populations within a given geographical area, e.g. regional or national.

The geographical scale at which a predicted significant impact will occur is determined by the value of the feature(s) affected, therefore a predicted significant impact on an interest feature of an SPA would be a significant impact at a European level. If the feature affected was a

population of regional importance, then the assessment would conclude that the predicted impact would be of country importance.

The assessment will focus on the highest level of importance of a feature (i.e. European importance) whilst acknowledging interest at other levels, such as local or national. The value of an ecological receptor (which may be significantly affected by the proposed development) is used to identify the geographical scale at which the impact is significant. Ecological value relates directly to the consequences, in terms of legislation, policy and/or licensing; in addition to development control, where appropriate. It is recognised that where impacts may not be significant at a national level, that these may still be significant at a local level. Categories used for defining the sensitivity and magnitude of ecological receptors are provided in Tables 3.2 and 3.3 below.

Sensitivity of Receptor	Definition
Very High	Species/assemblages which form qualifying interests of internationally designated sites (e.g. SPA interest features); Globally threatened species (e.g. listed as endangered or the IUCN red list); Species considered to be present in internationally important numbers.
High	Species/assemblages which form qualifying interests of nationally designated sites; Species which contribute to an international site but which are not listed as qualifying interests; Ecologically sensitive species or species occurring in numbers of national importance (e.g. cetaceans).
Medium	Species on Annex 2 of the EC Habitats Directive; Species listed in Schedule 1 of the Wildlife and Countryside Act 1981 (as amended); Species present in regionally important numbers; Species which contribute to an national /international site but which are not listed as qualifying interests; Species occurring within national/ international sites but are not crucial to the integrity of the site; Species listed as priority species in the UK Biodiversity Action Plan (BAP).
Low	Other species of conservation interest (e.g. Local BAP species)/
Negligible	Species of no conservation concern.

Table 3.2 Definitions for Sensitivity of Receptor

Magnitude of Impact	Definition
Severe	Widespread total loss or major alteration to species presence and habitat use, such that the post-installation species composition will be fundamentally altered; Anticipation of limited or no recovery.
Major	Widespread change to characterising species or lasting change to area use leading to medium-term damage; Recovery anticipated taking several years following completion of installation activities.
Moderate	Change of species composition using localised habitats (within the proposed development footprint and immediate surrounding area) for the project duration, however no permanent change to habitat use. Good recovery potential following completion of installation activities (approximately 2 years).
Minor	Measurable change in species composition and habitat use within proposed development footprint (within scale of natural variability); Temporary alteration or effects confined to a small percentage of species using the area, with rapid recovery likely.
Negligible	Effects unlikely to be measurable or discernable.

Table 3.3 Definitions for Magnitude of Impact

The sensitivity of a receptor (i.e. marine mammal species, fish species and seabird species) and the magnitude of impact are combined to define the environmental consequence of the impact (refer to Table 3.4Table). The environmental consequence may then be combined with a stakeholder and regulatory context to give an overall consequence ranking (TableTable 3.5). An average of the consequence rankings for each of environmental, stakeholder and regulatory categories is used to give an overall consequence ranking.

Magnitude	Sensitivity				
	Very High	**High**	**Medium**	**Low**	**Negligible**
Severe	Severe	Severe	Major	Moderate	Minor
Major	Severe	Major	Major	Moderate	Minor
Moderate	Major	Major	Moderate	Minor	Negligible
Minor	Moderate	Moderate	Minor	Minor	Negligible
Negligible	Minor	Minor	Negligible	Negligible	Negligible

Table 3.4 Environmental Consequence of Impact

ID	Consequence	Environmental	Regulatory	Stakeholder
5	Severe	See Table 3.4 for environmental consequence rankings	**Activity** prohibited. Likely major breach in compliance resulting in prosecution	International concerns
4	Major		Possible major non-compliance	National concerns
3	Moderate		Possible minor non-compliance	Regional concerns
2	Minor		Regulatory terms or corporate policy set defined conditions	Local concerns
1	Negligible		No specific statutory control	Individual concerns
0	Positive		N/A	No public interest or improves aspect of community importance

Table 3.5 Overall Consequence Rankings

To assess the significance of impact (or risk), the overall consequence ranking is combined with a frequency/probability of the impact occurring.

Frequency / Probability Category		Definition
5	Continuous / Likely	Continuous or permanent change over more than 5 years. Event likely to occur more than once over the lifetime of the project.
4	Regular / Possible	Continuous or permanent change over less than 5 years, or a regular event over more than 3 years. Possible the event will occur within the lifetime of the project.
3	Intermittent / Unlikely	Regular change over less than 3 years or intermittent change over more than 3 years. Event could occur within the lifetime of 10 similar projects, or the event has occurred on similar projects.
2	One-off Event / Remote	One-off event over the lifetime of the project with duration of several weeks, or an event happening once per year for less than 24 hours. A Similar event has occurred somewhere in the industry or similar industry but is not likely to occur with current practices and procedures.
1	One-off Event / Extremely Remote	One-off event over the lifetime of the project with duration of less than 5 days. Extremely remote event that has never occurred within the industry or similar industry but is theoretically possible.
0	Will Not Occur	Will not occur.

Table 3.6 Probability and/or Frequency Definitions

The overall impact significance ranking is derived by combining consequence and likelihood via the matrix presented in Table 3.7.

Consequence		Likelihood					
		5	4	3	2	1	0
5	Severe	25	20	15	10	5	0
4	Major	20	16	12	8	4	0
3	Moderate	15	12	9	6	3	0
2	Minor	10	8	6	4	2	0
1	Negligible	5	4	3	2	1	0
0	Positive	0	0	0	0	0	0

Table 3.7 Significance Rankings

In terms of the significance of impacts in relation to the EIA regulations:

- **Severe** – Intolerable risk/highly significant – requires immediate action
- **Major** – Intolerable risk/highly significant – requires action
- **Moderate** – Significant – requires additional control measures and/or management
- **Minor** – Not significant – however will require some management to ensure remains within acceptable limits
- **Negligible** – Not significant
- **Positive** – to be encouraged

In addition to project specific impacts, the marine wildlife assessment also considers potential cumulative impacts; refer to Section 5.

3.6 Difficulties or Limitations of Assessment

3.6.1 Site characterisation

Marine mammals (cetaceans and seals) – no difficulties or limitations; site specific marine wildlife monitoring has provided adequate site characterisation data.

Fish (including basking sharks) – Marine wildlife monitoring has collected site specific data on basking sharks in and around the proposed development area. However, some difficulties were encountered with regards to the provision of baseline information regarding other fish species; specifically, there was found to be an absence of data regarding species movements and distribution in coastal areas in the vicinity of Billia Croo. General information for the wider Orkney area only was available.

Seabirds - no difficulties or limitations; site specific marine wildlife monitoring, supplemented by the EMEC monitoring over the wider wave test site has provided adequate site characterisation data.

3.6.2 Impact assessment

Due to the relatively early status of technology development in the marine (wave and tidal) industry, there is still a general lack of empirical data on the impact that different technologies may have on marine wildlife. This is being addressed by Aquamarine Power through their ongoing marine wildlife monitoring programme at the Billia Croo wave test site. The data being collected at the wave test site is an important aspect of the commercialisation of Oyster technology and will be used to inform the assessment of future Oyster arrays.

With regard to the assessment of impacts on seabird species, there is a paucity of available information regarding regional estimates of seabird populations for Orkney. Seabird populations have therefore been assessed in terms of national and international context; however it is anticipated that assessment of the potential impacts on the integrity of Special Protection Areas (SPAs) local to the proposed development site will also be sufficient for assessment of impacts at a regional level.

4. BASELINE DESCRIPTION

4.1 Marine Mammals

Taxon	Species Present at the Billia Croo Wave Test Site (Offshore and Inner Bay Areas)
Cetaceans	Minke Whale (*Balaenoptera acutorostrata*) Long-finned pilot whale (*Globicephala melas*) Killer whale (*Orcinus orca)* Risso's dolphin (*Grampus griseus*) White-beaked dolphin (*Lagenorhynchus albirostris*) White-sided dolphin (*Lagenorhynchus acutus*) Harbour porpoise (*Phocoena phocoena*)
Pinnipeds	Harbour Seal (*Phoca vitulina*) Grey Seal (*Halichoerus grypus*)

Table 4.1 Species Present at the Billia Croo Wave Test Site

Seventeen cetacean species have been recorded in Orkney Waters since 1980 (Seawatch Foundation, undated), with data from the SeaWatch Foundation highlighting the importance of Orkney waters; seven cetacean species (representing 25% of the UK cetacean fauna) are recorded throughout the year.

In addition to cetacean species, both the common (harbour) and grey seal are commonly found in Orkney waters, however there are no known or significant seal populations in close vicinity of the wave test site and Billia Croo is not considered to be as important as other areas in Orkney. Notably, grey seals are capable of moving over large distances; however harbour seals have more localised movements, with studies suggesting harbour seal foraging generally takes place within 20 km of the departure haul-out sites with little movement between haulout regions within the Orkney isles. Harbour seal pups show more extensive movements (SMRU Ltd, 2011).

Site specific data collected by both EMEC (for the wider wave test site) and Aquamarine Power (for the inner bay area), provide more detail of the specific marine mammal species present in the immediate and surrounding area of the proposed Oyster 2 Array. These data indicate that grey seals, harbour seals and harbour porpoise are the most commonly observed marine mammal species occurring within the proposed development area of the Oyster 2 Array project.

It should however be noted that when comparing the EMEC and Aquamarine Power data sets there appear to be a lot more marine mammal sightings recorded by EMEC. This is likely to be due to the wider survey coverage of the EMEC data, which includes deeper areas of water away from the inner bay, potentially where more marine mammal species may potentially occur (e.g. when passing through the area to foraging grounds, moving between haul-out sites). The Aquamarine Power data set focuses on the inner bay area, where it is likely that marine mammals will occur only if habitats in this area are of some importance to that species (e.g. for foraging, or resting), therefore there are likely to be less species utilising the immediate vicinity of the Oyster 2 Array, than occurring in the wider wave test site. For this reason, the EMEC data have been used to provide context for the results of the marine wildlife monitoring undertaken by Aquamarine Power (inner bay area). Utilising the EMEC data set, which is of a greater size than the Aquamarine Power one will also reduce the chance of missing rarer species. The distribution of marine mammal observations at Billia Croo, undertaken by both EMEC and Aquamarine Power, are illustrated in the figures on the following pages. Table 4.2 Summary of Marine Mammal Species Observed During EMEC and Aquamarine Wildlife Monitoring. Table 4.2 provides an overview of species observed in the Oyster 2 Array area, the inner bay area and the outer bay area of the wave test site.

Monitoring Period	Species Observed in the Vicinity of the Oyster 2 Array	Species Observed in Inner Bay Area of the Wave Test Site	Species Observed in Outer Bay Area (deeper water) of the Wave Test Site
2009-2010	Seals (unidentified). Grey seals (more abundant than harbour seals). Harbour porpoise.	Harbour porpoise and seal species most prevalent, with Risso's dolphin and white-sided dolphin. (No basking sharks observed during this period).	Minke whale White-sided dolphin Pilot whale Killer whale
2010-2011	Greater number of marine mammal observations during this period. Grey seal, harbour seal and harbour porpoise most abundant species in close vicinity to the Oyster 2 Array.	In addition to seal species and harbour porpoise, Risso's dolphin and white-sided dolphin (basking sharks were observed during this period).	Minke whale White-sided dolphin White-beaked dolphin Killer whale Several unidentified cetacean sightings.

Table 4.2 Summary of Marine Mammal Species Observed During EMEC and Aquamarine Wildlife Monitoring.

Maximum numbers of marine mammals observed during the Aquamarine Power wildlife monitoring are presented in Table 4.3. This is the maximum number of individuals which are likely to be observed in the inner bay area during a particular month (when a species is likely to be most abundant, based upon the results of the Aquamarine Power wildlife monitoring).

Species	Month	Maximum number of individuals likely to be observed
Harbour Porpoise	May	3
Risso's Dolphin	October	3
Harbour Seal	November	2
Grey Seal	May/July	2

Table 4.3 Summary of the Maximum Number of Marine Mammal Species, Likely to be Observed at the Site, based on the Results of the Aquamarine Power Wildlife Monitoring.

Cetaceans

Overall, numbers of cetacean species observed at the Oyster 2 Array location were low. Harbour porpoise was the most commonly recorded species at the wave test site, but there have been no sightings within the proposed footprint of the Oyster 2 Array. All sightings of harbour porpoise during the collection of data by Aquamarine Power have been during the spring and summer months (refer to Table 4.3 for details). EMEC collected data over the wider wave test site and deeper water areas offshore Billia Croo has recorded greater numbers of

harbour porpoise during the spring and summer months, with only occasional sightings during the rest of the year. The harbour porpoise is a common species in Orkney waters, with records of sightings in every month of the year, although it is much more common from June to September (Booth and Booth, 2005). Although this species has been observed at Billia Croo, Booth and Booth (2005) suggest it favours the more sheltered waters around Orkney, with the area to the south of Scapa Flow between Cantick Head and South Ronaldsay often holding the largest numbers.

The only other cetacean species observed by Aquamarine Power in the inner bay area is Risso's dolphin, which was recorded over 700 m from proposed development in autumn. EMEC collected data over the wider wave test site and deeper water areas offshore Billia Croo, has also recorded Risso's dolphin. Risso's dolphin is regularly recorded in Orkney waters and since 1980 it has been recorded more regularly than any other dolphin species. It is seen most frequently from June to October with August and September the peak months for sightings. The maximum school size reported in Orkney waters has been 20, but the majority of sightings have been between 3 and 8 dolphins (booth and Booth, 2005). Thus the survey data collected at the wave test site is consistent with the general pattern of sightings around Orkney.

Other cetacean species observed during the EMEC data collection include, killer whale, pilot whale, minke whale, white-sided dolphin and white-beaked dolphin. Many of these cetaceans were observed occasionally and during the summer months only. Notably, the majority of the cetacean sightings were observed at locations 1 km or greater from the proposed Oyster 2 Array location with only harbour porpoise and occasional Risso's dolphin observed in shallower inshore waters.

Seals

Both grey and harbour (common) seals have been observed during the Aquamarine Power monitoring of the inner bay area at Billia Croo. Grey seals were recorded more frequently than harbour seals; with observations taking place throughout the year and greatest concentrations during the spring and summer months. The majority of observations were outwith the immediate footprint of the proposed Oyster 2 Array, although some observations during the summer months were within the proposed development footprint and immediate surrounding environment (i.e. within 100 m to 400 m of the proposed development footprint). Harbour seals were less abundant, with very few records of seals occurring within the proposed development footprint or surrounding environment; harbour seal observations were recorded during the autumn and winter periods only.

Monitoring data collected by EMEC on seals also indicates that grey seals are more frequent in the wave test site area than harbour seals. Initial review of the EMEC data suggests there are no clear seasonal patterns of the area by seals. However, sightings of grey seals are apparently higher between October and March, timing which coincides approximately with the pupping and moulting periods of the species' life cycle. Distribution of sightings suggests increased occurrence in the more inshore waters, compared to the deeper offshore waters. Notably, there does not seem to be any difference by species in habitat use of the inner bay area. Figure 4.1 and Figure 4.2, illustrate cetacean sightings during the EMEC survey and Aquamarine Power survey, respectively, during the period 2010 – 2011. Seal observations during the same surveys are shown in Figure 4.3 and Figure 4.4, respectively, for the same period.

Approximately 45% of the world's grey seals breed in the UK and 90% of these breed at colonies in Scotland with the main concentrations in the Outer Hebrides and in Orkney (SCOS 2009). Of the five main breeding areas of grey seals in the UK, the greatest numbers of pups (43% of the UK total and approximately 15% of the world total) are born at colonies in Orkney (SMRU 2011a). Thus, the populations of grey seal in Orkney are very important both in

national and international terms. Although the number of pups throughout Britain has grown steadily since the 1960s when records began, this growth is now leveling off (SCOS 2009).

Grey seals pup on small uninhabited islands and isolated beaches in the autumn, and use separate haul out areas throughout the year. There are several grey seal breeding colonies within Scapa Flow, the nearest of these, on Hoy being c. 12 km swimming distance from the proposed development (SMRU 2011a). The closest grey seal haul outs to the proposed development are on North Hoy c. 4 km swimming distance from the proposed development (SMRU 2011a). The proposed development is c.51 km swimming distance from the Faray and Holm of Faray SAC. Adult grey seals routinely move large distances (SMRU 2011a).

Approximately 30% of European harbour seals are found in the UK although this proportion has declined from approximately 40% in 2002 (SCOS 2009). Harbour seal populations in the Wash and Eastern England declined following epidemics of phocine distemper virus (PDV) in 1988 and 2002. These populations have failed to demonstrate any recovery since the epidemic, in contrast to the adjacent European colonies which have experienced rapid growth since 2002. Major declines have now also been documented in harbour seal populations around Scotland with major declines since 2000 in Orkney, Shetland, the Moray Firth and the Firth of Tay (SCOS 2009). In Orkney, harbour seal numbers declined by 63% between 2001 and 2008 (SMRU 2011a). Until 2001, Orkney was the main stronghold for harbour seals in the UK, holding 22% of the population. Following these populations declines the contribution to the UK total provided by Orkney fell to 12% in 2008 (SMRU 2011a). Even so, Orkney is still important nationally and internationally for common seals.

Harbour seals give birth to their pups in June and July and moult in August. At these, as well as other times of the year, harbour seals haul out on tidal rocks and sandbars, with the pups taking to the water soon after birth. Harbour seal movements are relatively local compared to grey seals, and there is less movement between haul out regions than there is for grey seals (SMRU 2011a). The proposed development is c. 65 km swimming distance from the harbour seal SAC at Sanday, and clearly falls outside the main areas used by adults from Sanday and other nearby islands (Eynhallow, Rousay and Stronsay) as shown by tagging studies (SMRU 2011a). However, tagging studies of pups show that they wander much more widely, and could potentially visit the development area (SMRU 2011a).

The proposed development is c.8.7 km and c.4.2 km respectively from the major August haul outs identified by in the Bay of Ireland, east of Stromness, and on the north tip of Hoy. It is only c.0.5 km from the minor haul out at Breckness Point, and 4.7km from the well known haul out at Point of Ness near Stromness. All of these haul outs are within easy foraging distance of the proposed development site SMRU 2011a .

The Orkney harbour seal population is in a parlous state, having declined greatly in recent years. Using a PBR approach (Lonergan 2011), SMRU 2011b estimate that only 18 out of an estimated population of 2989 common seals in Orkney and along the North coast of Scotland, 0.6%, could safely be removed in 2010 without threatening the population.

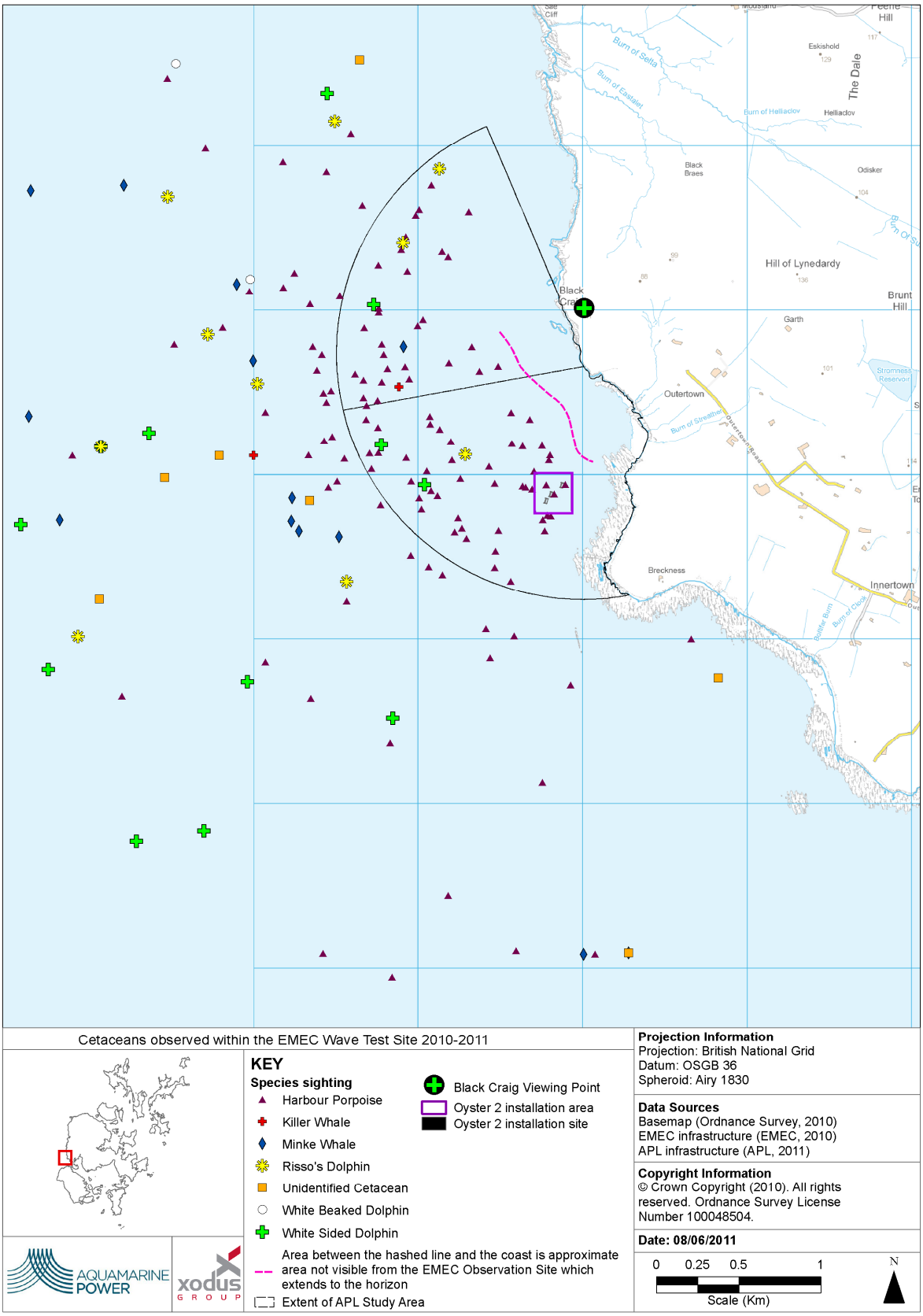

Figure 4.1 **EMEC cetacean observations, recoded during the 2010-2011 period**

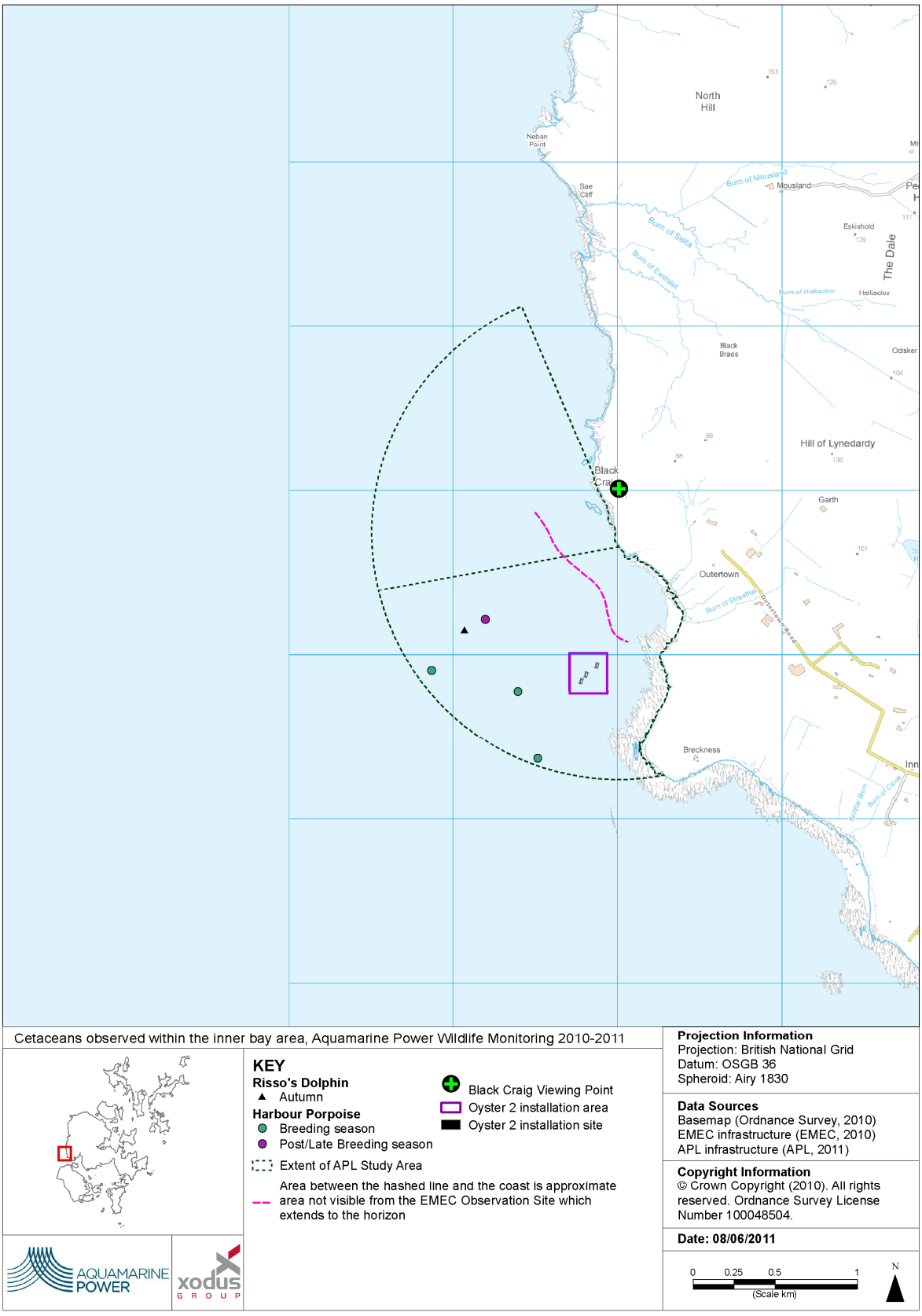

Figure 4.2 Cetaceans observed during Aquamarine Power observations 2010 – 2011

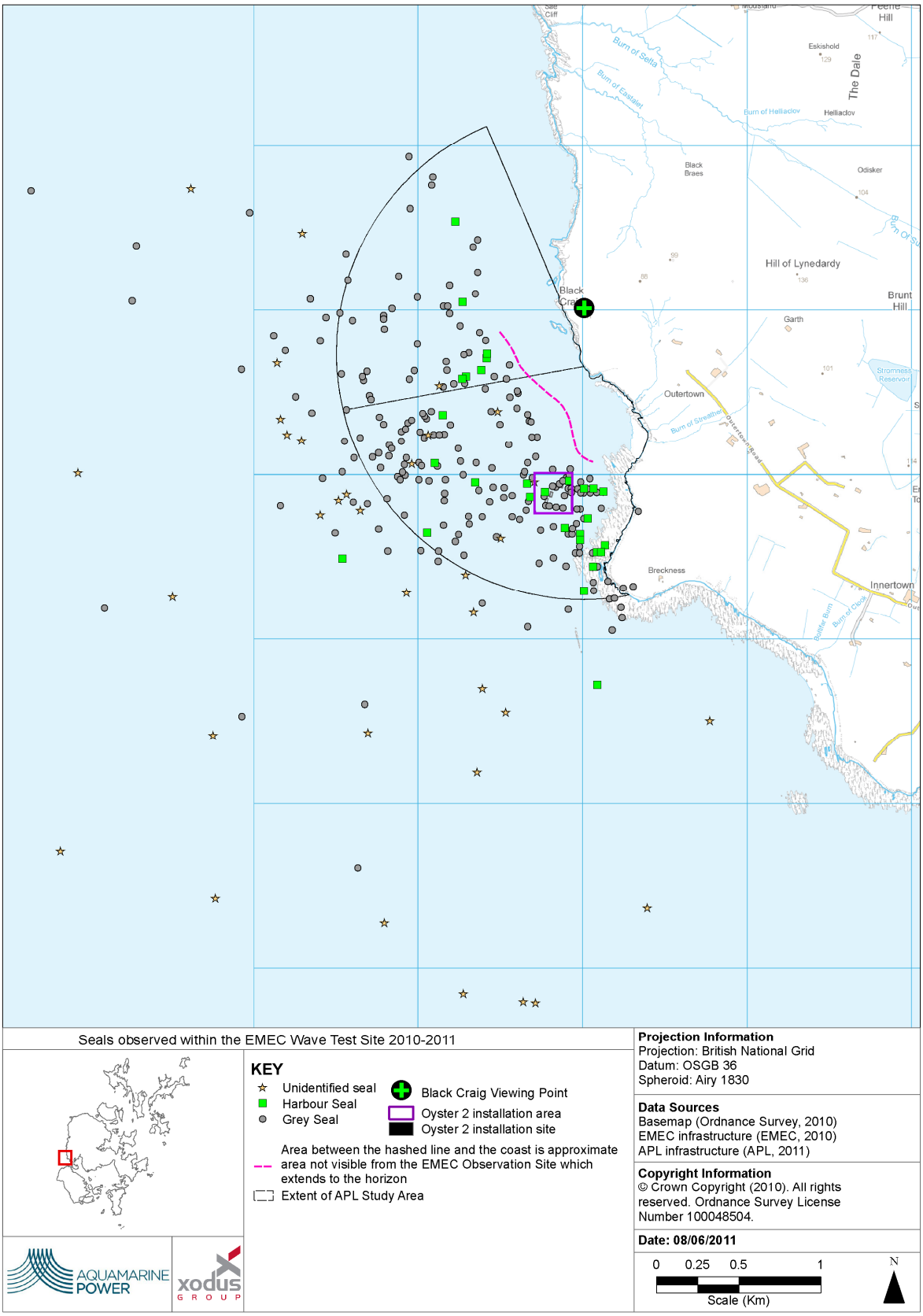

Figure 4.3 EMEC seal observations during the 2010 – 2011 period

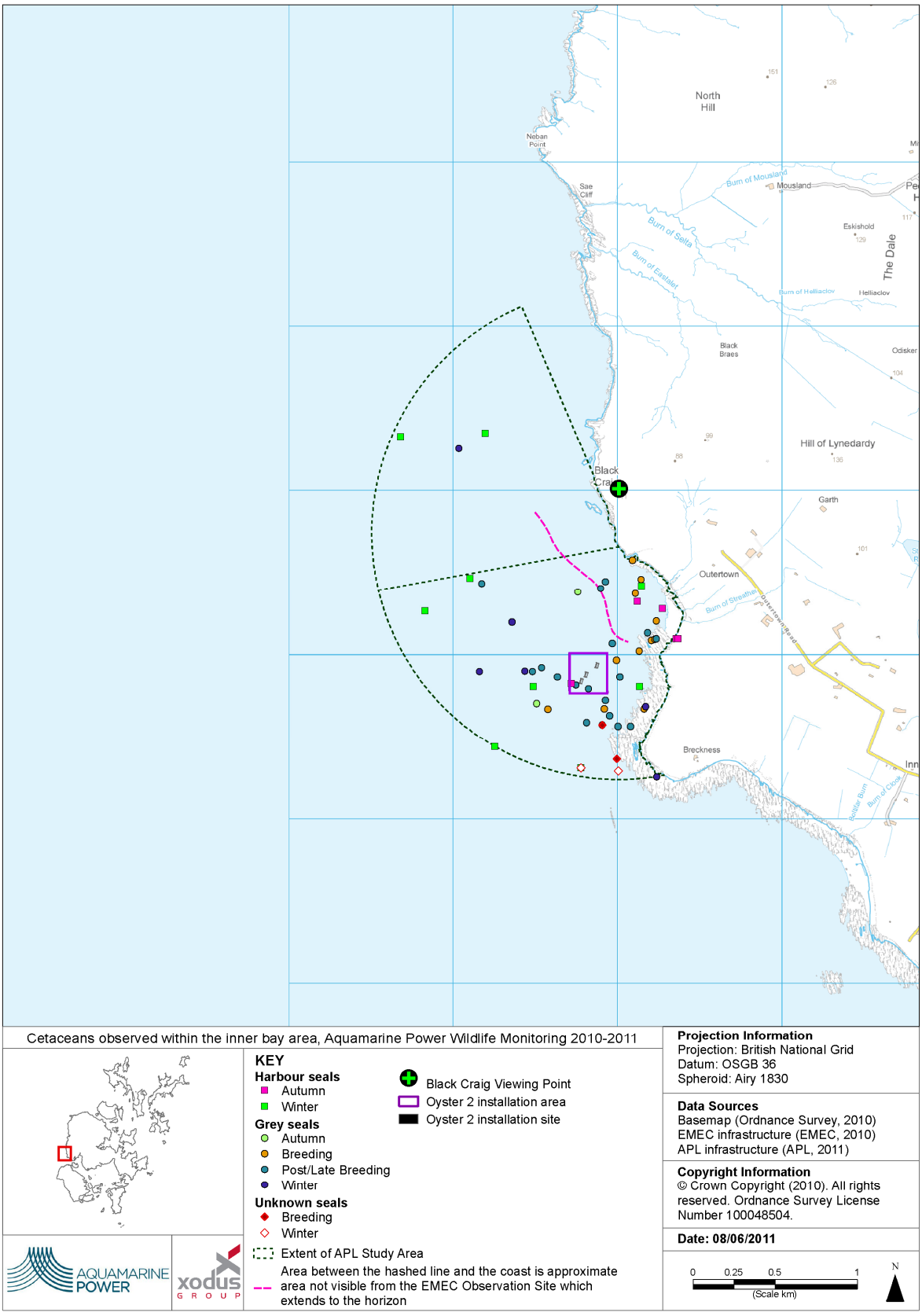

Figure 4.4 **Seals observed during Aquamarine Power observations 2010 – 2011**

4.2 Fish

Taxon	Species Potentially Present at the Billia Croo Wave Test Site (Offshore and Inner Bay Areas)
Fish	Mackerel (*Scomber scombrus*) Herring (*Clupea harengus*) Atlantic salmon (*Salmo salar*) Sea trout (*Salmo trutta*) Lemon sole (*Microstomus kitt* Sandeel (*Ammodytes spp.*) Sprat (*Sprattus sprattus*) Haddock (*Melonogrammus aeglefinus*) Ling (*Molva molva)* Saithe (*Pollachius limanda*) Cod (*Gadus morhua*) Common skate (*Dipturus Batis*) Basking shark (*Cetorhinus maximus*)

Table 4.4 Summary of Fish Species Potentially Occurring at Billia Croo.

EMEC produced an environmental description for the wave test site to inform potential developers of the environment within which the site is located and reported that fish fauna studies are poorly represented for this part of Orkney (EMEC, 2009). Due to this lack of site specific information, it should be recognised that fish species distribution is seasonal with distribution and habitat requirements varying at different lifecycle stages; therefore, there may be any number of fish species (listed above in Table 4.4) with varying distribution and abundance, occurring at the site (or surrounding environment), at any one time.

Herring, sandeel and sprat have recognised spawning grounds in Orkney Waters: it is therefore possible that the offshore area adjacent to Billia Croo may be used as a spawning ground for these species; this habitat may also be used as a nursery area for sandeel, lemon sole, saithe and nephrops. Seasonality of spawning is species-specific, with herring spawning from August to September, lemon sole spawning from April to September, Sandeels spawning from November to February and Sprat spawning from May to August (Gordon, 2003).

Mackerel are present in Orkney waters during the summer months, with a small proportion of the Scottish population entering and spawning in Orkney waters around May and June. Highest numbers of mackerel are found in late summer and autumn, when returning migration to the south-west takes place (Robson, 1996).

As noted above, other fish species may be present in Orkney waters; species without a defined spawning ground include haddock, ling, saithe and cod. Flat fish species such as plaice and dab occur on sandy areas of the seabed, with juveniles living close inshore nursery areas; the benthic habitat present at Billia Croo (exposed bedrock with dense kelp forest) is largely unsuitable for these species, therefore it is unlikely that flat-fish species will be present in high numbers, if at all. Other non-commercial fish species may be present at the site including elasmobranchs such as dogfish and ray species; the common skate (classified as critically endangered by IUCN) is also present in Orkney waters, it is therefore possible that this species may occur in the vicinity of the site.

Numerous sea lochs, small burns and surrounding coastal seas of Orkney are reported to contain populations of the salmon and sea trout (Robson, 1997). There are no large rivers in the vicinity of the site; therefore it is unlikely that migratory salmonids are abundant at the site. Two small burns are present in the vicinity the development (Burn of Dykeside, approximately 650 m north-east of the Oyster 2 Array and the Burn of Streather, approximately 550m north-east of the Oyster 2 Array); however investigations by the Orkney Trout Fishing Association (OFTA) confirm that these are not important for salmonids, specifically sea trout.

Basking sharks are regular visitors to Orkney waters, although numbers vary year to year (Orkney Field Club, 2009). During the Aquamarine Power monitoring, basking sharks were recorded during 10 scans, undertaken over 5 dates in the summer and autumn months. The recorded basking sharks were widely distributed across the site, with the closest observation to the proposed Oyster 2 Array occurring at approximately 150 m from the proposed development footprint.

Maximum numbers of basking sharks observed during the Aquamarine Power wildlife monitoring are presented in Table 4.5. This is the maximum number of individuals which are likely to be observed in the inner bay area during a particular month (i.e. the month when the basking sharks are most likely to abundant at the inner bay area, based upon the results of the Aquamarine Power wildlife monitoring).

Species	Month	Maximum number of individuals likely to be observed
Basking shark	June	1

Table 4.5 Summary of the Maximum Number of Basking Sharks, Likely to be Observed at the Site, Based on the Results of the Aquamarine Power Wildlife Monitoring.

As noted above it is possible that any number of fish species may be present in the proposed development footprint and/or immediate surrounding environment at the time of device installation and operation. Many of these species are widely distributed in waters around Orkney and further a field, but no specific data exists for the Billia Croo area, with the exception of the basking shark (see Figure 4.5 for Aquamarine Power basking shark observations, and Figure 4.6 for EMEC basking shark observations during the period 2010 - 2011).

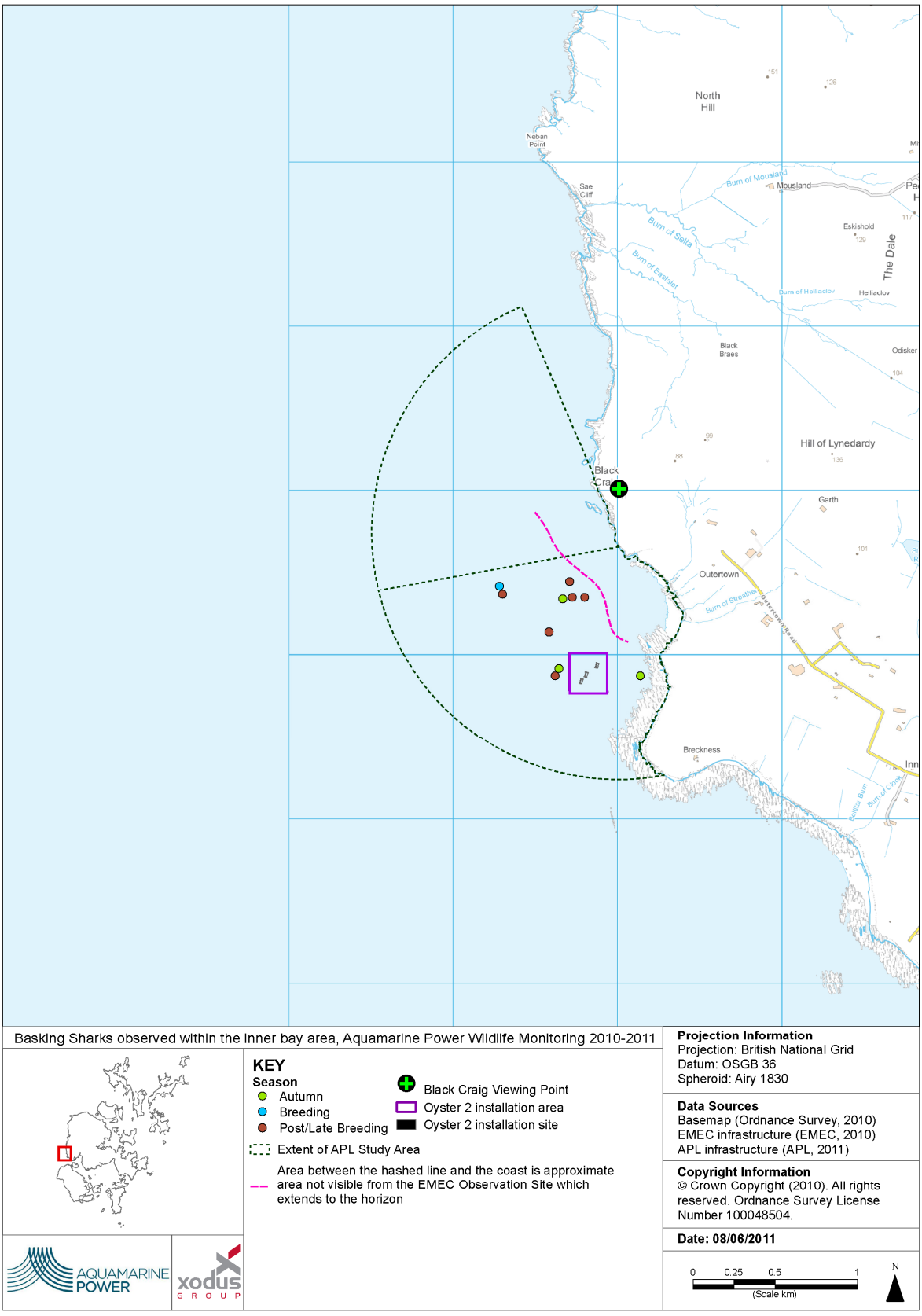

Figure 4.5 **Basking shark observations during Aquamarine Power wildlife monitoring**

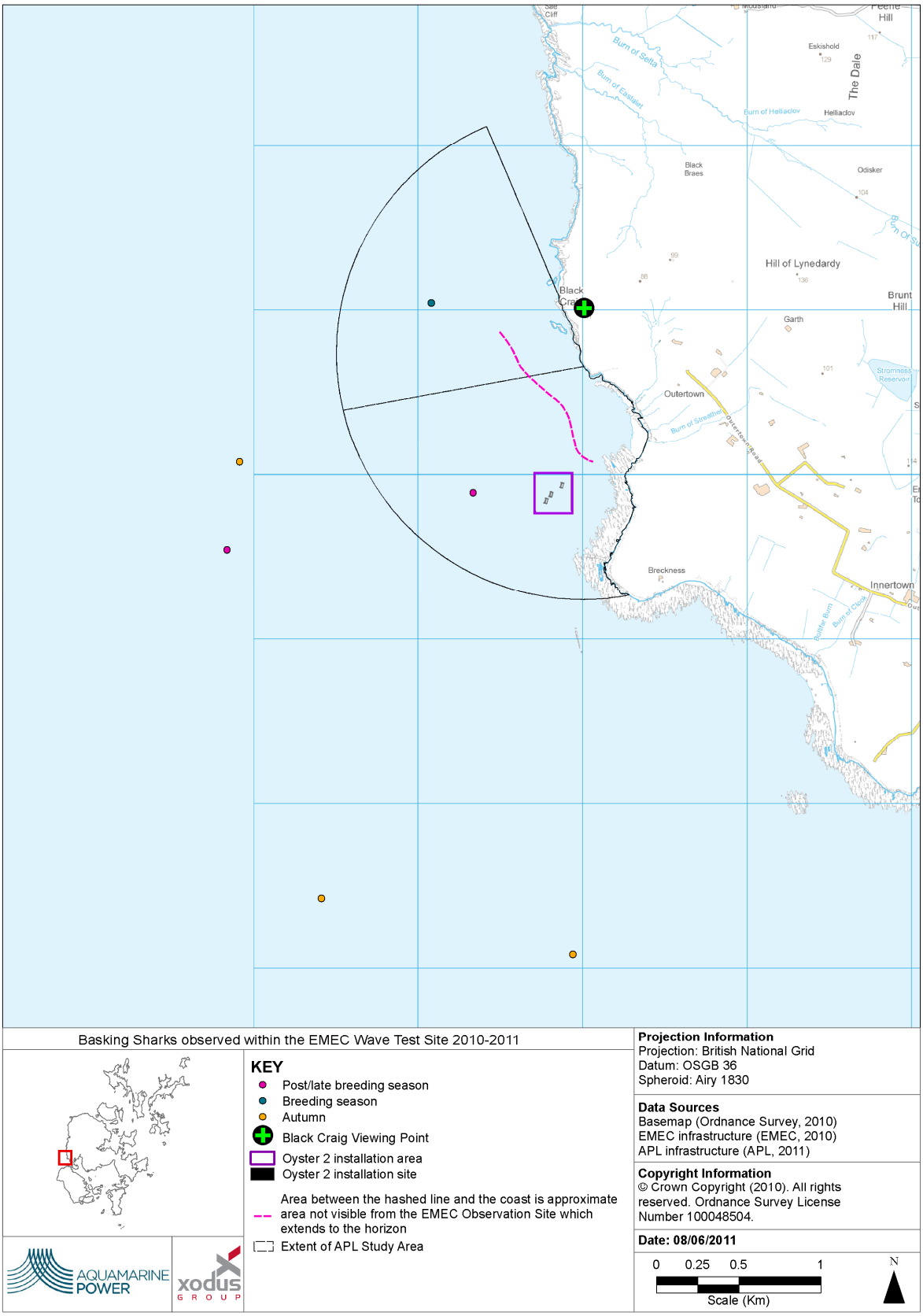

Figure 4.6 EMEC basking shark observations during 2010 – 2011

4.3 Seabirds

Taxon	Seabird Species observed at the Billia Croo Wave Test Site (Offshore and Inner Bay Areas)
Seabirds	Arctic skua (*Stercorarius parasiticus*) Fulmar (*Fulmarus glacialis*) Great black-backed gull (*Larus marinus*) Great skua (*Catharacta skua*) Guillemot (*Uria aalge*) Kittiwake (*Rissa tridactyla*) Peregine (*Falco peregrinus*) Puffin (*Fratecula arctica*) Red-throated diver (*Gavia stellata*) Common gull (*Larus canus*) Herring gull (*Larus argentatus*) Black-headed gull (*Chroicocephalus ridibundus*) Great black-backed gull (*Larus marinus*) Shag (*Phalacrocorax aristotelis*) Eider (*Somateria mollissima*) Cormorant (*Phalacrocorax carbo*) Arctic tern (*Sterna paradisaea*) Black guillemot (*Cepphus grylle*) Razorbill (*Alca torda*) Little auk (*Alle alle*) Whooper swan (*Cygnus cygnus*) Great northern diver (*Gavia immer*) Manx shearwater (*Puffinus puffinus*) Wigeon (*Anas penelope*)

Table 4.6 Summary of Seabird Species Observed During EMEC and Aquamarine Wildlife Monitoring.

There are specific areas along the west coast of the Orkney mainland which provide important habitats to a large variety of bird species, including breeding colonies and wintering sites. The most important sites are designated as internationally or nationally important areas, specifically, Marwick Head SPA and Hoy SPA. These sites are designated for supporting internationally important populations of seabirds and additionally for supporting seabird assemblages; refer to Table 4.7 for details. Only these two aforementioned SPAs were identified and raised by SNH during the EIA scoping process, for consideration in relation to the proposed Oyster 2 Array project.

In addition, the waters of Scapa Flow are notable for meeting SPA status criteria, having met criteria for both summer and winter seabird assemblages. In winter, two species, great northern diver and Slavonian grebe, are present in the Flow in internationally important numbers; in addition to significant numbers of wintering European shag (Dawson *et al*, 2009). In summer, observational work has shown that Scapa Flow is a key foraging area for red-throated divers which nest within the Hoy SPA. The importance of such coastal habitats (for regional, national and international seabird populations) is acknowledged, in addition to their proximity to the proposed development site at Billia Croo. However, it is noted that the coastline adjacent to the Billia Croo wave test site does not support as large seabird populations as those which occur elsewhere along the west coast of the Orkney mainland, or Scapa Flow.

Table 4.6 above shows the seabird species recorded at Billia Croo and in the wider environment by both the Aquamarine Power and EMEC marine wildlife monitoring. The EMEC data provides information regarding the movements of seabirds in more offshore habitats and shows that some species are widely distributed across the site (not just in the inner bay area),; these species include fulmar, great skua, great black-backed gull (particularly winter observations), guillemot, kittiwake and shag.

SPA	Qualifying Species	Qualifying Interests
Hoy SPA	Arctic skua (*Stercorarius parasiticus*) Fulmar (*Fulmarus glacialis*) Great black-backed gull (*Larus marinus*) Great skua (*Catharacta skua*) Guillemot (*Uria aalge*) Kittiwake (Rissa tridactyla) Peregine (Falco peregrinus)* Puffin (Fratecula arctica) Red-throated diver (Gavia stellata) Seabird assemblage (qualifying species: Arctic skua, Fulmar, great black-backed gull, guillemot, kittiwake, puffin).	Hoy SPA qualifies under Article 4.1 by regularly supporting populations of European importance of the Annex 1 species: red-throated diver *Gavia stellata* (58 territories, 6% of the GB population) and peregrine *Falco peregrinus* (6 pairs, 0.5% of the GB population). Hoy SPA further qualifies under Article 4.2 by regularly supporting populations of European importance of the migratory species: great skua *Stercorarius skua* (1,900 pairs, 14% of the world biogeographic population). Hoy SPA also qualifies under Article 4.2 by regularly supporting in excess of 20,000 individual seabirds. It regularly supports 120,000 seabirds including nationally important populations of the following species: Atlantic puffin *Fratercula arctica* (3,500 pairs, 0.7% of the GB population); black-legged kittiwake *Rissa tridactyla* (3,000 pairs, 0.6% of the GB population); Arctic skua *Stercorarius parasiticus* (59 pairs, 2% of the GB population); Northern fulmar *Fulmarus glacialis* (35,000 pairs, 6% of the GB population); great black-backed gull *Larus marinus* (570 pairs, 3% of the GB population); guillemot *Uria aalge* (13,400 pairs, 2% of the GB population).
Marwick Head SPA	Guillemot (*Uria aalge)* Kittiwake (*Rissa tridactyla)* Seabird assemblage (qualifying species; kittiwake)	Marwick Head qualifies under Article 4.2 by regularly supporting populations of European importance of the migratory species: guillemot *Uria aalge* (37,700 individuals 1.1% of the western European biogeographic population). Marwick Head SPA also qualifies under Article 4.2 by regularly supporting in excess of 20,000 individual seabirds. It regularly supports 75,000 seabirds including nationally important populations of the following species: black-legged kittiwake *Rissa tridactyla* (7,700 pairs, 2% of the GB population) and guillemot *Uria aalge* (37,700 individuals, 4% of the GB population).

Table 4.7 Details of SPA Designations Local to Billia Croo.

** It is noted that peregrine falcon is a qualifying species for Hoy SPA, however no observation of this species were made at Billia Croo during at any time during the survey, therefore this species has not been included in the assessment.*

As previously described, Aquamarine Power and EMEC have collected seabird data for the Billia Croo inner bay area and wider wave test site respectively and this has been analysed to provide more specific data on the bird populations present and the proposed Oyster 2 Array development and in the surrounding area.

Data obtained from the Aquamarine Power monitoring of the inner bay has been summarised in Table 4.6. The table presents both maximum numbers of birds expected to be present in the survey area, based on the results of the wildlife monitoring. This figure is the maximum number of individual seabirds (of a particular species) likely to be observed at the site, based on the time taken to complete scans and the number of seabirds observed during the scans. The month column describes the month in which the maximum number of individual seabirds were observed.

Seasonality of sightings has been taken into account in the analysis, with the following distinctions used to assess the monitoring data for seabird species:

- April to June: breeding season (B)
- July to August: Post/Late breeding season (P/L B)
- September to October: Autumn (A)
- November to March: Winter (W)

Species	Month	Maximum number of individuals likely to be observed	B	P/L B	A	W	General distribution across the Aquamarine Power inner bay survey area
Red-throated diver	September	2	×	✓	✓	×	The species was recoded in the inner bay area during the post/late breeding and autumn seasons only, with very low numbers of observations, all of which occurred in close proximity to the proposed Oyster 2 Array
Fulmar	June	241	✓	✓	✓	✓	Fulmar was recorded throughout the duration of the inner bay monitoring, with the greatest number of birds occurring throughout the breeding and winter seasons. The majority of observations were distributed to the north and north-west of the proposed array, with the greatest number of fulmars recorded in close proximity to the proposed Oyster 2 Array during the breeding and post/late breeding seasons
Manx shearwater	September	3	×	×	✓	×	Only very few observations of Manx shearwater occurred in the inner bay area during the autumn, with two to five birds recorded to the north-west of the proposed Oyster 2 Array
Gannet	August	44	✓	✓	✓	✓	Gannet was recorded in the inner bay area throughout the wildlife monitoring, with greatest numbers of birds recorded during the post/late breeding and autumn seasons, and with very few gannet observations during the breeding and winter seasons. During the post/late breeding and autumn seasons, observations were recorded within close proximity to the proposed Oyster 2 Array location, with the majority of observations recorded within 300 m of the proposed development
Cormorant	August	1	×	✓	×	✓	Very few observations of cormorant were recorded, with only one observation occurring in close proximity to the proposed Oyster 2 Array (within 200m) during the post/late breeding season and very low numbers occurring during the winter with observations recorded only at the survey extent
Shag	December	551	✓	✓	✓	✓	Shags were record in close proximity to the proposed Oyster 2 Array (within 100 to 600m) throughout the year, with the greatest number of observations recorded during the autumn and winter, but also with relatively large distributions occurring during the breeding and post/late breeding season
Whooper swan	May	1	✓	×	×	×	A single whooper swan was observed within 400m of the proposed Oyster 2 Array during the breeding season

Species	Month	Maximum number of individuals likely to be observed	B	P/L B	A	W	General distribution across the Aquamarine Power inner bay survey area
Eider	March	50	✓	✓	✓	✓	This species was recorded in the inner bay throughout the duration of the wildlife monitoring, with the greatest distributions occurring during the winter months and within close proximity to the proposed Oyster 2 Array. The majority of observations were recorded to the north-east of the proposed development, with eiders present mostly in marine habitat adjacent to the coastline
Arctic skua	June	3	✓	✓	×	×	Arctic skua were recorded in low numbers in the inner bay, with few observations recorded during the breeding and post/late breeding season only and all observations located more than 100 m or more from the proposed Oyster 2 Array
Great skua	June	14	✓	✓	✓	×	Great skua were recorded in the inner bay during the breeding, post/late breeding and autumn seasons only, with the greatest number of observations occurring in close proximity to the proposed Oyster 2 Array during the post/late breeding season. Few observations of great skua were recorded during the autumn months and observations occurring during the breeding season were largely located 500-600 m from the proposed Oyster 2 Array
Black-headed gull	May	2	✓	×	×	×	Few observations of black-headed gull were recorded at the site, with two to five birds recorded at approximately 500 m from the proposed Oyster 2 Array during the breeding season only
Common gull	November	154	✓	✓	✓	✓	Common gull was recorded at the site throughout the year, with observations largely occurring within 100-600 m of the proposed Oyster 2 Array, to the north-east of the proposed development adjacent to the shoreline. The greatest number of common gull observations was recorded during the autumn
Lesser black-backed gull	April	6	✓	×	×	×	Very few observations of lesser black-backed gull occurred at the site, with few observations recorded within 500-600 m of the proposed Oyster 2 Array, during the breeding season only
Herring Gull	November	41	✓	✓	✓	✓	Herring gull was observed at the inner bay throughout the year, with the majority of observations occurring to the east of the proposed Oyster 2 Array, adjacent to the coastline. Relatively scattered and dispersed observation of this species was recorded during the winter, with the greatest number of observations occurring during the autumn

Species	Month	Maximum number of individuals likely to be observed	B	P/L B	A	W	General distribution across the Aquamarine Power inner bay survey area
Great black-backed gull	October	42	✓	✓	✓	✓	This species was observed at the site throughout the year, with a relatively scattered distribution of observations occurring within 600m of the proposed Oyster 2 Array during the breeding, post/late breeding and autumn seasons. During the winter months, observations were largely located to the west and north-west of the proposed Oyster 2 Array, with observations scattered across the inner bay area
Kittiwake	November	26	✓	✓	✓	✓	Kittiwake was recorded in the inner bay area throughout the year, with a single observation observed during the breeding and autumn seasons and 3 observations recorded in close proximity to the proposed Oyster 2 Array during the post/late breeding season. During the winter months slight more observations of kittiwake were recorded, with the majority of observations located to the north-west of the proposed development area
Arctic Tern	June	20	✓	×	×	×	Arctic tern was recorded at the inner bay area during the breeding season only, with few observations located to the west of the proposed Oyster 2 Array. The majority of observations were located more then 600 m from the proposed development location
Guillemot	April	21	✓	✓	✓	✓	Guillemot was recorded at the inner bay area throughout the year, with the majority of observations occurring during the breeding season, located to the immediate north and north-west of the proposed Oyster 2 Array. Very few observations of this species were recorded during the post/late breeding season (two birds, located approximately 500-600m from the proposed development), with few and scattered observations occurring during the autumn and winter months, largely located to the north and west of the proposed Oyster 2 Array
Razorbill	March	19	✓	×	✓	✓	No razorbill observations were recorded within the footprint of the proposed development, with the majority of observations occurring more than 200m north of the proposed during the breeding and winter season, when observations were more scattered across the inner bay area. One observation was recorded approximately 500m west of the proposed Oyster 2 Array, during the autumn months, with no observations of razorbill occurring during the post-late breeding season

Species	Month	Maximum number of individuals likely to be observed	B	P/L B	A	W	General distribution across the Aquamarine Power inner bay survey area
Black guillemot	March	25	✓	✓	✓	✓	Black Guillemot was recorded at the site throughout the wildlife monitoring, with the majority of observations scattered across the inner bay and occurring to the north and north-west of the proposed Oyster 2 Array, recorded during the breeding, post/late breeding and winter seasons. Black guillemots were most widely distributed across the site during the winter season, when the majority of black guillemots were observed in close proximity to the proposed Oyster 2 Array (i.e. within 600m). Only one observation of black guillemots (two –five birds) was recorded during the autumn, at approximately 700m from the proposed development location
Little Auk	September / December	1	×	×	✓	✓	Very few observations of little auk occurred throughout the monitoring, with only two observations during the autumn months and one observation during the winter. These observations were located in the southern half of the inner bay area, the closest occurring at approximately 200m to the proposed Oyster 2 Array location
Puffin	June	4	✓	✓	✓	✓	Puffins were recorded in very low numbers in the southern area of the inner bay throughout the wildlife monitoring, with the majority of observations occurring approximately 400m (or greater) north of the proposed Oyster 2 Array. Only one observation occurred during the autumn, with two occurring during the winter, recorded at more than 600m north-west of the device; the greatest number of puffins was recorded during the breeding season, with observations occurring to the north of the propose Oyster 2 Array
Auk Species	June	155	✓	×	×	×	Unidentified auk species and guillemot or razorbill observations show a similar distribution and occurrence, with low number of observations occurring only during the breeding season and to the north-west of the proposed Oyster 2 Array within the southern half of the inner bay area.
Guillemot or Razorbill	April	5	✓	×	×	×	

Table 4.6 Summary of the Maximum Number of Seabird Species, Likely to be Observed at the Inner Bay of Billia Croo, Based on the Results of the Aquamarine Power Wildlife Monitoring.

The seabird assemblage occurring at the inner bay area is relatively diverse, with a total of 22 species recorded during the Aquamarine Power wildlife monitoring. Several species are notable for an almost constant presence at the site throughout all seasons; including fulmar, gannet, shag, eider, guillemot, great skua and common gull. Fulmar was observed in high numbers throughout the wildlife monitoring, with the greatest number of birds recorded in the breeding and post/late breeding season. Gannet also recorded throughout the year, was observed in greatest numbers during the breeding and wintering seasons. Guillemot also recorded in relatively high numbers throughout the year, was observed in greatest numbers during the breeding season. Common gull observations, although recorded at the inner bay throughout the year, were largely located to the north-east of the proposed Oyster 2 Array, adjacent to the coastline, with greatest numbers occurring in the autumn.

Notably, shag was recorded in close proximity to the proposed Oyster 2 Array (i.e. within 100-600m) throughout the year, with greatest numbers occurring in autumn and winter. Eider, also recorded in greatest numbers during the winter, showed a distinct distribution throughout the year, with the majority of observation located to the east of the proposed Oyster 2 Array, adjacent to the coastline.

Less abundant species record at the site include great skua; observations of which were located outwith the footprint of the proposed Oyster 2 Array. Herring gull observations occurring throughout the year, were largely located to the east of the device, with scattered observations across the inner bay during the winter months. Great black-backed gull observations have a scattered distribution across the site; slightly less abundant razorbill observations were largely recorded approximately 200m north of the proposed Oyster 2 Array location. Black guillemot observations showed an even distribution across the site, with the majority of observation occurring to the north-west of the proposed Oyster 2 Array and within the winter season.

Seabird species recorded in relatively lower numbers and largely seasonal visitors to the inner bay area include the following; red-throated diver, manx shearwater, cormorant, whooper swan, arctic skua, black-headed gull, lesser black-backed gull, kittiwake, arctic tern, little auk, puffin and other observations of unconfirmed auk species. It is considered that the aforementioned species recorded at inner bay area (due to their seasonal occurrence and relatively low abundance) were recorded in insignificant numbers, particularly when considering population estimates at a regional or national level.

As noted previously, the EMEC data shows several species (frequently recorded in the inner bay area by the Aquamarine Power monitoring), as having a wider distribution across the site, in addition to the inner bay area. Kittiwakes and puffins were recorded more frequently by the EMEC monitoring, particularly in the winter months; this is likely due to the greater area of survey coverage enabled by the EMEC methodology. Notably, increased sightings of puffins were recorded by EMEC over the wider site during the breeding season also. Results of the monitoring for guillemot concur for each data set; with the largest sightings of birds recorded to the immediate north-west of the proposed Oyster 2 Array during the breeding season and a presence at the site throughout the year, with the second greatest sightings of birds recorded in the winter months, when EMEC data records birds over the wider site in a similar (but less abundant observations) than guillemots recorded during the breeding season. Data monitoring sets for shag also concurs, with the greatest number of observations of this species occurring in the inner bay and wider site during all seasons with a particularly high number of observations during the winter. Notably, EMEC observations recorded eider presence in the winter months only, however Aquamarine monitoring identified the presence of eider at the inner bay throughout the year, with greatest numbers occurring in the winter. Notably, both data sets show eider distributed along the coastline, with birds occurring in waters between the

proposed Oyster 2 Array location and the shore. A summary of seabird results obtained from the EMEC monitoring is provided below in Table 4.8.

Seabird Species	Season(s) Observed	General distribution across the wider site
Arctic skua	Breeding, Post/late breeding	Relatively few observations, widely distributed across the site, with scattered and infrequent observations only
Great black-backed gull	Breeding, Post/late breeding Autumn Winter	Distributed across the wider wave test site, with several offshore sightings and the greatest observations of birds occurring within the winter
Eider	Winter	Sightings of eider were restricted to the winter months only, with all observations being located in close proximity to the coastline including the footprint of the proposed Oyster 2 Array
Fulmar	Breeding, Post/late breeding Autumn Winter	Fulmar was one of the most abundant species recorded throughout the wave test site, with frequent observations throughout the year, with greatest observations of birds occurring in the breeding, post/late breeding and winter season. There were notably fewer observations during the autumn
Great skua	Breeding, Post/late breeding Autumn Winter	Great Skua were recorded throughout all seasons, with the greatest observations of birds recorded during the breeding/post late breeding season and only a single record of great skua recorded during the winter. Some birds were recorded utilising habitats within close proximity to the proposed Oyster 2 array location; however the majority of birds recorded were widely dispersed across the site, with numerous sightings occurring at more than 1 km offshore
Guillemot	Breeding, Post/late breeding Autumn Winter	The majority of birds were observed in a clumped distribution, occurring to the north and north-west of the proposed Oyster 2 Array and within 1 – 2 km offshore
Kittiwake	Breeding, Post/late breeding Autumn Winter	Kittiwake was recorded throughout all seasons, with a generally sparse distribution of observations and the majority of sightings occurring over 1 km offshore. Greatest numbers of observations were during the winter, with only a single record occurring in close vicinity to the proposed Oyster 2 Array footprint (during the autumn)
Puffin	Breeding, Post/late breeding Autumn Winter	Puffins were recorded in all seasons, but there were less observations occurring during the autumn and winter compared to the breeding and post/late breeding seasons. The majority of puffins were observed utilising marine habitat to the north and north-west of the proposed Oyster 2 Array, with a small number of birds recorded within the proposed development footprint. Puffins were generally not observed further offshore than 2 km

Seabird Species	Season(s) Observed	General distribution across the wider site
Shag	Breeding, Post/late breeding Autumn Winter	Shag was one of the most commonly observed species recorded, with frequent observations throughout the year. Greatest observations of birds occurring in the breeding and wintering seasons. Numerous observations of shag occurred within the proposed development footprint and surrounding habitat; with the majority of observations occurring within 2 km of the coastline
Red-throated diver	Breeding	Five observations of red-throated diver occurred to the immediate east, south and south-east of the proposed Oyster 2 Array, recorded during the breeding season. The majority of these observations were recorded in water located between the coastline and proposed development footprint. One observation of red-throated diver was recorded during the winter months, located at approximately 600 m south of the proposed Oyster 2 Array footprint

Table 4.8 Summary of Seabird Species Observed During EMEC Wildlife Monitoring (2010-2011).

4.4 Baseline Summary and Sensitivity of Species Taken Forward for Assessment

Following consideration of the desk and field study results, the species listed in Table 4.9 have been selected for assessment. The table also summarises the sensitivity of the species listed.

Taxon	Species Selected for Assessment	Sensitivity
Marine Mammals	All cetacean species Grey Seal Harbour Seal	Wildlife monitoring has identified use of marine habitats by marine mammals within the development footprint and surrounding environment All cetacean species are classified as European Protected Species Cetaceans and seals are considered significant at regional, national and international levels **High sensitivity**
Fish	Basking shark	Basking sharks have been recorded in the surrounding environment and within 600m of the development Basking sharks are listed as vulnerable on the IUCN red list and are fully protected under Schedule 5 of the Wildlife and Countryside Act (1981) against disturbance in British waters **High sensitivity**

Taxon	Species Selected for Assessment	Sensitivity
Seabirds	Arctic skua Fulmar Great black-backed gull Great skua Guillemot Kittiwake Puffin Red-throated diver Shag Eider	All seabird species which qualify as interest features of Hoy or Marwick Head SPA have been selected for assessment due to their ecological significance and high sensitivity. In addition to SPA species, other potentially locally or regionally significant species have been selected **High/very high sensitivity**

Table 4.9 Summary of Species Selected for Assessment and their Sensitivity

5. IMPACT ASSESSMENT

5.1 Overview of Potential Impacts

A summary of the potential environmental impacts that might be associated with each taxon are summarised in Table 5.1, below.

Taxon	Potential Impacts
Cetaceans, Seals, Fish	▪ Physical damage from anchor drilling and vessel noise ▪ Auditory damage from anchor drilling and vessel noise ▪ Auditory damage from movement/presence of wave energy convertors ▪ Indirect impacts due to effects on prey species
Cetaceans, Seals, Fish, Seabirds	▪ Disturbance/displacement from anchor drilling and vessel noise/presence ▪ Physical damage from movement/presence of wave energy converters ▪ Disturbance/displacement from movement/presence of wave energy convertors ▪ Habitat exclusion and/or creation ▪ Contamination from accidental discharges and spills

Table 5.1 Overview of Potential Marine Wildlife Impacts

Potential effects on each taxon will be dependant upon the species and number of species present within the proposed development footprint (and immediate surrounding environment) at the time when potentially impacting activities are taking place. With regards to ecological receptors and levels of sensitivity, this will also likely to be dependant upon the time that particular activities are taking place, due to the seasonality of fish, seabird and cetacean species. For example, some seabird species may be more sensitive to impacts during the breeding season, whilst other species may be more sensitive during the wintering season. In addition, depending upon the timing of activities, migratory species may also be affected.

For all taxon, installation, construction, and decommissioning phases are likely to be the most impacting; with the highest levels of disturbance (from underwater noise, vibration and general vessel activity) likely to occur within this period. However impacts may also occur during the testing (operation) and maintenance of the devices. Impacts from all development phases are considered in the following sections.

5.2 Marine Mammals

5.2.1 Assessment of effects

Wildlife monitoring has identified the use of the Billia Croo wave test site by marine mammals. All cetacean species are classified as European Protected Species and therefore carry international importance. In addition to cetaceans, grey and harbour seals carry local and national significance and the species observed at the Billia Croo wave test site may also be linked to larger, internationally important sites protected for their seal populations. These species are therefore considered in the following assessment.

Construction, installation and decommissioning

The marine wildlife monitoring that has been undertaken by Aquamarine Power and EMEC indicates that the majority of species of cetacean appear to only pass through the wave test

site, and generally through the deeper water offshore berths, rather than directly through the inshore location of the Oyster 2 Array. The Billia Croo wave test site is not believed to be used as a foraging habitat and therefore the Oyster 2 Array project will not directly affect cetacean foraging habitat or cetacean foraging behaviours.

During construction and installation and decommissioning of phase 2 of the Oyster 2 Array, impacts on marine mammals (cetaceans and seals) are likely from the presence of vessels and general construction activity at the Oyster 2 Array location. This will include underwater noise generated by both vessels and the drilling of anchors (rock anchors, latching anchors and stabilisation anchors).

The equipment proposed for the drilling of the various anchors will emit less noise than that associated with the drilling of the monopile foundation (already consented as part of the first phase of the Oyster 2 Array). The vessels associated with the installation of Oyster 2b and Oyster 2c will comprise tugs and multi-cats. There will be no large jack-up barge required for the anchor drilling. The vessels are therefore also expected to be less noisy than those associated with Phase 1 of the Oyster 2 Array project.

Subacoustech were commissioned to undertake an assessment of underwater noise effects from the Oyster 2 Array. Their initial assessment (Subacoustech, 2010) undertaken to support the environmental assessment for Phase 1 of the Oyster 2 Array modelled noise associated with the drilling of the pile/monopole foundations and installation vessels (including a jack-up drilling barge). This assessment has been updated (Subacoustech, 2011) to consider the underwater noise impacts from the anchor drilling operations required as part of Phase 2 of the Oyster Array project. This work has included the modelling of underwater noise propagation.

The modelling results show that the levels emitted from the drilling of anchors and general vessel activity are not sufficiently high to cause physical or auditory damage to any cetaceans or seals.

Although some disturbance may be exerted within a few metres (< 10 m) of anchor drilling activities, the noise emitted from vessels, will extend over a greater area than the anchor drilling emissions and thus any individuals likely to demonstrate disturbance behaviour would be likely to encounter this reaction well outwith the range over which anchor drilling activities could possibly exert any impact. There is also no possibility that marine species would be exposed to a rapid rise in noise emissions from the anchor drilling against an ambient noise level as the vessels involved in the installation and construction activities will be operating throughout the installation period.

The majority of cetaceans species recorded during monitoring were observed over 600 m from the Oyster 2 Array location, with the exception of harbour porpoise, observed within 400 m of the proposed Array location during April and May. The majority of observations were therefore outwith the potential zone of disturbance impacts and additionally it should be noted that this species is common throughout Orkney waters. With a potential consequence of impact, taking into account the international importance of cetaceans and their high sensitivity, of moderate, and a remote likelihood given that the majority of observations were outwith the potential zone of disturbance, the significance is assessed to be minor and not significant.

Seal species were recorded within the proposed Array location and surrounding environment, particularly grey seals, which were most frequently observed during May/July; it is therefore possible that disturbance will take place to seal species, if present in the vicinity of the proposed Oyster 2 Array location during construction activities. Underwater noise from installation operations is likely to be perceived by seals at a low level (even for harbour seal which is considered to be the most sensitive species of seal to underwater noise), with a mild

behavioural response likely if a seal occurs within close proximity to installation operations (Subacoustech, 2011).

Grey seals have been observed using habitats at the site throughout the year, with the greatest numbers observed from July to August, when seals were recorded within the footprint of the proposed development. Overall the number of grey seals observed at the site is small. It should also be noted that the Orkney grey seal population is relatively healthy. Using a PBR approach (Lonergan, 2011), SMRU 2011b estimate that 959 out of an estimated population of 15,976 grey seals in Orkney and along the north coast of Scotland, 6% could be safely removed in 2010 without threatening the population.

Harbour seals were observed during the autumn and winter months only, with few records occurring in close vicinity to proposed development site; the majority of harbour seals were recorded more than 500 m away from the site. The apparent seasonality of seal occurrence at the site may be a reflection of the seasonality of seal prey species occurring at the site, or may be related to the use of haul-out sites occurring elsewhere in Orkney, in accordance with pupping seasons. Harbour seals give birth to their pups in June and July and moult in August. At these, as well as other times of the year, harbour seals haul out on tidal rocks and sandbars, with the pups taking to the water soon after birth. Harbour seal movements are relatively local compared to grey seals, and there is less movement between haul out regions than there is for grey seals (SMRU 2011). The proposed development is c. 65 km swimming distance from the harbour seal SAC at Sanday, and clearly falls outside the main areas used by adults from Sanday and other nearby islands (Eynhallow, Rousay and Stronsay) as shown by tagging studies (SMRU 2011a). However, tagging studies of pups show that they wander much more widely, and could potentially visit the development area (SMRU 2011a).

The proposed Oyster 2 Array is c.8.7 km and c.4.2 km respectively from the major August haul outs identified by SMRU 2011a in the Bay of Ireland, east of Stromness, and on the north tip of Hoy. It is only c.0.5 km from the minor haul out at Breckness Point, and 4.7km from the well known haul out at Point of Ness near Stromness. All of these haul outs are within easy foraging distance of the proposed development site.

The Orkney harbour seal population is in a parlous state, having declined greatly in recent years. Using a PBR approach (Lonergan 2011), SMRU 2011b estimate that only 18 out of an estimated population of 2989 common seals in Orkney and along the North coast of Scotland, 0.6%, could safely be removed in 2010 without threatening the population.

Grey seals may be considered to have high sensitivity, and assuming the magnitude of impact (as defined in Section 3) is minor, the potential consequence of impact is considered to be moderate. Overall, potential for disturbance due to underwater noise is considered to be relatively remote, with disturbance of grey seal species likely to result from increased vessel traffic and disturbance of the water column. In addition, whilst sightings of grey seals have been greatest in summer months, installation activities are intended to occur outwith the grey seal pupping season which occurs from October to March. Therefore, the significance of potential impacts on grey seals due to installation and decommissioning of the Oyster 2 Array Project is considered to be minor and not significant.

Harbour seals, due to the parlous state of the population, are considered to have very high sensitivity. Assuming the same magnitude of impact as described above, the potential consequence of impact is considered to be moderate. As with grey seals, the potential for disturbance due to underwater noise is considered to be remote, with disturbance more likely to result from increased vessel traffic and disturbance of the water column. Sightings of harbour seals suggest they use the Oyster 2 Array Project development area less during their pupping season and more during the winter months. The likelihood of an impact occurring due to

temporary installation or decommissioning activities is therefore considered to be remote. Thus, the significance of potential impacts on harbour seals due to installation and decommissioning of the Oyster 2 Array Project is considered to be minor and not significant.

The most likely potential source of contamination during construction, installation and decommissioning will relate to leaks of oil from vessels and ancillary construction equipment such as underwater power tools. Appropriate measures and working practices will be in place to reduce the risk of contamination as much as possible, therefore the likelihood of contamination from oil leaks is considered extremely remote.

Wildlife monitoring has shown limited and occasional use of the inner bay area by a small number of marine mammal species. Temporary disturbance to marine mammals may result from increased vessel traffic and construction operations, however consideration of potential underwater noise impacts, and risk of contamination has concluded that no significant impacts will be exerted on marine mammal species. The overall significance of potential impacts on marine mammal species during installation is considered to be minor and not significant.

Operation and maintenance

During the operational period vessels will only be present occasionally. However the WECs will be present and operational continuously over a period of up to 20 years. Data that has been collected by Aquamarine Power for the inner bay area indicates that the only marine mammal species likely to be present in the immediate vicinity of the Oyster 2 Array are grey seal, harbour seal and harbour porpoise. As noted previously, harbour seal is likely to be most sensitive to underwater noise; notably, operational noise levels are likely to be less than those experienced during construction operations, therefore the likelihood of impacts to marine mammals from underwater noise is considered to be unlikely. Grey seal, harbour seal and harbour porpoise may be sensitive to disturbance and displacement due to vessels present on site during maintenance operations, however potential impacts will be temporary only, with vessels slow moving or stationary for the duration of maintenance operations. Long term impacts of Oyster WEC device presence and operation are not yet known and until the acoustic signature of the Oyster technology is better understood it is difficult to assess the potential significance of impacts from the operation of the device. However based on our knowledge of the device and its moving parts underwater it is not expected to be as noisy as say vessel activity and any potential effects are expected to be less than is predicted during installation and construction, i.e. minor, and therefore will not be significant.

Natura interests

Grey seal - Based on the information provided above it is not thought that the proposed Oyster 2 Array will result in any detrimental effect on the Faray and Holm of Faray SAC, or any other grey seal SAC in Scotland.

Harbour seal - The proposed development is c. 65 km swimming distance from the nearest harbour seal SAC at Sanday, and clearly falls outside the main areas used by adults from Sanday and other nearby islands (Eynhallow, Rousay and Stronsay) as shown by tagging studies (SMRU 2011a). However, tagging studies of pups show that they wander much more widely, and could potentially visit the development area (SMRU 2011a). Based on the nature of activities during installation, construction and decommissioning and the testing of the Oyster technology at Billia Croo it is very unlikely that these will result in the killing of harbour seals and therefore unlikely to result in the removal of any individuals from this or any other harbour seal SAC population in Scotland.

5.2.2 Management and mitigation

During an operation involving vessels, vessels will move slowly onto site and remain slow moving or stationary throughout the installation or maintenance period. Marine species will therefore be exposed to a slow rise in noise levels and thus have the opportunity to move away from the small area (90 – 500 m) in which vessels may exert any impact.

Although the anchor drilling operations are not expected to result in any significant disturbance or displacement of marine mammals, it should be noted that anchor design will aim to minimise drilling time without compromising the technical performance of the anchor.

Due to the nature of the vessels and drilling activity associated with Phase 2 of the Oyster 2 Array, no further specific mitigation measures, for example deployment of a Marine Mammal Observer (MMO), are considered necessary during the construction and installation.

As stated above there is still some uncertainty over the impacts that the operation of the Oyster technology may have on marine mammals. Continued marine wildlife monitoring at Billia Croo during the operational phase of the Oyster 2 Array will establish if there is any long term disturbance impacts from the presence and movement of the devices (see Section 7).

Further consultation with Marine Scotland will establish the need for a European Protected Species (EPS) licence with regards to potential to impact whales and dolphins.

Aquamarine Power is aware of the recently implemented Seal Licence system under the Marine (Scotland) Act 2010. Consultation with Marine Scotland will establish any potential requirement for such a licence with regard to Phase 2 of the Oyster 2 Array.

5.2.3 Residual impacts

It is likely that any potential impacts on marine mammals may occur from construction operations, particularly installation of devices and subsea infrastructure, when disturbance of marine habitats at the site is more likely. Potential impacts to marine mammals from underwater noise are considered to be minor (if any) and general disturbance from vessel presence and drilling activities will be temporary in nature. In addition, due to the volume of existing vessel traffic in the area marine mammals may be habituated to vessel noise and traffic. Despite the infrequent and irregular presence of cetacean species in the inner bay area, seasonal presence of seal species and temporary and minor nature of potential construction impacts, the high sensitivity of marine mammal species has been taken into account and the residual impact significance remains at minor and therefore not significant. Ongoing monitoring and a growing evidence base will help to ensure this residual significance remains the case.

5.3 Fish

5.3.1 Assessment of effects

Wildlife monitoring has identified the use of the Billia Croo wave test site by basking sharks. Basking sharks are listed as vulnerable on the IUCN red list and are fully protected under Schedule 5 of the Wildlife and Countryside Act (1981) against disturbance in British waters. Basking sharks have been selected as the only fish species to be taken forward in the following assessment.

Construction, installation and decommissioning

The desk study has indicated that there is potential for basking shark to be present in the local environment of the proposed development; this species may therefore be subject to temporary disturbance during the installation of the Oyster 2b and Oyster 2c devices, with potential for impact from seabed and sea water column disturbance, underwater noise from installation activities.

Underwater noise may be a principal impact on basking sharks, however noise modelling undertaken as part of the underwater noise impact assessment (Subacoustech 2010, Subacoustech 2011), shows that levels emitted by vessels and the drilling of anchors are not sufficiently high to cause physiological damage to fish species; additionally, vessel noise is unlikely to produce a behavioural response in fish species. Disturbance is likely within close vicinity of the drilling operations; however it is likely that vessel noise (which will occur throughout installation, construction and decommissioning activities) will extend over a greater area; notably, due to the to existing vessel traffic occurring in the area, it is likely that fish species (including basking shark) will be habituated to such noise levels, and therefore disturbance will be minimal.

With regards to the likely impacts, a mild avoidance response is expected to installation operations; however the noise is likely to be of a low enough level to limit the impact. Notably, vessel noise may mask the drilling noise; it is expected that vessels will spend 60 days on site during both installation and construction and decommissioning. It is likely that impacts on basking shark from installation will be of a temporary and limited nature; therefore it is considered that impacts will be of a minor magnitude, leading to a potential consequence (given the high sensitivity of basking sharks) of moderate.

As noted above, basking sharks have been recorded during the marine wildlife surveys, within the vicinity of the proposed development site. There is therefore potential for this species to be in this area during the installation and operation of the Oyster 2b and Oyster 2c devices; consequently there is potential for disturbance or displacement of this species. Notably, slow moving vessels will enter the area prior to commencement of pilling operations (when vessels will be stationary); therefore it is likely that basking sharks will have time to exit the area, prior to installation works. The likelihood of any impact is therefore considered to be remote, giving a potential significance of minor and therefore not significant.

The most likely potential source of contamination during construction, installation and decommissioning will relate to leaks of oil from vessels and ancillary construction equipment such as underwater power tools. Appropriate measures and working practices will be in place to reduce the risk of contamination as much as possible, therefore the likelihood of contamination from oil leaks is considered extremely remote. The significance of impacts from contamination is therefore considered to be negligible and therefore not significant.

Operation and maintenance

Following installation, it possible that the operational noise and the presence of the Oyster 2b and Oyster 2c devices will affect basking sharks; however, based on the potential impact of noise impacts from the installation operations; there is potential that operational noise impacts may have a minor consequence. The presence of operation devices may deter basking sharks from entering the inner bay area and localised displacement of this species may occur, however the significance and magnitude of potential operational impacts to basking sharks are currently unknown and therefore are given a likelihood of 'possible'. Therefore, the significance, given an assumed minor consequence, of potential operation and maintenance impacts on basking sharks is considered to be minor and not significant.

5.3.2 Management and mitigation

During an operation involving vessels, vessels will move slowly onto site and remain slow moving or stationary throughout the installation period. Basking sharks will therefore be exposed to a slow rise in noise levels and disturbance of the water surface and thus will have the opportunity to move away from the small area (90 – 500 m) in which vessels may exert any significant impact.

Due to the nature of the vessels and drilling activity associated with Phase 2 of the Oyster 2 Array, no further specific mitigation measures (for example deployment of a Marine Mammal Observer (MMO) to include a procedure for basking sharks), are considered necessary during the construction and installation.

As stated above there is still some uncertainty over the impacts that the operation of the Oyster technology may have on basking sharks. Continued marine wildlife monitoring at Billia Croo during the operational phase of the Oyster 2 Array will therefore establish if there is any long term disturbance impacts from the presence and movement of the devices (see Section 7).

5.3.3 Residual impacts

Due to the volume of existing vessel traffic in the area basking sharks may be habituated to vessel noise and traffic. Localised vessel movement in the inner bay will be of a temporary nature, with vessels travelling at very low speeds. Despite the mitigation measures proposed regarding the slow movement of vessels to the site and developing the understanding of the Oyster technology, it is still relatively unknown how basking sharks will react to the Oyster 2 Array project. Therefore the residual impact significance is considered to remain as minor, and not significant.

5.4 Seabirds

5.4.1 Assessment of effects

Due to the number of seabird species considered in the impact assessment and the differences in their physiology and habitat use (influencing their specific sensitivities to the different types of activity associated with the second phase of the Oyster 2 Array project), this section has assessed impacts on a species by species basis; considering construction and installation, operation and maintenance and decommissioning. Following each species assessment a table is provided to highlight the resulting significance ranking for each of the project phases. This section should be read in conjunction with the following reports, which provide maps to illustrate the text:

- Xodus (2011), EMEC Marine Wildlife Monitoring Data Summary. Report by Xodus Aurora, Stromness, UK, to Aquamarine Power, Edinburgh, UK.
- Craigton Ecological Services, 2011. Analysis of marine wildlife monitoring data collected between April 2010 and March 2011 for Aquamarine Power Ltd in support of the Oyster 2 Environmental Statement. Craigton Ecological Services (on behalf of Aquamarine Power Limited).

All seabird species which qualify as interest features of Hoy or Marwick Head SPA have been included in the impact assessment due to their ecological significance and high sensitivity. In addition to SPA species, other potentially locally or regionally significant species have been included; these have been selected due to the recording of large numbers of seabirds within the vicinity of the development footprint (or immediate surrounding area), during a particular

season (e.g. breeding or overwintering period) when seabirds may be sensitive to potential impacts. The occurrence of large number of particular species may be significant in terms of national populations; this has also been considered when selecting seabird species for impact assessment, in addition to the possibility that the proposed development site comprise part of a locally important habitat. Species selected for assessment are now considered separately.

Arctic Skua

Reason for Inclusion in Impact Assessment
Qualifying species for Hoy SPA (Article 4.2, named component of seabird assemblage).

Arctic skua is a qualifying species for Hoy SPA with small numbers observed during the Aquamarine Power monitoring, located approximately 200-600 m north-west of the proposed development footprint, throughout the breeding/post breeding season only. EMEC data shows a scattered distribution of arctic skua, with several observations occurring in more offshore waters and only limited numbers occurring in the inner bay area. It is therefore concluded that the inner bay area is not of any greater importance than habitats occurring elsewhere within the wider site.

The UK population of arctic skua has declined consistently throughout the period of 1986-2010, with a population index suggesting a decline of 56% over this period (JNCC 2011). A survey of the Orkney population in 2010 found just 376 apparently occupied territories (AOT) compared to 720 AOT in 2000 (Meek 2011). Even taking into account these declines in breeding populations, the numbers of birds recorded at Billia Croo are not significant in local, national or international terms (Booth and Booth 2005, Forrester *et al*. 2007, Mitchell *et al*. 2004).

The activities with greatest potential to disturb birds present in the immediate development will take place during construction and installation, maintenance and decommissioning. These activities, with the exception of occasional maintenance vessel visits, will take place during the summer months, when arctic skua has been recorded in greatest numbers in close vicinity to the inner bay area. If birds are present at the site during these times, temporary disturbance and displacement may occur. These impacts are given a magnitude of minor and therefore a potential consequence of moderate. The probability of an impact occurring is considered unlikely given the temporary nature. Therefore, the overall significance to arctic skua during installation is considered to be minor and not significant.

During the operational period vessels will only be present occasionally, although the WECs will be present and operational continuously over a period of up to 20 years. Continued marine wildlife monitoring during the operational phase of the Oyster 2 Array will establish if there is any long term disturbance impacts from the presence and movement of the devices. As the impacts are relatively unknown at present, the likelihood is considered to be “possible”. Therefore, with a potential moderate consequence, the significance is deemed to be moderate and significant, requiring additional control measures and/or management.

Arctic skua do not spend a substantial amount of time on the sea surface (in comparison to species such as the puffin and guillemot) and are more aerial-based in their behaviour, and therefore are considered to be of lower sensitivity to potential pollution events. Due to the relatively low numbers of arctic skua likely to be present in the Oyster 2 Array (i.e. 3 individuals maximum during the breeding season) a lower impact consequence ranking is expected; resulting in a predicted impact significance of negligible.

Phase	Installation	Operation and Maintenance	Potential Pollution Events
Significance	**Minor**	**Moderate**	**Negligible**

Arctic skua

Natura interests

Billia Croo is within easy foraging range (Langston 2010) of arctic skuas breeding within the Hoy SPA, for which this species is a qualifying interest as part of the seabird assemblage. On Hoy and South Walls, numbers have declined precipitously from 72 pairs in 2000 (59 pairs within the SPA) to just 12 pairs in 2010 (Meek 2011).

If it is assumed (very conservatively) that every bird seen at Billia Croo during June (during the Aquamarine Power survey) was a breeding arctic skua from the Hoy and that only one bird from any pair was out at sea at any one time then this suggests up to 25% of the birds foraging from the Hoy breeding colony could potentially have been in the Billia Croo study area at any one time. However, during the breeding season, arctic skuas were only recorded within the study area on 2 dates, suggesting it is not a regularly used foraging area. Furthermore, given the large potential foraging range of this species (Langston 2010), and that they mainly forage by kleptoparasitism of other seabirds, it is thought extremely unlikely given its small scale that the proposed Oyster 2 Array could have any detrimental effect on the Hoy breeding population.

Guillemot

Reason for Inclusion in Impact Assessment
Qualifying species for Hoy SPA (Article 4.2, named component of seabird assemblage).
Qualifying species for Marwick Head SPA (Article 4.2 internationally important population and also named component of seabird assemblage).

Guillemot is a qualifying species for both Hoy and Marwick Head SPA and data collected by the Aquamarine Power marine wildlife monitoring has been recorded this species in relatively small numbers to the immediate north of the Oyster 2 Array. The majority of guillemots were recorded during the breeding season. EMEC data shows guillemot presence across the wider site during all seasons, with the majority of observations occurring to the north and north-west of the proposed development footprint. Greatest numbers of birds were recorded within 1-2km offshore, suggesting that the inner bay area, although utilised by this species, is not imperative to its occurrence at the site. As a consequence, both inside and outside the breeding season the maximum number of birds during a single scan within 600 m of the proposed Oyster 2 Array was only 5 birds. These numbers are insignificant in population conservation terms at a local, national or international scale (Mitchell *et al*. 2004, JNCC 2011, Forester *et al* 2007).

The activities with greatest potential to disturb birds present in the immediate development will take place during construction and installation, maintenance and decommissioning. These activities, with the exception of occasional maintenance vessel visits, will take place during the summer months. This is the period when guillemot have been recorded in greatest numbers in the inner bay area. However, if birds are present during these times, temporary disturbance and displacement may occur. These impacts are given a magnitude of minor and therefore a potential consequence of moderate. The probability of an impact occurring is considered

unlikely given the temporary nature. Therefore, the overall significance to guillemot during installation is considered to be minor and not significant.

During the operational period vessels will only be present occasionally, although the WECs will be present and operational continuously over a period of up to 20 years. Continued marine wildlife monitoring during the operational phase of the Oyster 2 Array will establish if there is any long term disturbance impacts from the presence and movement of the devices. As the impacts are relatively unknown at present, the likelihood is considered to be "possible". Therefore, with a potential moderate consequence, the significance is deemed to be moderate and significant, requiring additional control measures and/or management.

Due to ecology of this species, guillemots spend a substantial amount of time on the sea surface with moulting often occurring in the post-late breeding season, therefore guillemots are considered to be sensitive to potential pollution incidents, particularly accidental oil leaks. The likelihood of such an event is considered remote; as appropriate measures and best working practices will be in place during construction and installation operations. Therefore, assuming a potential moderate consequence, the impact significance is considered to be minor.

Phase	Installation	Operation and Maintenance	Potential Pollution Events
Significance	**Minor**	**Moderate**	**Minor**

Guillemot

Natura interests

Billia Croo is easily within foraging range (Langston 2010) of birds breeding within the Hoy and Marwick Head SPAs. For Hoy SPA, guillemots are a qualifying interest as part of the seabird assemblage. For Marwick Head they are a qualifying interest in the own right, as a European population of importance, constituting 1.1% of the western European biogeographic population, as well as part of the seabird assemblage.

During Seabird 2000 (1998-2000) c.14,590 pairs of guillemot bred on Hoy and South Walls (pairs calculated by multiplying 21,777 individuals on breeding ledges by 0.67, Mitchell *et al*. 2004) of which c. 13,400 pairs (SPA site citation) bred within the SPA. At Marwick, c. 23,235 pairs (34,679 individuals on breeding ledges multiplied by 0.67 (Mitchell *et al*. 2004)) were recorded during the same survey.

If it is assumed that every one of the maximum count of 20 individuals recorded during the Aquamarine Power survey during the breeding season were from the Hoy SPA, and that only one bird from any pair was out at sea at any one time, then this suggests that a maximum of 0.15% of the birds foraging from the Hoy breeding colony could potentially have been in the Billia Croo study area at any one time. The corresponding figure for the Marwick colony is 0.09%. These figures would be much lower if only birds within 600m of the devices were considered.

Thus, although on the basis of their diving behaviour potentially exposing them to physical contact with the devices, and being moderately sensitive to disturbance and inflexible in habitat requirements (King *et al*. 2010) guillemots could potentially have been sensitive to the proposed development, the very small numbers of birds recorded in the vicinity of the devices means that any detrimental effect on the Marwick Head and Hoy SPA populations is extremely unlikely.

Kittiwake

Reason for Inclusion in Impact Assessment
Qualifying species for Hoy SPA (Article 4.2, named component of seabird assemblage). Qualifying species for Marwick Head SPA (Article 4.2, named component of seabird assemblage).

Kittiwake is a qualifying species for both the Hoy and Marwick Head SPAs. However the results of the Aquamarine Power marine wildlife monitoring results show very small numbers were recorded in the inner bay area of the wave test site. Maximum numbers of birds were observed during the winter months. There were only very occasional sightings during the spring and summer months; with only a single sighting of kittiwake during the breeding season. EMEC data shows a scattered distribution of kittiwake across the site, with only one observation in close vicinity to the proposed development footprint and the majority of birds recorded in offshore waters. Results of the wildlife monitoring suggest that the inner bay area is not as important to this species as more offshore waters may be. The numbers of kittiwake are completely insignificant in population conservation terms at a local, national or international scale (Mitchell *et al*. 2004, JNCC 2011, Forester *et al* 2007).

As it is likely that construction will commence in May and continue through to September at the latest, disturbance and displacement impacts during installation are remote. Therefore, the impact significance on kittiwake during construction is considered to be negligible.

During the operational period vessels will only be present occasionally, although the WECs will be present and operational continuously over a period of up to 20 years. Continued marine wildlife monitoring during the operational phase of the Oyster 2 Array will establish if there is any long term disturbance impacts from the presence and movement of the devices. As the impacts are relatively unknown at present, the likelihood is considered to be “possible”. Therefore, with a potential moderate consequence, the significance is deemed to be moderate and significant, requiring additional control measures and/or management.

Kittiwake do not spend a substantial amount of time on the sea surface (in comparison to species such as the puffin and guillemot) and are more aerial-based in their behaviour, therefore are considered to be of lower sensitivity to potential pollution events such as oil leaks. Wildlife monitoring result indicate that habitats within the proposed development footprint and surrounding area are not utilised regularly or of importance to kittiwake, therefore a lower impact consequence ranking is expected; resulting in a predicted impact significance of negligible.

Phase	Installation	Operation and Maintenance	Potential Pollution Events
Significance	**Negligible**	**Moderate**	**Negligible**

Kittiwake

Natura interests

Billia Croo is easily within foraging range of birds breeding at either the Hoy or Marwick Head SPAs (Langston 2010), for both of which sites kittiwakes are a qualifying interest as part of the

seabird assemblage. However, with just a single sighting of a single bird during the breeding season it is seen as extremely unlikely that the proposed development would have a detrimental impact on either of these populations.

Fulmar

Reason for Inclusion in Impact Assessment
Qualifying species for Hoy SPA (Article 4.2, named component of seabird assemblage).

Fulmar is a qualifying species for Hoy SPA. Results from Aquamarine Power marine wildlife monitoring indicate that fulmar is one of the most abundant species present throughout the wider wave test site area at Billia Croo. The Aquamarine Power data collected for the inner bay area suggests that fulmar predominantly use marine habitats to the immediate north and north-east of the proposed Oyster 2 Array; with birds occurring throughout the year, with the greatest number of birds observed during the breeding season/post-late breeding season. Notably, although high numbers of birds were recorded at the site during the Aquamarine Power wildlife monitoring; compared to the number of birds in the estimated local, national and international breeding populations, the numbers of fulmar recorded at Billia Croo was very small.

EMEC collected data shows numerous birds recorded across the wider site during all seasons, with the majority of birds recorded within 1-2 km of the coastline, largely to the immediate north and north-west of the proposed development site.

The activities with greatest potential to disturb birds present in the immediate development will take place during construction and installation, maintenance and decommissioning. These activities, with the exception of occasional maintenance vessel visits, will take place during the summer months. This is the period when fulmar have been recorded in greatest numbers in the inner bay area. However, if birds are present during these times, there remains potential for temporary disturbance and displacement may occur. In the context of offshore wind farms, King *et al*. (2009) place fulmars in the least sensitive category both with respect to disturbance by ship and helicopter traffic, and with respect to habitat flexibility. Potential impacts are therefore given a magnitude of minor and therefore a potential consequence of moderate. The probability of an impact occurring is considered unlikely given the temporary nature. Therefore, the overall significance to fulmar during installation is considered to be minor and not significant.

During the operational period vessels will only be present occasionally, although the WECs will be present and operational continuously over a period of up to 20 years. As described above, in the context of offshore wind farms, King *et al*. (2009) place fulmars in the least sensitive category both with respect to habitat flexibility. Thus, given proportionally (relative to Hoy SPA, see *Natura interests* below) small numbers of fulmar present (particularly in the immediate vicinity of the devices), the remote probability of these birds coming into physical contact with the device, and their deemed resilience to both disturbance and habitat loss it is judged that impacts will be negligible and not significant.

Fulmar do not spend a substantial amount of time on the sea surface (in comparison to species such as the puffin and guillemot) and are more aerial-based in their behaviour, therefore are considered to be of lower sensitivity to potential pollution events such as oil leaks so a lower impact consequence ranking is expected; resulting in a predicted impact significance of negligible.

Phase	Installation	Operation and Maintenance	Potential Pollution Events
Significance	**Minor**	**Negligible**	**Negligible**

Fulmar

Natura interests

The estimated 35,000 pairs fulmar breeding in the Hoy SPA are a named component of the seabird assemblage which is one of its qualifying interests (SPA citation, Mitchell *et al*. 2004). Billia Croo is within easy foraging range of these birds (Langston 2010). However even if we assume every bird feeding at Billia Croo during the breeding season originated from Hoy, the peak count during the breeding season of 241 birds only represents 0.7% of breeding birds from this colony potentially at sea at any one time (assuming one member of each pair remains at the nest). The concentration of birds away from the devices further reduces the number of birds potentially exposed to them.

Great Black-backed Gull

Reason for Inclusion in Impact Assessment
Qualifying species for Hoy SPA (Article 4.2, named component of seabird assemblage).

This is a qualifying species for Hoy SPA, and Aquamarine Power marine wildlife monitoring results show the great black-backed gull to be on the sea in close vicinity to the Oyster 2 Array site and immediate surrounding habitat. The greatest numbers recorded in close vicinity to the proposed development footprint during the winter (42 birds in October). EMEC data shows scattered observations of great black-backed gull across the site, with several observations of birds in offshore waters and in concurrence with the Aquamarine observations, the greatest numbers of birds were found to occur during the winter months. The numbers recorded are not significant relative to either breeding or wintering populations at a local, national or international scale (Booth and Booth 2005, Mitchell *et al*. 2004, JNCC 2011 Calbrade *et al*. 2010, Forester *et al* 2007).

As it is likely that construction will commence in May and continue through to September at the latest, disturbance and displacement impacts during installation are remote. Therefore, the impact significance on great black-backed gull during construction is considered to be negligible.

During the operational period vessels will only be present occasionally, although the WECs will be present and operational continuously over a period of up to 20 years. Continued marine wildlife monitoring during the operational phase of the Oyster 2 Array will establish if there is any long term disturbance impacts from the presence and movement of the devices. As the impacts are relatively unknown at present, the likelihood is considered to be “possible”. Therefore, with a potential moderate consequence, the significance is deemed to be moderate and significant, requiring additional control measures and/or management.

Great black-backed gull do not spend a substantial amount of time on the sea surface (in comparison to species such as the puffin and guillemot) and are more aerial-based in behaviour, therefore are considered to be of lower sensitivity to potential pollution events such as oil leaks, so a lower impact consequence ranking is expected; resulting in a predicted impact significance of negligible.

Phase	Installation	Operation and Maintenance	Potential Pollution Events
Significance	**Negligible**	**Moderate**	**Negligible**

Great black-backed gull

Natura interests

Billia Croo is within easy foraging range (Langston 2010) of great black-backed gulls breeding within the Hoy SPA, for which this species is a qualifying interest as part of the seabird assemblage.

In 2000, when it was designated, the Hoy SPA held 570 pairs of Great Black-backed gulls (c..3% of the GB population), including 207 pairs in the Burn of Forse colony, and 176 pairs in the Stourdale colony (Mitchell *et al*. 2010). In 2000, numbers in these two colonies had declined greatly over the previous decade, and this decline has continued so that in 2009 the Burn of Forse colony, held only about 40 adults in July, and the Stourdale colony, had only 16 apparently occupied nests (Williams 2010).

Thus, the numbers of breeding pairs of great black backed gull on Hoy in 2010 was probably no greater than 50.

If it is assumed (very conservatively), that every one of the 18 birds seen at Billia Croo on the 14th June was a breeding adult from the Hoy SPA, and that only one bird from any pair was out at sea at any one time, then this suggests that up to 36% of the birds foraging from the Hoy breeding colony could potentially have been in the Billia Croo study area at any one time. Although these numbers are probably unrealistically high, with the low number of birds remaining on Hoy, even very small numbers feeding at Billia Croo could potentially be numerically significant. However, given the large potential foraging range of this species (Langston 2010), and very catholic diet it is thought extremely unlikely given its small scale and location that the proposed Oyster 2 Array could have any detrimental effect on the Hoy breeding population.

Great Skua

Reason for Inclusion in Impact Assessment
Qualifying species for Hoy SPA (Article 4.2, internationally important population).

This is a qualifying species for Hoy SPA, and the Aquamarine Power marine wildlife monitoring results show the great skua to be present on the sea in close vicinity to the Oyster 2 Array site during the post/late breeding season. From April to September, great skuas were recorded within the Billia Croo study area, with a high proportion of sightings (68 out of 95 observations, 72%) occurring during August, when up to 7 birds and an average of 0.82 birds were recorded during each scan. During the breeding season (April-June) the maximum number of birds recorded during a single scan was 14 birds, although the maximum count within 600 m of the device was 3 birds. During July/August, when most sightings occurred, birds appeared to be concentrated in the bay, in close proximity to the proposed location for the Oyster 2 Array. At other times of year any patterning in the smaller number of sightings is less obvious, but again birds are occurring in areas close to the proposed location for the devices.

A complete survey of the Orcadian population in 2010 found only 1,710 pairs almost 23% fewer than was recorded during Seabird 2000 (Meek 2011). Surveys of the rest of the UK (Scottish) population, especially that of Shetland, are required to ascertain whether this decline is more widespread. Even if we assume that these declines in the Orkney population do apply to the whole population, the numbers of birds recorded at Billia Croo are not significant in local, national or international terms (Meek 2011, Booth and Booth 2005, Forrester *et al*. 2007, Mitchell *et al*. 2004, JNCC 2011).

EMEC data shows great skua occurrence widely distributed across the site, with the majority of birds occurring in offshore waters greater than 1km from the coastline. The largest numbers of birds were recorded during the breeding and pot/late breeding season, with only a single observation occurring during the winter months.

As it is likely that construction will commence in May and continue through to September at the latest, disturbance and displacement impacts during installation are remote. Therefore, the impact significance on great black-backed gull during construction is considered to be negligible.

During the operational period vessels will only be present occasionally, although the WECs will be present and operational continuously over a period of up to 20 years. Continued marine wildlife monitoring during the operational phase of the Oyster 2 Array will establish if there is any long term disturbance impacts from the presence and movement of the devices. As the impacts are relatively unknown at present, the likelihood is considered to be "possible". Therefore, with a potential moderate consequence, the significance is deemed to be moderate and significant, requiring additional control measures and/or management.

Great skua are generally aerial in their behavioural ecology (particularly foraging behaviour), therefore do not spend a substantial amount of time on the sea surface (in comparison to species such as the puffin and guillemot). Great skua are therefore considered to be of lower sensitivity to potential pollution events such as oil leaks, and with the remote likelihood of such an event happening, this potential impact is considered to be negligible.

Phase	Installation	Operation and Maintenance	Potential Pollution Events
Significance	**Negligible**	**Moderate**	**Negligible**

Great skua

Natura interests

Billia Croo is within easy foraging range (Langston 2010) of great skuas breeding within the Hoy SPA, for which this species is a qualifying interest on the basis of Hoy supporting 14% of the world biogeographic population. The estimated numbers of great skuas breeding on Hoy and South Walls has declined from 2,209 pairs in 2000 (1,900 pairs in the SPA according to the SPA citation) to 1,710 pairs in 2010, of which an estimated 1,406 pairs (calculated by subtracting 304 pairs outside the SPA in 2008) were within the SPA (Meek 2011).

If it is assumed (very conservatively), that every bird seen at Billia Croo during June was a breeding great skua from the Hoy SPA, and that only one bird from any pair was out at sea at any one time then this suggests that up to 1% of the birds foraging from the Hoy breeding colony could potentially have been in the Billia Croo study area at any one time. Given this relatively low percentage, and the large potential foraging range of this species (Langston 2010), and that in the Northern Isles they mainly forage on fishery discards and sandeels (Votier *et al*. 2003), it is thought extremely unlikely given its small scale and location (i.e. not on

a key feeding habitat such as sandbank suitable for spawning sandeels) that the proposed Oyster 2 Array could have any detrimental effect on the Hoy Great skua population.

Puffin

Reason for Inclusion in Impact Assessment
Qualifying species for Hoy SPA (Article 4.2, named component of seabird assemblage).

Puffin is a qualifying species for Hoy SPA; the Aquamarine Power marine wildlife monitoring has recorded very small numbers to the immediate north of the Oyster 2 Array footprint, principally during the breeding season. The very small number of birds observed suggests that the site is not of great importance to this species and that puffins do not utilise this habitat. The numbers are insignificant in population conservation terms at a local, national or international scale (Mitchell *et al*. 2004, JNCC 2011, Forrester *et al* 2007).

EMEC data shows puffin presence at the wider site throughout the year, with the majority of observation occurring in the breeding season and within waters to the immediate north-west of the proposed Oyster 2 Array. The inner bay area is located on the periphery of EMEC breeding and post/late breeding observations, therefore it is not likely that the inner bay is of more importance to puffins than habitats occurring elsewhere in the wider site.

The activities with greatest potential to disturb birds present in the immediate development will take place during construction and installation, maintenance and decommissioning. These activities, with the exception of occasional maintenance vessel visits, will take place during the summer months. This is the period when puffin have been recorded in greatest numbers in the inner bay area. However if birds are present during these times, temporary disturbance and displacement may occur. These impacts are given a magnitude of minor and therefore a potential consequence of moderate. The probability of an impact occurring is considered unlikely given the temporary nature. Therefore, the overall significance to puffin during installation is considered to be minor and not significant.

During the operational period vessels will only be present occasionally, although the WECs will be present and operational continuously over a period of up to 20 years. Continued marine wildlife monitoring during the operational phase of the Oyster 2 Array will establish if there is any long term disturbance impacts from the presence and movement of the devices. As the impacts are relatively unknown at present, the likelihood is considered to be “possible”. Therefore, with a potential moderate consequence, the significance is deemed to be moderate and significant, requiring additional control measures and/or management.

Puffins are considered to be sensitive to potential pollution events, as they spend a large amount of time on the sea surface and moults often occur in the post-breeding season, potentially making this species particularly susceptible. Notably, vessel operations are unlikely to be happening during the post-late breeding season and appropriate measures/good working practices will be in place to ensure the likelihood of such an event is as low as possible. Due to the and with the remote likelihood of such an event happening, this potential impact is considered to be negligible.

Phase	Installation	Operation and Maintenance	Potential Pollution Events
Significance	**Minor**	**Moderate**	**Negligible**

Puffin

Natura interests

Puffins are a qualifying interest for the Hoy SPA, with a cited population of 3,500 pairs. Even if we assume that all 4 of maximum count of four birds were from this colony, and that only one bird from each pair was out at sea at any one time this represents only 0.1% of the estimated foraging population. This plus the low number of dates when birds were present, and their absence from the immediate vicinity of the Oyster 2 Array suggests that it is extremely unlikely that the proposed development would have an adverse impact on the Hoy SPA puffin population.

Red-throated diver

Reason for Inclusion in Impact Assessment
Qualifying species for Hoy SPA (Article 4.1, nationally important population of Annex 1 species).

Red-throated diver is a qualifying species for Hoy SPA; results of the Aquamarine Power wildlife monitoring show very few birds recorded in close vicinity to the proposed development footprint, with the majority of observations in the autumn; overall comprising 3.4% of the Hoy SPA population, and only 0.05% of the UK population. The maximum number of individual red-throated divers to likely to be observed at the site in autumn is 2, suggesting that habitats within the proposed development footprint and surrounding area are not of great importance to this species and are unlikely to be utilised by red-throated diver during the breeding season. EMEC wildlife monitoring did not record this species utilising the inner bay area or wider site. The numbers of birds involved is of negligible importance at regional, national or international spatial scales (Booth and Booth 2005, Williams 2008, Dawson *et al*. 2008, Calbrade *et al*. 2010).

This species is particularly sensitive to disturbance and displacement due to vessel traffic and habitat disturbance, however wildlife monitoring results suggest that red-throated divers are most likely to be present on site in the autumn, therefore this species will not likely be affected by construction and installation activities taking place during the spring time, with the likelihood of potential impacts to red-throated divers occurring during maintenance activities only. These impacts are given a magnitude of minor and therefore a potential consequence of moderate. The probability of an impact occurring is considered remote given the temporary nature and timing of activities on the site during the summer months. Therefore, the overall significance to red-throated diver during installation *and* operation (including maintenance) is considered to be minor and not significant.

Due to the foraging ecology of this species, red-throated divers spend a considerable amount of time on the sea surface, therefore are considered to have very high sensitivity to potential pollution incidents, particularly accidental oil leaks. The probability of such an event is considered remote as appropriate measures and best working practices will be in place during

construction and installation operations. Due to the relatively small likelihood of occurrence of this species at the Oyster 2 Array site, there is a predicted impact significance of minor.

Phase	Installation	Operation and Maintenance	Potential Pollution Events
Significance	**Minor**	**Minor**	**Minor**

Red-throated diver

Natura interests

Billia Croo is within the potential foraging range (Langston 2010) of birds breeding within either the Hoy or Orkney Mainland Moors SPAs. However, apart from the possible exception of the single bird observed during August (during the Aquamarine Power survey), there was no evidence of any birds using the Oyster 2 Array area during the breeding season, nor evidence of birds regularly flying to and from breeding lochs to feed. Thus there was no evidence of breeding birds from either of these SPAs using the study area for foraging.

Shag

Reason for Inclusion in Impact Assessment
Area used on regular basis by significant proportion of birds from internationally important wintering population within Scapa Flow.

Although not an SPA species, the shag is the species recorded in greatest abundance in the inner bay area and wider wave test site, and in close proximity to the proposed Oyster 2 Array.

The shay was the most regularly recorded and abundant species during the Aquamarine Power survey, with a distribution mainly concentrated in the inner bay area, in close proximity to the proposed location of the Oyster 2 development. Birds were present throughout the year, but were most abundant in the period August to November, when peak monthly counts within the southern area varied between 139 and 551. For the remaining months of the year, peak monthly counts for the same area varied between 7 and 71.

In 1998/2002 the UK breeding population of shags was estimated at 26,600 pairs, with 1,872 pairs breeding in Orkney, both populations were declining at this time, and for the UK population at least this decline has continued until the present day (Mitchell *et al*. 2004, Forrester *et al* 2007, JNCC 2011). For the relevant biogeographical population (North east Atlantic population of *Phalacrocorax aristotelis aristotelis*) the breeding population is estimated at 66,000-73,000 pairs (Mitchell *et al*. 2004) and the wintering population as 200,000 birds. There is currently no generally accepted estimate for the UK wintering population of shag (Calbrade *et al*. 2010), although Sarah Wanless and Mike Harris in Forrester *et al*. (2007) tentatively estimate the Scottish winter population, including immatures as 60,000-80,000 individuals. For Orkney also, there is no generally accepted wintering population for shags, although the numbers of shag wintering within Scapa Flow has in recent times being of international importance (Dawson *et al*. 2008, Williams 2008), with total population counts ranging from 2,233 to 3,393 individuals over 3 winters between 1998/99 and 2006/2007. This represents 1-2% of the relevant biogeographical wintering population (Calbrade *et al*. 2010). During a survey primarily focussed on waders of Orkney's low-lying shores during 2006/2007 winter a total of 4,699 shag were recorded although this is likely to be a considerable

underestimate given the avoidance of high cliffs, and the primary focus on waders (Corse and Summers 2009).

The sudden build up of birds in August and September during the Aquamarine Power survey, suggests that most of the adult birds present are likely to be post/failed breeders, or non breeders rather than birds still with dependent young at the nest. Making the very conservative assumption that all of the birds present in August (218 birds) and September (531 birds) were adults from the local breeding population suggests that 6-14% of the Orkney breeding population, 0.4%-1% of the UK breeding population and 0.2%-0.4% of the relevant biogeographical breeding population could potentially be present. These are very much worst case scenario figures, assuming the flocks include no fledged young (it was usually not possible to age the birds present, given the distances involved), but suggest that the area could potentially be important for the local breeding population of shags even if, as seems likely, the flocks do include a substantial proportion of fledged young and pre-breeders.

The peak winter count of 551 birds in December represents 0.28% of the international population (Calbrade *et al*. 2010), c. 0.8% of the (tentative) Scottish wintering population (Forrester *et al*. 2007), and c. 12% of the Orkney population based upon the 2006/2007 coastal wader survey (Corse and Summers 2009). Even if the last of these underestimated the Orkney shag population by a factor of 3, this still suggests that the peak counts recorded at Billia Croo, within a small area, would represent c.4% of the local shag population and so is likely to be of local significance. The peak count is equivalent to 16-25% of the estimates for birds wintering within Scapa Flow. This represents a density of 306 birds/km^2 (551 birds in 1.8 km^2). The corresponding density estimates for the Scapa Flow estimates are 14-21 birds/km^2 (2233-3393 birds in 160 km^2, Williams 2008[1]). Thus the numbers and densities of shag recorded at Billia Croo are comparable in magnitude to those recorded for the nearby internationally important shag population within Scapa Flow. Given the internationally importance of Scapa Flow, this suggests that the numbering of wintering birds using Billia Croo are likely to be at least of local significance. Further support for this suggestion is provided by the observation that the peak numbers recorded at Billia Croo from August to September are comparable to the largest counts reported in recent years during Webs counts and casually elsewhere in Orkney (Calbrade *et al*. (2010), recent Orkney Bird Reports), and that the numbers recorded represent a sizeable proportion of the total numbers recorded along the low lying sections of Orkney's coastline in 2006/2007 (Corse and Summers 2009).

Furthermore, the principal observer at Billia Croo, Paul Higson, reports that the birds using the Billia Croo area often originate from within Scapa Flow, with large numbers of birds coming out of the Flow via Hoy Sound into the sea area between Billia Croo and Hoy. Most of these birds stay south of the study area but some do move in, yielding the large counts. This suggests that Billia Croo, along with adjoining area may be important to the internationally wintering population of shag within Scapa Flow. Thus, although when considered in isolation the numbers of shag wintering at Billia Croo may only be of local significance, the area used by the shags at Billia Croo, if considered as part of the site used by wintering shag within Scapa Flow may be of international importance, although the site is not designated as an SPA.

[1] Taking the area as 160 km^2, the estimated area covered by land based counts, within c. 2 km of the shore, during which most shags were recorded, rather than the total area of the flow, 240 km^2 (Williams 2008)

As surface-divers, shag could potentially come into physical contact with the devices. On the basis of expert opinion, with respect to wind farm development King *et al*. (2009) scored shag as 4/5 with respect to vulnerability to disturbance by ship and helicopter traffic and 3/5 with respect to inflexibility in habitat use.

Thus, the shags wintering at Billia Croo may form part of an internationally important population, and also be locally important. Their distribution across the site suggests that they are likely to come into close proximity to the proposed development.

The activities with greatest potential to disturb birds present in the immediate development will take place during construction and installation, maintenance and decommissioning. These activities, with the exception of occasional maintenance vessel visits, will take place during the less sensitive summer months. However if birds are present during these times, temporary disturbance and displacement may occur. Craigton Ecological Services (2011) (see accompanying CD), Figure 9, shows that shags were recorded throughout the survey area and are not confined to any particular location. EMEC collected data over the wider wave test site and offshore deeper waters also recorded significant numbers of shag, again suggesting that Billia Croo may be of local importance to his species. These impacts are given a magnitude of minor and therefore a potential consequence of moderate. The probability of an impact occurring is considered unlikely given the temporary nature. Therefore, the overall significance to shag during installation is considered to be minor and not significant.

During the operational period vessels will only be present occasionally, although the WECs will be present and operational continuously over a period of up to 20 years. Due to their ecology, there is potential for shags to come into contact with devices (whilst surface diving), however full understanding of potential interactions with WEC devices is not yet know. Continued marine wildlife monitoring during the operational phase of the Oyster 2 Array will establish if there is an interaction between shags and the WEC devices, or indeed if there are any long term disturbance impacts from the presence and movement of the devices. As the impacts are relatively unknown at present, the likelihood is considered to be “possible”. Therefore, with a potential moderate consequence, the significance is deemed to be moderate and significant, requiring additional control measures and/or management.

As surface divers, shags can spend a considerable amount of time on the sea surface, therefore are considered sensitive to potential pollution incidents, particularly accidental oil leaks. The likelihood of such an event is considered remote; as appropriate measures and best working practices will be in place during construction and installation operations. Due to the significant number of shags recorded at the site (and within close proximity to the proposal footprint), a high sensitivity and a potentially high magnitude of impact, it is considered that the consequence of any impact will be moderate which, combined with likelihood, leaves a significance ranking of minor.

Phase	Installation	Operation and Maintenance	Potential Pollution Events
Significance	**Minor**	**Moderate**	**Minor**

Shag

Eider

Reason for Inclusion in Impact Assessment
Area used by c.1% of Orkney wintering population, which because of uncertain subspecies status of Orkney eider population, could potentially be of national or international significance.

Eider are not an SPA qualifying species, however relatively large numbers of eider were observed within close vicinity to the proposed development footprint, within approximately 100m of the shore (refer to Figure 11 of Craigton Ecological Services (2011) on accompanying CD).

During the Aquamarine Power survey, eider were present throughout the year, although the highest numbers (in terms of maximum and mean numbers per scan) occurred between December and March, when up to 50 birds were recorded during a single scan. Throughout the year, birds were concentrated within c.500 m of the shore in the bay to the south of the vantage point, so that the proposed location of the Oyster 2 Aray is on the outer edge of this distribution.

Furness *et al*. (2010) have recently shown on the basis of morphometrics, plumage and mitochondrial DNA that eider breeding in Shetland belong to the same subspecies (*faeroeensis*) as birds from the Faroe Islands and southern Iceland, which is distinct from the nominate *mollissima* to which all Scottish eiders have been conventionally assigned. The genetics and biometrics and thus subspecies of eiders in Orkney remain unknown. Although Orkney lies close to Shetland, studies suggest that movement of eiders between these two archipelagos is very infrequent (Pennington *et al*. 2004 cited in Furness *et al*. 2010). Furthermore, ringing recoveries of eider ringed in Orkney and Shetland suggest that birds in this area move shorter distances than in other parts of Scotland, with 90% of ringing recoveries being within 10 km of where the birds were ringed (Baillie 2002). All 7 recorded recoveries of birds ringed in Orkney, where within Orkney (Colin Corse, Orkney Ringing Group, pers. comm.). Thus, Orkney birds could potentially belong to the *faeroeensis* subspecies, or the *mollissima* subspecies, or could be genetically distinct from both. However, irrespective of which subspecies Orkney birds belong to the maximum count of 50 birds at Billia Croo during a single scan is not significant in local, national or international terms (Booth and Booth 2005, Forrester *et al*. 2007, Calbrade *et al*. 2010). For example, even if it is assumed that the most extreme, and unlikely, case of the Orkney population being a distinct subspecies, then the maximum count of birds represents only 0.8% of the estimated Orkney wintering population (6000 birds, Forrester *et al*. 2007) and thus national and international populations.

EMEC wildlife monitoring recorded Eider in the winter months only, with a dense aggregation of birds along the coastline, largely occurring within 500 m of the shoreline. EMEC observations show a dense aggregation of eider occurring to the immediate south and east of the proposed Oyster 2 Array, suggesting in concurrence with the Aquamarine Power data, that marine habitats located between the proposed development site and shoreline may be of importance to this species.

It is therefore possible that if eiders are present during any period of significant activity (i.e. construction and installation, maintenance and decommissioning) temporary disturbance and displacement will occur. The maximum period of disturbance would be throughout the summer installation months in 2012 and also potentially 2013. Similar periods of disturbance would be expected during decommissioning. As periods of significant vessel activity will be during summer, they avoid the more sensitive winter months and therefore reduce the consequence of

any impact to minor. Considering a probability of impact as unlikely given the temporary nature of activities, the significance may be deemed to be minor.

During the operational period vessels will only be present occasionally, although the WECs will be present and operational continuously over a period of up to 20 years. Continued marine wildlife monitoring during the operational phase of the Oyster 2 Array will establish if there is any long term disturbance impacts from the presence and movement of the devices. As the impacts are relatively unknown at present, the likelihood is considered to be "possible". Therefore, with a potential moderate consequence, the significance is deemed to be moderate and significant, requiring additional control measures and/or management.

Eiders are considered to be sensitive to potential pollution events, as they spend a large amount of time on the sea surface throughout the year, making this species particularly susceptible to events such as accidental oil spills. Notably, the majority of construction activities and vessel operations will occur within the spring months when eiders are less abundant at the site, reducing the likelihood of impact to this species. In addition, appropriate measures/best working practices will be in place to ensure the likelihood and impact of such an event is as remote and as minor as possible. Therefore, the significance of the potential for pollution events from the Oyster 2 Array project is considered to be negligible.

Phase	Installation	Operation and Maintenance	Potential Pollution Events
Significance	**Minor**	**Moderate**	**Negligible**

Eider

5.4.2 Management and mitigation

Construction and installation, maintenance and decommissioning

The types of activities that will take place in the coastal waters of Billia Croo are of similar nature to other coastal construction activities that take place in other industries. Based on this and the results of the above impact assessment, no mitigation measures specific to birds are considered necessary during installation, maintenance and decommissioning.

With regards to the potential for pollution as a result of accidental events, all contracted vessels will carry oil and chemical spill mop up kits and will comply with IMO/MCA codes for prevention of oil pollution. As far as possible vessels will have an established track record of operating in similar water conditions.

Operation

Based on the novel nature of the marine (wave and tidal) renewables industry, there is as yet a lack of empirical data on whether there are significant or detrimental impacts on seabird species from the presence of wave energy devices in coastal waters. Until this is better understood it is not possible to determine the need for mitigation measures. In such an instance the most appropriate measure is to implement an appropriate monitoring programme, to ascertain if any or what mitigation measures might be suitable for future developments. For this reason, Aquamarine Power has implemented a marine wildlife monitoring programme at the Billia Croo. Monitoring will be ongoing during installation of Oyster 2a in summer 2011 and beyond in order to collect data to understand how the Oyster technology interacts with marine wildlife. As the results of this ongoing monitoring become available, they will be used to determine the need for any technology specific mitigation measures.

With regard to the potential for pollution of seabirds from device leaks, Aquamarine Power is developing emergency response plans which will be dovetailed with EMEC's procedures for dealing with spills or leaks.

5.4.3 Residual impacts

The key potential impacts during construction and installation, maintenance and decommissioning relate to disturbance effects from the installation/decommissioning activities, the presence of vessels and the potential for pollution from accidental events. These activities, with the exception of occasional maintenance vessel visits, are likely to take place during the spring and summer months and therefore it is those species present at this time of the year that have the greatest potential to be impacted.

For all species, the potential impacts arising from installation or construction, or decommissioning, of the Oyster 2 Array project are considered to be minor or negligible and therefore not significant. With no specific mitigation proposed for installation activities, the residual impact remains as minor or negligible and not significant.

During operation of Oyster, the impacts are relatively unknown and for some species the potential impacts are considered to be moderate. It is proposed to continue marine wildlife monitoring in order to understand exactly what the impacts might be and their extent. With the implementation of an appropriate monitoring programme it is considered that the residual impact may be reduced to minor and not significant.

With regard to the potential for pollution events to have a significant impact on seabirds, the potential impact is rated as minor for some species and negligible for others. Given that appropriate measures and best practice will be employed on vessels and during operation of the Oyster 2 Array Project, it is considered appropriate that the residual impact is reduced to (or remains at) negligible and not significant.

6. CUMULATIVE IMPACTS

Aquamarine Power is not aware of any other proposals to deploy wave energy technologies in the inner bay area of the EMEC wave test site, and therefore in the immediate vicinity of the Oyster 2 Array installation site. The Oyster 1 WEC, deployed in 2009, was recently removed from its berth approximately 33 m to the north east.

It is likely, considering the surrounding waters comprise part of the EMEC test centre, that other renewable devices will be installed in the region over the life of the Oyster 2 Array project. There have been announcements in the local Orkney press of at least 3 other devices being tested at the EMEC wave test site from 2011 onwards. All other existing test berths at the wave site are located further offshore in deeper waters and therefore outwith the immediate vicinity of the Oyster 2 Array; it assumed that this is where future wave energy devices will be deployed.

Offshore test berths at EMEC are located several hundred metres away and tens of metres apart resulting in relatively wide spacing of single wave energy devices. Although as yet there is no empirical data on zones of influences from the operation to such devices, it is expected that impacts are likely to be limited to the immediate vicinity (tens of meters) of devices. The small area of sea potentially impacted means that should similar developments be located in the wave test site and/or in similar water depths to Oyster, then the potential for cumulative impact in terms of percentage of habitat affected would be low.

Areas of disturbance of marine wildlife could be slightly greater during installation and decommissioning when there are likely to be several vessels associated with the activities taking place. However the EMEC permit to work system controls simultaneous activities at the wave test from a safety perspective and this will also result in advantages from an environmental perspective in terms of controlling the levels of vessel activity taking place at the wave test site at any one time.

Cumulative impacts with development outwith the marine renewable industry are unlikely as no such other developments are foreseen in the area.

Cumulative impacts of increased vessel traffic from both the proposed Oyster 2 Array and potential installation of other renewable devices may result in temporary disturbance and displacement of sensitive species, particularly marine mammals and diving birds (e.g. red-throated divers) from the Billia Croo site. It is possible that less sensitive species will not be affected by these potential cumulative impacts; with habituation to vessel presence likely by species occurring in existing areas of high vessel traffic around the west coast of Orkney, such as eider and shag.

7. PROPOSED MONITORING

Aquamarine Power has an ongoing marine wildlife monitoring programme covering the inner bay area at the EMEC Billia Croo test site. This is additional to the EMEC marine wildlife monitoring, which collects data for the wider wave test site. These monitoring programmes collect data on cetaceans, basking sharks and seabirds.

Aquamarine Power began data collection in April 2010. Data is presently collected as recommended by Harding (2010), a methodology that has been agreed with Marine Scotland and SNH, and the data collected up to the end of March 2011 has been analysed and used to inform this assessment. Monitoring will be ongoing during installation of Oyster 2a in summer 2011 and beyond, for data collection to understand how the Oyster technology interacts with marine wildlife.

In addition to marine wildlife monitoring, Aquamarine Power will measure the underwater acoustic signature of the Oyster 2 array.

Reports presenting the results of the monitoring will be submitted to Marine Scotland in the timescales agreed as part of the Environmental Monitoring Plan (EMP).

Analysis of the data will be used to inform the future scope, effort and duration of the monitoring, which will be discussed and agreed with Marine Scotland, SNH and other relevant stakeholders, as appropriate.

8. SUMMARY AND CONCLUSIONS

The principal impact to marine wildlife from the proposed Oyster 2 Array will be the potential for disturbance and displacement or marine wildlife from the inner bay at Billia Croo during the installation (and decommissioning) phase of the proposed development, with potentially disturbing activities to marine mammals, fish and seabird species occurring in close proximity to the proposed development site during device installation and maintenance. This disturbance impact is expected to be temporary in nature, with short intermittent periods of disturbance from vessel traffic and vessel presence during maintenance activities. Disturbance impacts will be minor or negligible and therefore not significant.

The overall level of impact significance for marine mammals has been assessed as minor, due to the low likelihood of cetacean presence in the inner bay area, and where present, localised avoidance behaviour likely to be exhibited by seal species (due to vessel presence and related underwater noise). The assessment concludes that underwater noise from construction, installation and maintenance activities will not constitute a significant impact to marine mammal species. Where applicable (i.e. when marine mammal species are present at Billia Croo), potential impacts will comprise disturbance due to vessel traffic and installation operations. These impacts will likely be of a temporary nature, with infrequent and localised impacts resulting from maintenance activities. The potential for impact on marine mammal species has therefore been concluded to be remote and of a minor significance.

Basking sharks have been recorded at Billia Croo and within the inner bay area; due to their known occurrence at the site, slow swimming speeds and medium/high sensitivity, the level of potential consequence to basking sharks has been assessed as moderate. If present within the inner bay area or wider site at the time of construction, installation or maintenance, basking sharks may affected by increased vessel traffic/presence and underwater noise; causing localised disturbance and displacement of this species. Residual impacts on basking sharks have been assessed as minor, due to the low vessel speeds and largely stationery vessels likely to be employed in the inner bay area during maintenance activities, therefore providing basking sharks (if present), with the opportunity to leave the area where potentially disturbing activities may occur.

The potential for impact to seabird species has been assessed as having negligible, minor or moderate significance, depending on the species abundance and seasonal presence at the site, and on the activity being assessed. The potential impact on all species was assessed to be minor or negligible during installation, maintenance and decommissioning, due to the potential for localised disturbance and displacement during the breeding season, when birds may use habitats at the site for foraging purposes.

Results of the Aquamarine Power wildlife monitoring have identified significant numbers of shag and eider occurring at the site during winter months, suggesting that habitats at Billia Croo may be locally important to these species. Potential for disturbance from winter maintenance activities exists, however this is likely to be temporary and localised to the vicinity of the development footprint. Nevertheless, due to the potential local importance of the site to shag and eider, the impact significance to these species has been assessed as minor (rather than negligible) during installation, maintenance and decommissioning.

Notably, indirect effects on seabirds and marine mammals may occur due to localised changes in fish distribution and abundance due to device presence, however there is potential that this impact may be positive, as devices may provide shelter for fish species or act as ‘fish aggregating devices’, potentially increasing local fish abundance and improving seabird and marine mammal foraging success. As the long term effects and impacts of WEC devices are

unknown, this may or may not be a notable impact. Consequently, potential impact of operation of the Oyster 2 Array Project is given a ranking of moderate for some seabird species, with the residual impact reduced to minor providing that an appropriate monitoring programme is continued to help understand the potential impacts of the Oyster technology.

Appropriate mitigation will be employed to reduce potential impacts identified in the impact assessment; primarily with the aim to reduce disturbance to marine mammals, basking sharks and seabird species. Vessels required for construction, installation and maintenance will move at very low speeds and will be largely stationary within the inner bay area. In addition, Aquamarine Power is aware of the recently implemented Seal Licence system under the Marine (Scotland) Act 2010. Consultation with Marine Scotland will establish any potential requirement for such a licence with regard to Phase 2 of the Oyster 2 Array. Appropriate measures including best working practices will be employed throughout construction operations and vessel use at the site, to ensure risk of accidental pollution events is minimised.

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