

Shapinsay Sound Scale Site: Environmental Description



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Shapinsay Sound Scale Site Environmental Description

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1.00	June 2010	Initial client accepted version of document.	Xodus Aurora	LF	JN
2.00	April 2011	Inclusion of baseline wildlife monitoring data	DC	JN	JN

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1 PURPOSE AND SCOPE

The function of this environmental description is as supporting documentation to inform applications/consents for a new tidal test site. Subject to grant of these licences it will also inform potential developers coming to the European Marine Energy Centre (EMEC) to test their prototype tidal energy devices of the environment within which the intermediate scale test site, at Head of Holland, is located. It will also remind potential developers of their responsibilities towards the receiving environment.

An initial examination of seasonal environmental sensitivities has been undertaken, based on present understanding of the environmental characteristics of the area.

The description covers the character of the physical, biological and human environment as well as conservation areas around Head of Holland. The following sections provide background and a detailed description of each important environmental characteristic.

2 CONTEXT

EMEC has secured additional funding from the UK's Department of Energy and Climate Change, DECC, which will allow the creation of nursery or intermediate scale test sites; one for tidal devices and one for wave devices. These have been sited and designed to allow developers to trial smaller scale marine energy devices – as well as full size prototypes – in less challenging sea conditions than those experienced at EMEC's main test sites at Billia Croo and the Fall of Warness.

Funding conditions have been stipulated by DECC including:

- > Sites must be constructed in benign conditions;
- > Sites must be capable of use for:
 - o Testing of large scale prototype wave and tidal machines and/or
 - o Rehearsal of wave and tidal operations and deployment techniques;
- > Sites must incorporate test berths for both wave and tidal energy devices; and,
- > Sites must be equipped with:
 - o Ancillary equipment to enable monitoring of devices in situ
 - o Load dumping devices for shredding of electricity generated.

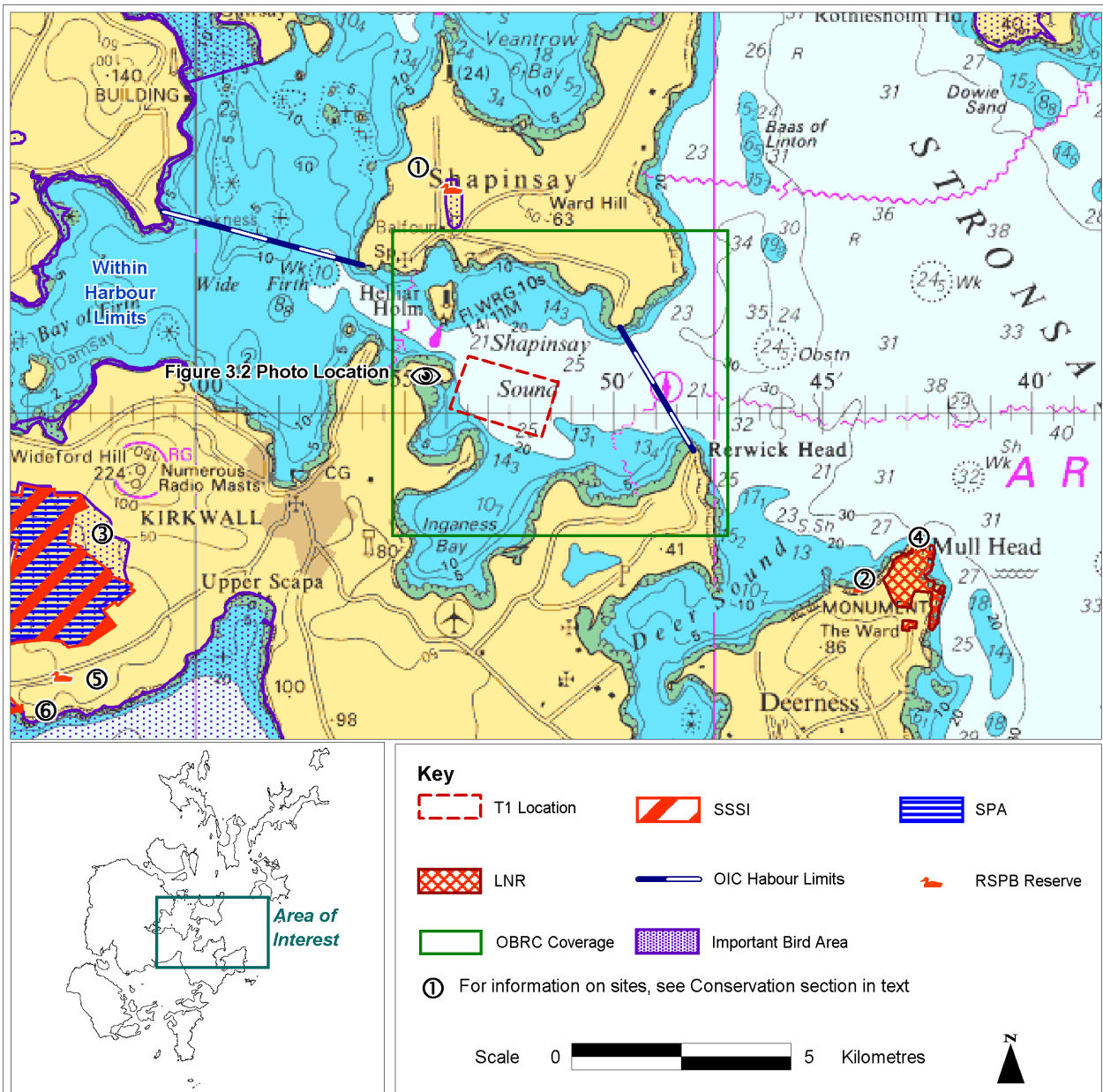
Operational data will be communicated via the SCADA interface; transmitted by air from a communications buoy at each test site. Unlike the larger, established, wave and tidal test sites the nursery sites will not be connected to the grid and there will be no cabling from the berths to shore nor will there be any onshore infrastructure provided by EMEC. Therefore, a description of the intertidal or coastal habitats has not been included in this report.

3 ENVIRONMENTAL DESCRIPTION

3.1 Location

The Head of Holland (T1) tidal site is located offshore from Head of Holland along the south coast of Shapinsay Sound; the site is shown in Figure 3.1 in context with the wider area and in relation to harbour limits and sites of conservation interest (discussed further in Section 3.10). To the west of the site is the Head of Work, at which is a Scheduled Monument, and The String, a relatively narrow tidal channel leading to and from Wide Firth and the Bay of Firth. The site is within Harbour Limits, with Orkney Islands Council Marine Services being the Competent Harbour Authority. It should be noted that the site boundaries shown on the figures extend further than expected for the final site (the area within which moorings will be deployed will occupy between one-third and one-half of the box shown) but are shown as such to allow flexibility in final deployment of the moorings.

Figure 3.1 Location of T1 Shapinsay Sound tidal site



3.2 Seascape

Most of the Orkney Islands are composed of sedimentary rocks of Devonian age (410 - 360 million before present) and are predominantly Middle and Upper Old Red Sandstone. There are older metamorphic rocks and younger dykes in some places. The nature of the rock and the glacial features help to determine the present day landscape of the coast (Doody, 1997).

Land Use Consultants (1998) report the sea as being very important to the physical and cultural landscapes of Orkney. The same authors also comment that the sea and the coast are key elements of the Orkney landscape. Whilst the west coast is particularly renowned for cliffs, arches, stacks and geos, the lower lying coastal features likely to be found in the vicinity of T1 (such as tilted flags, sand dunes and sandy bays) are considered important for recreation and accessibility (Land Use Consultants, 1998). The coastlines also contain sites of built and natural heritage interest; prehistoric remains are characteristic features and the cliffs and adjacent heaths are key seabird nesting sites (Land Use Consultants, 1998).

Scott *et al.* (2005) report that the seascape of the eastern half of Orkney (including Shapinsay Sound) and the outer isles comprises 'Type 12: Deposition Coasts of Islands'. The key characteristics of this classification of seascape are the existence of causeways linking a number of islands, generally low lying coasts backed by open flat pastures and an interplay of land and water that results in a diverse form and changing views as the viewer moves through the landscape. Scott *et al.* (2005) state that the east Orkney area, in which Shapinsay Sound lies, has little containment with short distances to the sea and a low lying landform, devoid of woodland and intervening relief with a resulting very open character and large horizontal scale. Closer to shore, scale is smaller as a degree of enclosure occurs between islands and, although few dramatic vertical landform features are present, the indented and highly complex form of inlets and bays and islands/sea are an important feature.

Figure 3.2 illustrates the general nature of the seascape in the vicinity of the proposed development site (see Figure 3.1 for photograph location).

Figure 3.2 View across Shapinsay Sound from the Orkney Mainland to Haco's Ness on Shapinsay



3.3 Seabed habitats

3.3.1 Surveys

The subsea sediments and communities of the T1 area have been the subject of a number of site surveys. As part of the site selection process, EMEC has commissioned both geophysical surveys (Netsurvey Ltd, 2010) and environmental sampling that included the collection of grab samples across the site aimed at determining biota and sediment particle size (Biotikos, 2010). In addition, Marine Scotland collected video and photographic stills imagery in Shapinsay Sound as part of a wider marine survey programme requested by Scottish Government to inform potential marine renewables development in this region. This information has subsequently been reviewed by SNH (Moore, 2009) to provide a description of the seabed habitats, species assemblages and biotopes.

These surveys have been used to establish an understanding of the baseline physical and biological environment at the T1 site.

3.3.2 Physical

The wider T1 area was surveyed on 3rd and 4th December 2009 by Netsurvey Ltd (2010) (Figure 3.9). Water depths across the area compared well with the existing Admiralty Chart data, although the 20 m contour extends 140 m further west than previously thought to be the case. The survey identified a number of contacts across the area which were assumed to be boulders or rocks, with the exception of one contact near the centre of the area which may be a wreck.

BGS Charts (BGS, 1985) for Shapinsay Sound show the T1 site to comprise parts of the lower Eday sandstone formation.

The site specific benthic survey conducted at T1 (Biotikos, 2010) reported that the type of sediment encountered reflects the degree of water movement that the site experiences, with little fines and a variety of rock and shell fragment size. Surficial sediments generally comprised maerl, maerl fragments, coarse sand, shell fragments, large shell fragments and stones. Some *Lanice* tubes and large stones were present also (Biotikos, 2010). The locations of sediment samples are illustrated in Figure 3.9.

3.3.3 Biological

3.3.3.1 Regional context

Moore (2009) report that most sites examined in the Pentland Firth and Orkney area display a community typical of circalittoral tideswept rocky communities. Diversity is low and the community is dominated by a fauna of the acorn barnacle *Balanus crenatus* and the Dahlia anemone *Urticina felina*. The habitats are predominantly sandy, sand-scoured rock or mixed substrates of sand and stones. Considering the location and tidal properties of the T1 site in Shapinsay Sound, it would be expected to support a similar habitat.

3.3.3.2 Site specific information

Moore (2009) reports the results of four sample sites surveyed in the east of Shapinsay Sound in and around the T1 site (Figure 3.9). The sites contained areas of rippled fine or medium sand and mixed substrate areas, with pebbles, cobbles and boulders on a bed of sand. The sandy areas supported a sparse epibiota of portunid crabs, the common starfish *Asterias rubens* and scattered fragments of live maerl. This corresponds to the 'Infralittoral fine sand' biotope (SS.SSa.IFiSa). In the mixed substrate areas the stones were encrusted with barnacles, Pomatoceros (a group of species that deposits calcareous tubes), bryozoans and yellow and red sponges. A patchy turf of the bryozoans *Flustra foliacea* and *Securiflustra securifrons*

was also reported. The biota is regarded as a rather poor example of the '*Flustra foliacea* and colonial ascidians on tide-swept exposed circalittoral mixed substrata' biotope (CR.HCR.XFa.FluCoAs.X). The results of the Marine Scotland surveys and SNH analysis are summarised in Table 3.1. Selected images made available by Marine Scotland are shown in Figure 3.3 to Figure 3.8.

Table 3.1 Summary of Marine Scotland survey results around the T1 site (Moore, 2009)

Site	Substrate	Biota	Biotope
SH/1	Rippled fine or medium sand with scattered shells. <i>Ensis</i> spp. shells.	Sparse scatter of live and dead maerl, drift algae and drift <i>F. foliacea</i> . Sparse epifauna includes <i>Liocarcinus</i> sp. and <i>A. rubens</i> .	SS.Ssa.lfiSa
SH/2	Fine or medium sand, initially flat with scattered pebbles and shells and occasional small boulders, becoming rippled, pure, fine-medium sand.	Sparse epibiota, including portunid crabs, <i>A. rubens</i> , the starfish <i>Crossaster papposus</i> , urchin <i>Echinus esculentus</i> , goby Gobiidae and very scattered fragments of live and dead maerl and drift algae and <i>F. foliacea</i> .	SS.Ssa.lfiSa
SH/3	Cobbles, boulders and pebbles on sand.	Stones encrusted with the barnacle <i>Balanus</i> spp., <i>Pomatoceros</i> , red bryozoans and pink calcareous algae. Erect forms are dominated by patches of <i>F. foliacea</i> ; other bryozoans are present, including <i>S. securifrons</i> , as well as hydroids, filamentous red algae and sea beech <i>Desmarestia aculeata</i> . Small <i>Urticina felina</i> anemones are common and small <i>Alcyonium digitatum</i> (soft coral) rare. Motile species include cod <i>Gadus morhua</i> , velvet crab <i>Necora puber</i> , edible crab <i>Cancer pagurus</i> , <i>L. depurator</i> , <i>E. esculentus</i> , <i>C. papposus</i> and the starfish <i>Henricia sanguinolenta</i> .	CR.HCR.XFa.FluCoAs.X (assignment uncertain)
SH/3	Rippled fine or medium sand with scattered boulders.	Sparse scatter of dead maerl fragments. Portunid crabs. Boulders densely encrusted with pink algae.	SS.Ssa.lfiSa
SH/4	Mixed substrate of cobbles, pebbles, shells and gravelly sand, with scattered boulders.	Most conspicuous feature is the scattered turf of <i>F. foliacea</i> , although scattered clumps of hydroids and filamentous red algae also present. Encrusting yellow sponges and the sponge <i>Esperiopsis fucorum</i> coat some of the stones, with others encrusted in <i>Balanus</i> spp., <i>Pomatoceros</i> and possibly the tunicate <i>Dendrodoa grossularia</i> . The sessile fauna also includes small colonies of <i>A. digitatum</i> and small individuals of <i>U. felina</i> , whilst the motile fauna includes the hermit crab <i>Pagurus bernhardus</i> , portunid crabs, <i>A. rubens</i> and <i>E. esculentus</i> .	CR.HCR.XFa.FluCoAs.X (assignment uncertain)

The site specific survey conducted at T1 (Biotikos, 2010) reports that the numbers (135 different taxa) and types of species taken from the four sample stations indicates a relatively diverse benthic assemblage. The

community is considered to be predominantly a surface feeding one, with suspension feeders such as polychaetes, *Jasmineira caudata*, and the surface detritus feeding *Polycirrus norvegicus* featuring strongly in numerical terms. Other notable contributors include Hesionid polychaetes and many species of the family Syllidae (also polychaetes). Crustaceans are well represented, with 35 taxa in total, of which those best represented include the amphipods *Urothoe elegans*, *Urothoe marina* and *Leptocheirus hirsutimanus*. Molluscs make up a significant constituent of the assemblages, with chitons, *Leptochiton asellus* and *Leptochiton cancellatus* particularly notable amongst several gastropod and bivalve species. The brittlestar *Amphipholis squamata*, commonly found amongst maerl, represents the most abundant taxon in terms of echinodermata. The site specific survey also reports the presence of maerl, which is often found in relatively shallow, high energy locations with little deposition, although cannot survive in very high water movement which destabilises it as it is not a fixed alga. The combination of good flushing and the physical structure of the live nodules and dead fragments mean that maerl habitats provide an ideal microenvironment for invertebrate species. Indeed, they are generally recognised as one of the most biologically diverse benthic systems in soft substratum ecology, supporting complex and dynamic associations. The overall relative contributions of the groups described above show an equitable community with high diversity and trophic indices that is characteristic of maerl samples.

Figure 3.3 Site SH/1 (Shapinsay Sound Tow 1 at T1) showing sparse scatter of live epifauna and drift algae



Figure 3.4 Site SH/2 (Shapinsay Sound Tow 2 at T1) showing sparse epibiota and drift alga with scattered pebbles/shells



Figure 3.5 Site SH/2 (Shapinsay Sound Tow 2 at T1) showing rippled, pure, fine-medium sand



Figure 3.6 Site SH/3 (Shapinsay Sound Tow 3 at T1) showing cobbles, boulders and pebbles with erect algae



Figure 3.7 Site SH/3 (Shapinsay Sound Tow 3 at T1) showing Rippled fine or medium sand with scattered, pink algae encrusted boulders

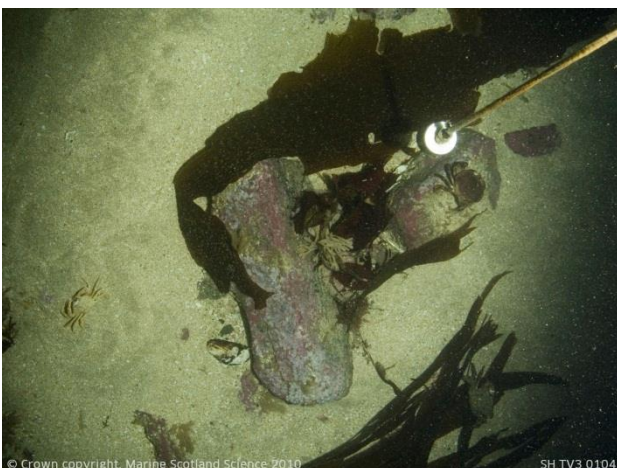


Figure 3.8 Site SH/4 (Shapinsay Sound Tow 4 at T1) showing a mixed substrate and scattered turf of F. foliacea and encrusting sponges

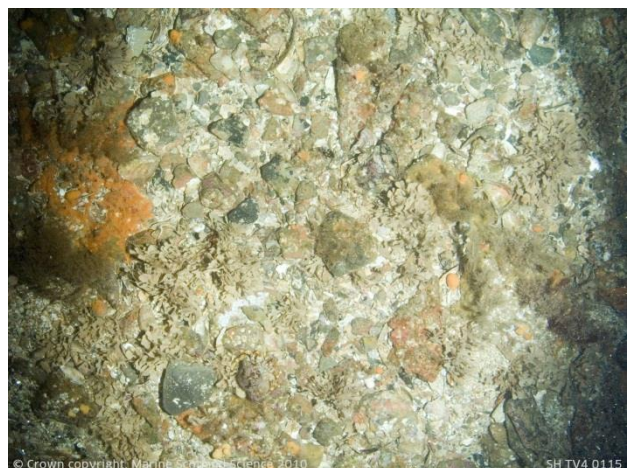
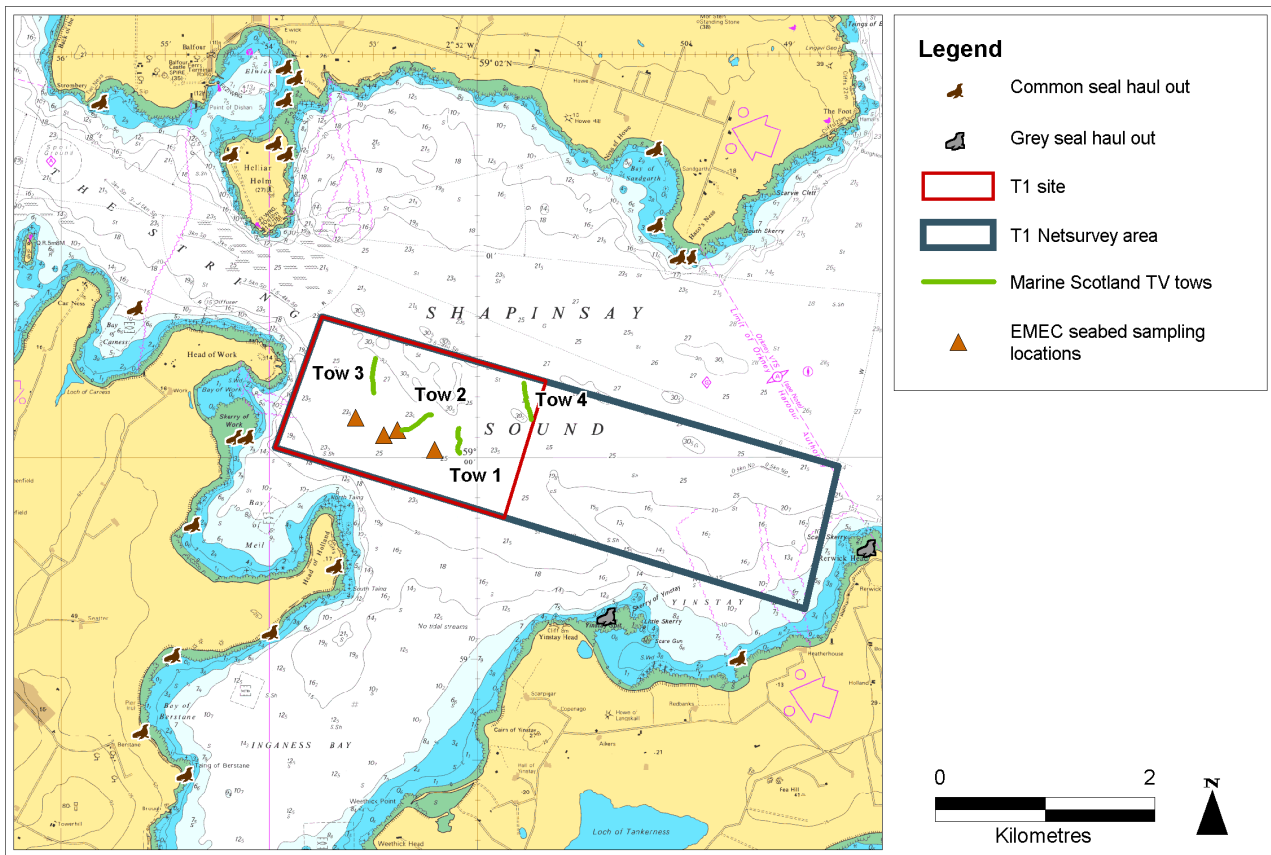


Figure 3.9 Summary of select environmental sensitivities and survey information



3.4 Plankton

Plankton in the region is likely to be characterised by coastal (neritic) and mixed (intermediate) water species that are largely influenced by the inflow of Atlantic water (Edwards and John, 1997), although the inflow from the Atlantic Ocean along the western edge of the North Sea in late summer/autumn may introduce more oceanic species.

A spring increase of phytoplankton (mainly diatoms) occurs in the waters around the T1 site (as well as wider Orkney waters) begins in March and peaks between April and May. This is followed by a decline in June to steady levels until another peak in September, with the dominant species present including barnacle larvae. The abundance of zooplankton during autumn is noticeably greater than that for phytoplankton, being dominated by crustaceans (principally copepods) (Jones and Beards, 1983). Nellen and Schadt (1992) report fairly large fluctuations in zooplankton taxa occurring that are considered linked to environmental conditions that vary from interannually. However, the overall variability in the zooplankton biomass is low, suggesting a relatively stable ecosystem.

Plankton is of fundamental importance as it is the basis of the entire marine ecosystem, forming a vital link in the food chain of larger organisms such as fish, seabirds and cetaceans (whales and dolphins). Zooplankton is key to the survival of fish species such as herring.

There is documented evidence around Orkney of a rise in the incidence of dinoflagellates (such as *Gymnodium* spp.) with the ability to produce toxins. In particular, the dinoflagellate *Alexandrium tamarense*,

a species that is considered involved in paralytic shellfish poisoning (PSP), which has occurred in Orkney regularly since 1968 (e.g. Bresnan *et al.*, 2002). A number of potential sources, including vessel traffic and aquaculture, have been suggested as contributors to the occurrence of these unusual blooms as a result of localised nutrient enrichment. However, other studies have suggested that other causes such as increased awareness and monitoring are involved (e.g. Joyce, 2001).

3.5 Fish and Shellfish

3.5.1 Finfish

As with much of UK waters, fish studies of high spatial resolution are poorly represented for this part of Orkney. Despite this, it is possible to make general statements based on the location of the site and known seabed conditions. As such, fish species likely to be found include saithe *Pollachius virens*, pollack *Pollachius pollachius* and ling *Molva molva*. Other gadoids appear seasonally and include cod *Gadus morhua*, which is widely distributed around Orkney during the summer months. Whiting *Merlangius merlangus* and haddock *Melanogrammus aeglefinus* can appear during late summer and autumn in larger but often variable sized shoals. Both species are abundant and present throughout the wider Orkney area. Herring *Clupea harengus* and mackerel *Scomber scombrus* are present during their migratory passage past Orkney, but are unlikely to pass through Shapinsay Sound with any regularity. Monkfish *Lophius piscatorius* spawn in deep water along the edge of the UK continental shelf, mainly during March and June. However, juveniles and non-spawning adults are present throughout Orkney waters. Conger eels *Conger conger* and gurnard *Triglidae spp.* may also be expected to be present.

Orkney Biodiversity Records Centre (OBRC) report the presence of ballan wrasse *Labrus bergylta*, butterfish *Poronotus triacanthus*, cod and saithe in the area (Gauld, pers. comm.), whilst the Marine Scotland survey of the benthos of the area incidentally recorded the presence of goby and cod.

Shapinsay Sound is located within important areas for a number of commercially important fish species. Herring spawn in the area in August and September, lemon sole *Microstomus kitt* between April and September, sand eels *Ammodytes marinus* between November and February and sprat *Sprattus sprattus* between May and August, with a peak in May and June. Saithe, lemon sole, sandeel and sprat use the area as a nursery ground year round (Coull *et al.*, 1998).

It is possible that migratory marine fish species such as eels, salmon *Salmo salar* and trout *Salmo trutta* may move through the wider Orkney area and through Shapinsay Sound. Whilst the amount of time that salmon spend in the coastal zone is limited, sea trout spend much longer periods in coastal waters (Faber Maunsell & Metoc, 2007). For example, numerous sea lochs, small burns and surrounding coastal seas of Orkney are reported to contain populations of the sea trout (Robson, 1997). Sea trout spawn in freshwater during the months of October to January and then migrate out to sea to mature. Despite the occurrence of trout in much of Orkney's inshore waters, Orkney Trout Fishing Association (2009) does not list any of the burns in the vicinity of T1 as having a demonstrable trout population.

3.5.2 Shellfish

Recent surveys (Section 3.3) have indicated the presence of the edible and velvet crab and OBRC also report the flat oyster *Ostrea edulis* has been found within and around the T1 site (Gauld, pers.comm.). It is likely that the lobster *Homarus gammarus* and other crustaceans (such as the shrimp *Nephrops norvegicus*) will be present at the site and within Shapinsay Sound.

3.6 Ornithology

Much of Orkney's extensive coastline is colonised by seabirds and some sections have several contiguous colonies. Of the seabird colonies in Orkney, in excess of twenty have historically held numbers of seabirds at or above 1% of the total population of the European total for that species (Tasker, 1997). In recent years, however, populations of seabirds around Orkney have been vastly reduced (RPSB, 2010a) and 2008 was reported to have been a poor breeding season (Meek, Undated).

SNH reported, during pre-screening for the nursery test sites, that the Shapinsay Sound area is very important for large numbers of seaducks (in particular eiders *Somateria mollissima*, great northern divers *Gavia immer* and Slavonian grebes *Podiceps auritus*), with RSPB confirming this by highlighting that the area acts as a wintering ground for scoters, divers, grebes, and eiders. There is also a gathering of species in spring months (lasting until May) prior to the migration north to breeding grounds. Sightings of various gulls and waterfowl would also be expected in the area (Tay and Orkney Ringing Groups, 1984). OBRC provided information on species sightings in the vicinity of the T1 site (Gauld, pers. comm.). These data indicate that numerous bird species have been recorded in the waters around T1 and onshore in the vicinity of the coast. In accordance with what would be expected, a large number of observations have been made of gull (e.g. great black backed *Larus marinus*, black-headed *Chroicocephalus ridibundus*), coot and duck (e.g. scoters, tufted duck *Aythya fuligula*, teal *Anas crecca*) species.

Lewis *et al.* (2009) report the results of a JNCC-led seaduck, diver and grebe survey conducted in Shapinsay Sound and the north of Orkney. High numbers of great northern diver, common eider *Somateria mollissima*, long-tailed duck *Clangula hyemalis* and smaller numbers of red breasted merganser *Mergus serrator* and unidentified divers were reported. The largest concentrations of birds were observed around the islands of Wyre and Gairsay and in Wide Firth, rather than Shapinsay Sound.

Whilst it is likely that the majority of these birds will be present (to varying degrees) across much of the rest of Orkney, there are a number of species that are listed on Annex I of the Birds Directive (Directive 2009/147/EC) that have previously been sighted in the wider offshore T1 area. For example, the black throated *Gavia arctica*, great northern and red throated *Gavia stellata* divers, the common tern *Sterna hirundo*, and the whooper swan *Cygnus cygnus* have all been sighted on numerous occasions. Other Annex I bird species that have been reported but on fewer occasions include the Arctic *Sterna paradisaea*, little *Sterna albifrons*, roseate *Sterna dougallii* and sandwich *Sterna sandvicensis* terns.

The time of year during which the highest population numbers are expected varies depending on the species. For example, the highest numbers of seabirds will occur between April and September when birds are breeding and fledging but species such as divers and grebes over winter in the region and thus sensitivity for these groups will be highest during that time. Specifically for the area in which this site is located, RSPB consider it to be less sensitive between June and September.

3.7 Marine Mammals

3.7.1 Pinnipeds

3.7.1.1 Grey seal

The Natural Environment Research Council's (NERC) Special Committee on Seals (SCOS, 2009) report that approximately 45% of the world's grey seals *Halichoerus grypus* breed in the UK and 90% of these breed at colonies in Scotland with the main concentrations in the Outer Hebrides and in Orkney. Growth has been

levelling off in Orkney (as with some other colonies in the northern North Sea) with 18,800 pups born in Orkney in 2008. The rate of increase in Orkney has declined since 2000 although pup production has been relatively constant since 2004.

The isolated coast and, islands and rocky skerries of Shapinsay Sound and the surrounding area act as suitable haul-out and breeding sites for grey seals. Data from aerial and other surveys (SMRU, pers. comm.) indicate that the nearest known grey seal haul-out (Figure 3.9) is 1.3 km south east at Yinstay where 14 animals have been observed whilst the closest grey seal pupping site is located on Grass Holm, 6.2 km to the north west.

3.7.1.2 Harbour seal

SCOS (2009) report that major declines have been documented in harbour seal *Phoca vitulina* populations around Scotland with declines of up to 50% since 2000 in Orkney. SCOS (2009) state that these latest results suggest that the Orkney harbour seal population declined by 67% since the late 1990s and has been falling at an average rate of over 13% annually since 2001. There were thought to be 2,867 harbour seals in Orkney between 2006 and 2008, but SCOS (2009) commented, in 2008, that repeat surveys of Orkney would be desirable to determine the ongoing trend in numbers.

Perhaps even more so for harbour seals than for grey seals, Shapinsay Sound and the surrounding area provides haul-out and breeding sites for the species. Indeed, there are numerous harbour seal haul-outs around the T1 site (Figure 3.9), with observations ranging between 1 and 86 animals (SMRU, pers. comm.). SNH, during the screening process, commented that up to 100 harbour seals can be found at breeding sites in the wider Shapinsay area.

3.7.2 Cetaceans

All species of cetacean are European Protected Species (EPS). SeaWatch (Undated) report that the cetacean fauna of Orkney is one of the richest in the UK, with the majority of sightings being made from the west coast. SeaWatch (Undated) report that, since 1980, seventeen species of cetacean have been recorded along the coast or in nearshore waters and that, of these, seven species (25% of the UK cetacean fauna) are present throughout the year or recorded annually as seasonal visitors. The minke whale *Balaenoptera acutorostrata* is the most frequently observed baleen whale in the region, with the long-finned pilot whale *Globicephala melas* an infrequent visitor. With regard to odontocetes, the killer whale *Orcinus orca* is widely distributed throughout Orkney waters, occurring in all months of the year (peak inshore June - October), with a similar pattern existing for Risso's dolphin *Grampus griseus* (peak in August) and the harbour porpoise *Phocoena phocoena* (peak July and August). The white-beaked dolphin *Lagenorhynchus albirostris* is common and widely distributed, peaking between June and October, whilst the Atlantic white-sided dolphin *Lagenorhynchus acutus* is an infrequent visitor with numbers highest in August. Recent unusual cetacean sightings include the humpback *Megaptera novaeangliae* and sperm whales *Physeter macrocephalus*.

Whilst these species may be present around the Orkney coastline, it is unlikely that the majority will be seen regularly within Shapinsay Sound due to its inshore location and shallower waters. Indeed, OBRC data (Gauld, pers. comm.) show that only the harbour porpoise (the most commonly sighted cetacean in the vicinity of T1), white-beaked dolphin and humpback, killer and minke whales as having been sighted in and around the T1 area. SNH, during the screening process, commented that harbour porpoise are frequently recorded off Rerwick Head.

It should be noted that there are no known resident populations of cetaceans within Shapinsay Sound or the wider Orkney area.

3.7.3 Otter

Otter are classed as EPS, but whilst otter may be spotted along shorelines, near burns and offshore to approximately 10 m water depth. The absence of any associated landfall with the nursery test site and the depth of around 20 m mean it is unlikely any otter will use the area of water at T1.

3.8 Turtles

DECC (2009) report that of the five species of turtles recorded in UK waters, the vast majority of records (in excess of 80%) are of the leatherback turtle *Dermochelys coriacea*. This species is a regular visitor to Scottish waters and is likely to be the only species sighted with any regularity in Orkney waters. It is considered that this species is at the limits of its northern extent when in UK waters and that most appearances are accidental (DECC, 2009). The species is most likely to be sighted between August and November (Booth and Booth, 1994). OBRC data for the T1 site do not show the presence of any turtle species.

3.9 Conservation

The T1 nursery site is not located within any designated conservation areas. The nearest site is Den Wick SSSI, 8 km from the development site. Figure 3.1 provides an overall context for the site showing that T1 is within approximately 10 km of a number of locally and nationally important sites; it is possible that some of these sites may support populations of species which use the T1 and wider Shapinsay Sound area for foraging. It is also important to acknowledge that the T1 site is located within a wider area of Orkney coastline and inshore habitats which represent, in some cases, nationally and internationally important regions of conservation interest which have been identified as Special Areas of Conservation (SACs), Special Protection Areas (SPAs) (including some areas for which extended marine boundaries have recently been established) and National Scenic Areas amongst others. The Orkney Local Plan (OIC, 2004) identifies some areas onshore as being sites of local nature conservation importance under policy LP/N1. Sites of local importance are representative of important Orkney nature conservation areas and the diversity of habitats and nature interests in the archipelago. Table 3.2 and Table 3.3 describe the conservation area types shown in the vicinity of T1 (Figure 3.1).

Table 3.2 Details of conservation designations (SNH, 2009, 2010a, 2010b)

Conservation Designation	Details
Special Protection Area (SPAs)	A SPA is a site designated under the Birds Directive. that are internationally important for threatened habitats and species. SPAs are selected for a number of rare, threatened or vulnerable bird species listed in Annex I of the Birds Directive, and also for regularly occurring migratory species.
Site of Special Scientific Interest (SSSIs)	SSSIs are those areas of land and water (to the seaward limits of local authority areas) that SNH considers to best represent Scotland's natural heritage - its diversity of plants, animals and habitats, rocks and landforms, or a combinations of such natural features. SNH designates SSSIs under the Nature Conservation (Scotland) Act 2004.
Local Nature Reserve (LNRs)	LNRs are areas of at least locally important natural heritage, designated and managed by local authorities to enhance public access to nature. Local authorities select and designate local nature reserves using their powers under section 21 of the National Parks and Access to the Countryside Act 1949 (as amended).
RSPB Reserve	RSPB reserves across the UK cover a wide range of habitats (including saline lagoons, native pinewoods, shingle and reed beds) and support 30 % of the UK's breeding populations of 13 species of Birds of Conservation Concern.

Table 3.3 Details of biological conservation areas of T1 area (RSPB, 2010b, 2010c, SNH, 2010c). Circled numbers refer to locations shown on Figure 3.1.

Site and Distance from T1	Details
Mill Dam RSPB Reserve - 4.1 km north north west ①	Described by the RSPB as an ideal place for birds throughout the year. In summer, large numbers of breeding wildfowl (including pintails, redshanks and wigeons) are present whilst in the winter migrating whooper swans and other birds can be sighted.
Den Wick SSSI - 8 km south east ②	Designated for its geological interest, Den Wick represents one of the best examples of a multiple till section in Orkney.
Keelylang Hill and Swartabeck Burn SSSI - 8.3 km south west ③	These moorlands are important for the density and diversity of the bird community they support and in particular for the variety and numbers of birds of prey; more than 18 species of moorland birds breed in the Keelylang/Swartabeck area. Of national importance are the thirty three traditional Hen Harrier sites of which the minimum number occupied in any year is estimated at 7 (~2% of the British population). In addition more than 1% of the national population of Merlin nest on the site along with a significant proportion (~10%) of Orkney's short-eared owls. Both species occur at a density higher than elsewhere in the islands.
Orkney Mainland Moors SPA - 8.3 km south west ③	The predominant habitats include extensive areas of blanket bog, acid grassland, wet and dry heath, acidic raised-mire and calcareous valley mire. Sheltered valleys and dales support willow scrub, tall-herb and flush vegetation. This site qualifies as a SPA by regularly supporting populations of European importance of the Annex I species hen harrier, red-throated diver and short-eared owl. The hen harrier population on this site is one of the largest and the densest in Britain. The short-eared owl is widely dispersed across its British distribution and Orkney Mainland Moors is one of the few sites to support significant numbers.
Mull Head LNR - 8.5 km south east ④	This site contains coastal grassland heath and sea cliffs that are colonised by hundreds of seabirds. There is a small colony of greater black-backed gull and pairs of great skua. Red-throated diver may be seen here and there is the chance of observing Peregrine also. Seals are a common sight in the seas and it may be possible to observe otters on the shoreline.
Hobbister RSPB reserve - 10.8 km south west ⑤	This reserve hosts sea cliffs, saltmarsh, moorland and sandflats. Hen harriers, short-eared owls and red-throated divers nest on the moorland. Red-breasted mergansers and black guillemots can be seen also.
Waulkmill SSSI - 11.9 km south west ⑥	This encompasses a wide range of nature conservation interests including a sandflat and well vegetated shingle spit behind which one of the more extensive areas of saltmarsh in Orkney has developed. Fragments of freshwater marsh also occur at the edge of the saltmarsh. These cliffs are considered to form one of the best general moths and butterfly habitats in Orkney. One species, <i>Coleophora vigaureae</i> , occurs here in its only known locality in Orkney. The surrounding areas of mature heather and shrub growth are frequented by breeding moorland birds.

With regards to species of conservation significance, a number of species listed on Annex I of the Birds Directive or Annex II of the Habitats Directive are considered to be present in varying numbers at differing times of the year (see Sections 3.5 and 3.6) but the T1 area is not thought to be integral to significant groups of any such species.

The T1 site is not located within any Important Bird Areas. The closest is Mill Dam, which is coincident with the RSPB reserve of the same name, but this is located approximately 3 km to the north (Figure 3.1). Waders, ducks and gulls are found at this site.

Moore (2009) gives a preliminary assessment of the conservation importance and potential sensitivity of seabed habitats to renewable energy schemes of the area using the information collected by Marine Scotland. This report concludes that the three species of recognised conservation importance recorded in the Pentland Firth are unlikely to be adversely impacted by renewable energy developments in the surveyed area. With regard to the habitat recorded, Moore (2009) report that the Pentland Firth probably represents the most extensive example of the UK BAP Priority Habitat “tidal rapids” in the United Kingdom. However, the communities observed during the Marine Scotland survey were of low diversity and composed of very common, widely distributed, scour-tolerant species, likely to be tolerant to modest reductions in current speed or sediment disturbance caused by the introduction of energy schemes. Similarly, it is considered that schemes are unlikely to affect significantly the conservation of habitats of conservation importance that were recorded during the survey, either at Scottish or UK levels. One of the biotopes (SS.Ssa.lfiSa) recorded at the T1 site is listed both the UK Biodiversity Action Plan and the Scottish Biodiversity List (SBL) whilst CR.HCR.XFa.FluCoAs.X is listed on the SBL only. It should be noted, however, that the latter assignment is currently rated by SNH as uncertain (Moore, 2009).

The site specific survey conducted at T1 (Biotikos, 2010) reported the presence of maerl, albeit accounting for no more than 25% of the sample, and ordinarily much less. If the maerl distribution were to extend across the wider Shapinsay Sound area then it would classify as a maerl bed according to UKBAP definition. However, it should be noted that Marine Scotland surveys coincidental with the T1 site report only scattered, sparse occurrences of maerl (Moore, 2009).

3.10 Other Sea Users

3.10.1 Fisheries

In Scotland there has been a steady decline in the numbers employed in sea fishing, and this trend is reflected in Orkney. The number of boats targeting white fish has reduced to just one out of Westray, with a further four boats in the Orkney fleet fishing from the Mainland. As problems have faced the white fish industry, the shellfish and creel sector now contribute a major part to the Orkney fleet. This spreads throughout the islands, playing a vital economic and social role that is of particular importance to the northern isles. The main species fished are brown, green and velvet crab and lobsters.

Considering the inshore location of the T1 site, and its positioning within the sound, regular fishing by the largest fisheries vessels is potentially unlikely, although given the proximity of the T1 site to Kirkwall, it is likely that any vessels fishing out of the town will pass through or near to T1 on occasion. Indeed, satellite information (Scottish Government, pers. comm.) for 2008 indicates that the T1 site is isolated from major fishing grounds worked by vessels greater than 15 m in length but that it sits immediately to the south of an apparent steaming route for fishing vessels in and out of Kirkwall.

The Orkney Fisheries Association (OFA) report that there are relatively high levels of fishing around Rerwick Head, echoing information from Orkney Fishermen’s Society (OFS) and the Orkney Creel Fishermen’s Association (OCFA) who report some activity (by divers for scallops) at the site. This seems to be confirmed by the Navigational Risk Assessment (NRA) commissioned as part of the development process that reports

fishing in the area consists of creeling, as well as dredging and diving for scallops. Vessels tend to be small, below 12 m in length and the most intense activity is at Rerwick Head to the east of the T1 site. Fishing takes place all year round with a peak period around Christmas.

3.10.2 Aquaculture

Whilst there are a number of aquaculture sites (mainly used for the farming of Atlantic salmon) located around Orkney coasts, there are only three sites in the vicinity of the T1 site in Shapinsay Sound; these are Meil Bay (the bay into which the western extreme of the T1 boundary extends), Carness (to the north and west) and a shell fish site at Inganess (a bay that lies off Shapinsay Sound to the south of T1), within 1 km, 2 km and 3 km respectively.

3.10.3 Vessel Traffic

Shapinsay Sound, in which T1 is located, provides one of only two marine exits from Orkney's capital Kirkwall, acting as the east of the two exits. The NRA collected six weeks of vessel data from Shapinsay Sound during summer 2009 and six weeks from winter 2010. Plots showed a total of 39 and 26 tracks¹ passing through the site boundary during summer and winter, respectively, corresponding to less than one track per day during each period (Figure 3.10 and Figure 3.11). The majority of these tracks were made by a small number of vessels; the Coastguard tugs *Anglian Prince* and *Anglian Sovereign* regularly intersected the site when heading to and from the important anchorage of Inganess Bay to the south. The pilot vessel *Kirkwall Bay* also passed through the site on several occasions when heading to and from Kirkwall to board and disembark pilots. Consultation with OIC Marine Services indicated that pilots disembark south of Shapinsay Sound in the vicinity of T1 in certain conditions. The frequency of this was estimated at 8 - 10 times per year. Other tracks generally crossed the northern fringe of the site when heading east-west via Shapinsay Sound and The String to and from Kirkwall. This route was used by an average of three vessels per day in summer and two per day in winter (excluding pilot vessels). This traffic includes the regular NorthLink passenger ferries *Hrossey* and *Hjaltland* heading between Kirkwall and Aberdeen / Lerwick.

Small vessel activity that is not represented on AIS, such as fishing and recreational vessels, was obtained from other data sources and consultation. Scapa Vessel Traffic Service (VTS), operated by OIC Marine Services, set-up a "Gate" between Rerwick Head and Head of Work, to log vessels passing in the vicinity (Figure 3.9). A total of 27 vessel tracks crossed the Gate, corresponding to an average of less than one per day. This suggests activity is low, although it is noted that the data currently only covers the spring period. Consultation indicated small vessels navigating via The String would tend to hug the coast (and cross the gate) when passing between Head of Work and Rerwick Head to avoid the strong tides. Hence, the count is likely to over-estimate small vessel activity as it extends well beyond the site to Rerwick Head.

Mainstream Scotland advise that a 10 m boat makes daily visits (hugging the coast) to the nearby Bay of Meil fish farm; quarterly inspections are conducted by 25 m boat.

¹ Shipping in the vicinity of the T1 site was primarily identified using Automatic Identification System (AIS) tracking data. AIS carriage is mandatory for the vast majority of vessels above 300 tonnes. A proportion of smaller vessels also carry it voluntarily.

Figure 3.10 AIS vessel tracks by type passing T1 site (Summer 2009)

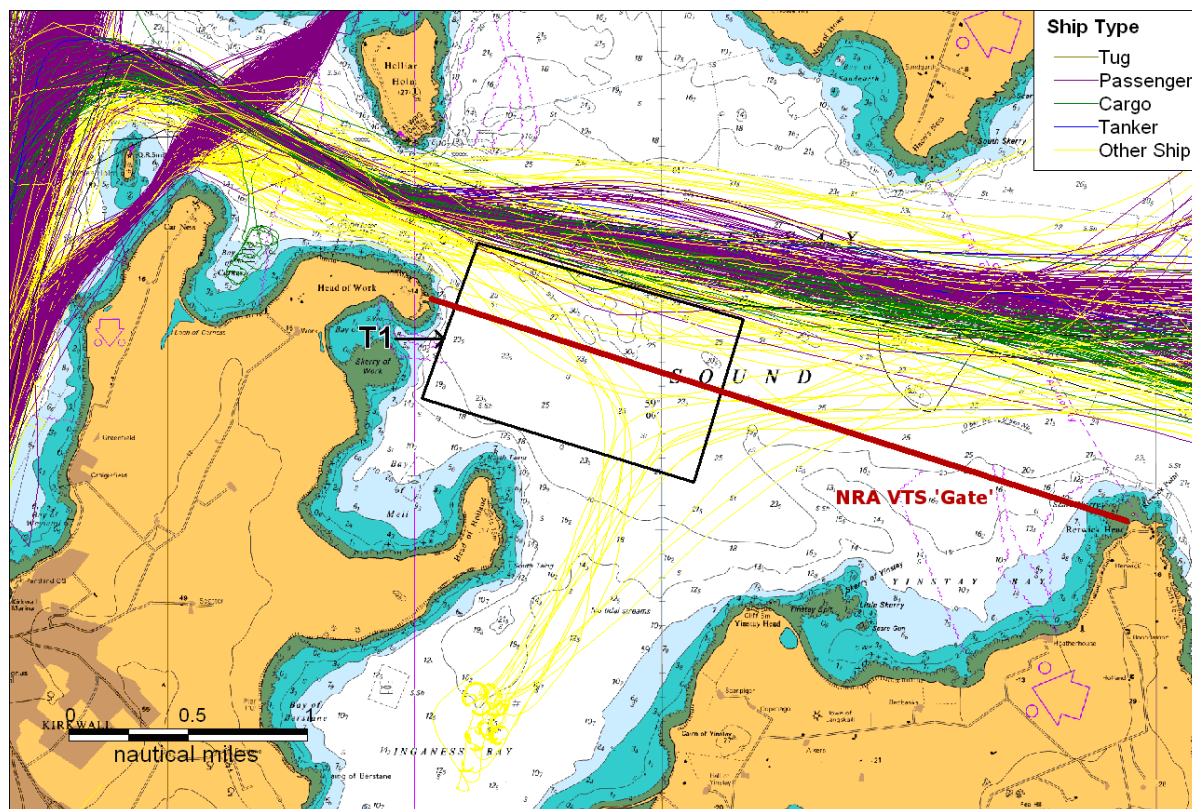
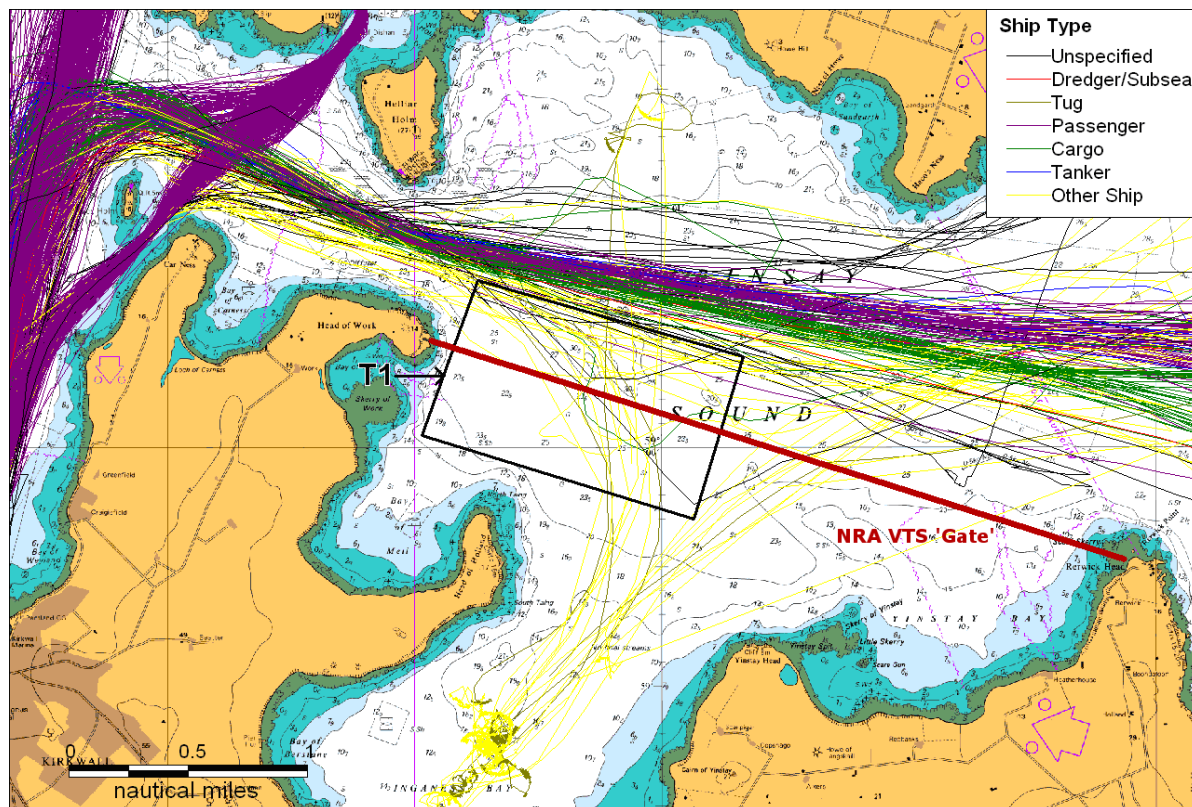


Figure 3.11 AIS vessel tracks by type passing T1 site (Winter 2010)



3.10.4 Recreation

Whilst the T1 site and surrounding waters are not a major location for recreational diving, the Orkney Dive Boat Operators Association comment that the occurrence of flood tides can require dive boats (and fishing boats) to move close inshore and to follow the 10 m depth contour. Most movement of diving vessels occurs, as would be expected, during the summer months. Jet skiers and wind surfers are known to use Inganess Bay and the Coastguard tug Anglian Monarch often anchors in Inganess Bay. The site sits on a popular advanced kayaking route from Kirkwall via The String through to Rerwick Head and Yinstay Bay. These trips would only tend to occur in good weather during daytime and the route taken stays close to the coastline. Inganess Bay is popular for such use when the weather excludes other areas. There is no surfing reported at or near this site. Recreational vessels, such as yachts, transit the area heading to and from Kirkwall marina. Vessels tend to keep close to the coastline to avoid commercial ships as well as the strong tidal flows in Shapinsay Sound. This is characterised as a “medium-use” route by the RYA.

3.10.5 Archaeology

Recent evidence suggests the possibility of the presence of submerged landscapes around the Orkney coastline (Orkney Communities, 2009). However, the potential for the survival of any prehistoric interests is likely to be lower at the T1 site due to the high energy environment of the open waters of Shapinsay Sound.

Interrogation of the RCAHMS, Historic Scotland and Local Authority Sites and Monuments Records database (Pastmap, 2010) shows that, whilst there are sites of archaeological interest along the nearby coast (for example, onshore to the west of T1 is the Scheduled Monument ‘Head of Work Chambered Cairn’), there are no known archaeological sensitivities in the T1 offshore area.

Whilst the geophysical survey noted the presence of a possible wreck in the wider area being surveyed (see Section 3.3.2), there were no wrecks in the proposed area for licensing. The relevant Admiralty charts do not report any submerged objects.

3.10.6 Others

Admiralty charts show the presence of a cable approximately 1.4 km to the north west of the site but a lack of pipelines, foul grounds or wrecks in the area (UKHO, 2008). There are no sea surface military practice and exercise areas (PEXA) in the vicinity of T1, although the area is located in an Air Force PEXA (DECC, 2009).

4 KEY ENVIRONMENTAL SENSITIVITIES

Harbour Seals	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
<p>Harbour seals begin to arrive at the breeding grounds in June and most births take place at the end of June and the beginning of July. This seal species moults in August and September. Data from aerial and other surveys indicate that there are numerous harbour seal haul-outs around the T1 site, with between 1 and 86 animals at each site. The key issues to consider are collision risk and construction/operation/decommissioning disturbance.</p>												
Grey Seals	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
<p>Female and male grey seals begin to arrive at the main breeding beaches towards the middle of September, and pups are born from the end of September until mid December. Females moult between mid January to late February, while males moult between mid February and early April. Data from aerial and other surveys indicate that the nearest known grey seal haul-out is 1.3 km south east at Yinstay where 14 animals have been observed whilst the closest grey seal pupping site is located on Grass Holm, 6.2 km to the north west. The key issues to consider are collision risk and construction/operation/decommissioning disturbance.</p>												
Harbour Porpoise	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
<p>Whilst there are no known resident populations of Harbour Porpoise in Orkney waters, OBRC data show the harbour porpoise to be the most commonly sighted cetacean in the vicinity of T1. SNH, during the screening process, commented that harbour porpoise are frequently recorded off Rerwick Head. This species has a large ranging nature and it has been suggested that they move offshore during the winter. The key issues to consider are collision risk and construction/operation/decommissioning disturbance.</p>												
Other Cetaceans	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
<p>OBRC data show that the white-beaked dolphin and humpback, killer and minke whales have been reported in the vicinity of T1. These species are likely to be sighted in low numbers with variable seasonal occurrence; sightings of most species will be highest between May and October, with the exception of pilot whales which are sighted most often in winter months (Evans, 1997). The key issues to consider are collision risk and construction/operation/decommissioning disturbance.</p>												
Birds	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
<p>Although bird species are present all year round, the highest population numbers will vary depending on the species. The highest numbers of seabirds are likely to occur between April and September when birds are breeding and fledging. For the T1 area, RSPB consider the area to be part of a larger wintering ground for scoters, divers, grebes, and eiders that gather in spring prior to migration north to breeding grounds; the site will consequently be less sensitive June to September.</p>												
Finfish & Shellfish	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
<p>As with much of Orkney, W2 is located within spawning and nursery areas of a number of fish species. Spawning times vary by species.</p>												
Other Sea Users	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
<p>Whilst fishing takes place all year round, there is a peak around Christmas. This is the opposite of what the NRA shows for general vessel use of the area, which showed more vessel passages during summer months, and what consultation with recreational users suggests (peak activity in summer months).</p>												
Key:	High					Moderate				Low		

Table 4.1 Seasonal variations of key environmental sensitivities

5 REFERENCES

- BGS, 1985. Orkney Sheet 59°N - 04°W. British Geological Survey 1:250000 Series. Solid Geology.
- Booth, C. and Booth, J., 1994. The Mammals of Orkney. The Orcadian Ltd., Orkney.
- Bresnan, E., Fraser, S., Kelly, M. C., 2002. Toxic Phytoplankton Monitoring in Scotland. 1 January 1999 to 31 December 2000. Fisheries Research Services Report No 04/02.
- Coull, K.A., Johnstone, R. and Rogers, S.I., 1998. Fisheries Sensitivity Maps in British Waters. Published and distributed by UKOOA Ltd.
- DECC, 2009. Future leasing for offshore wind farms and licensing for offshore oil and gas storage. Environmental Report. Available online at http://www.offshore-sea.org.uk/consultations/Offshore_Energy_SEA/index.php [Accessed 28/04/10]
- Doody, J.P., 1997. Introduction to the region. In: Barne, J.H., Robson, C.F., Kaznowska, S.S., Doody, J.P., Davidsen, N.C. and Buck, A.L. (eds) Coasts and Seas of the United Kingdom, Region 2 Orkney. Joint Nature Conversation Committee, Peterborough.
- Edwards, M. and John, A.W.G., 1997. Plankton. In: Barne, J.H., Robson, C.F., Kaznowska, S.S., Doody, J.P., Davidsen, N.C. and Buck, A.L. (eds) Coasts and Seas of the United Kingdom, Region 2 Orkney. Joint Nature Conversation Committee, Peterborough.
- Evans, P.G.H., 1997. Whales, dolphins and porpoises. In: Barne, J.H., Robson, C.F., Kaznowska, S.S., Doody, J.P., Davidsen, N.C. and Buck, A.L. (eds) Coasts and Seas of the United Kingdom, Region 2 Orkney. Joint Nature Conversation Committee, Peterborough.
- Faber Maunsell and Metoc, 2007. Scottish Marine Renewables. Strategic Environmental Assessment (SEA). Environmental Report. Available online at <http://www.seaenergyscotland.net/> [Accessed 04/05/10]
- Jones, A.M. and Beards, F., 1983. Planktonic Cycles in Scapa Flow 1978-1979. Technical Report GEN/PL/1.
- Joyce, L. B., 2001. An investigation into the occurrences of harmful algal blooms in Scapa Flow, Orkney. MSc Dissertation, ICIT, Orkney.
- Land Use Consultants, 1998. No 100 - Orkney Landscape Character Assessment. Prepared by Land Use Consultants, Glasgow, to SNH, Edinburgh.
- Lewis, M., Wilson, L.J., Söhle, I., Dean, B.J., Webb, A. and Reid, J.B., 2009. Aerial surveys of aggregations of seabirds, divers and grebes in UK inshore areas outside the breeding season in 2007/08, *JNCC Report*, No. 434
- Meek, E., Undated. Seabird Monitoring in Orkney - 2008 Summary Report.
- Moore, C.G., 2009. Preliminary assessment of the conservation importance of benthic epifaunal species and habitats of the Pentland Firth and Orkney Islands in relation to the development of renewable energy schemes. Scottish Natural Heritage Commissioned Report No. 319.
- Nellen, W. and Schadt, J., 1992. Year to year variability in the plankton community on the spawning ground of the Hebrides-Buchan herring - hydrological variability in the ICES area, 1980-1989. *ICES Journal of Marine Science*, 195, 361 - 387.

Netsurvey Ltd, 2010. Multibeam Survey Report - Hi Resolution Survey of Potential Sites for Renewable Energy Testing. Prepared by Netsurvey Ltd, Oxon, for EMEC Marine Energy Centre Ltd, Orkney. Multibeam Survey Report REP284-01-04 20100331.

OIC, 2004. The Orkney Local Plan - Written Statement. Department of Development, Orkney Islands Council. Available online at http://www.orkney.gov.uk/nqcontent.cfm?a_id=9931 [Accessed 03/05/10]

Orkney Communities, 2009. Scapa Flow Land Partnership Scheme. Available online at <http://www.orkneycommunities.co.uk/SCAPAFLOW/news.asp?intent=viewstory&newsid=918> [Accessed 29/04/10]

Orkney Trout Fishing Association, 2009. Juvenile sea trout populations in Orkney. Available online at http://www.orkneytroutfishing.co.uk/envirionment/e_seatroutsurvey.html [Accessed 29/04/10]

Pastmap, 2010. Royal Commission on the Ancient and Historical Monuments of Scotland - Pastmap. Available online at <http://jura.rcahms.gov.uk/PASTMAP/start.jsp> [Accessed 29/04/10]

Robson, C.F., 1997. Fish: salmon, sea trout and eels. In: Barne, J.H., Robson, C.F., Kaznowska, S.S., Doody, J.P., Davidsen, N.C. and Buck, A.L. (eds) Coasts and Seas of the United Kingdom, Region 2 Orkney. Joint Nature Conversation Committee, Peterborough.

RPSB, 2010a. Orkney's vanishing seabirds. Available online at <http://www.rspb.org.uk/climate/wildlife/seabirds/orkney.asp> [Accessed 28/10/04]

RSPB, 2010b. The RSPB: Mill Dam, Shapinsay. Available online at <http://www.rspb.org.uk/reserves/guide/m/milldam/index.aspx> [Accessed 10/05/10]

RSPB, 2010c. The RSPB: The Hobbister: About Hobbister. Available online at <http://www.rspb.org.uk/reserves/guide/h/hobbister/about.asp> [Accessed 06/05/10]

SCOS, 2009. Scientific Advice on Matters Related to the Management of Seal Populations: 2009. SCOS Main Advice 2009. Available online at <http://www.smru.st-and.ac.uk/documents/341.pdf> [Accessed 03/05/10]

Scott, K.E., Anderson, C., Dunsford, H., Benson, J.F. and MacFarlane, R., 2005. An assessment of the sensitivity and capacity of the Scottish seascape in relation to offshore windfarms. Scottish Natural Heritage Commissioned Report No.103 (ROAME No. F03AA06)

SeaWatch, Undated. Cetaceans of Orkney. Available online at <http://www.seawatchfoundation.org.uk/docs/Orkney.pdf> [Accessed 28/04/10]

SNH, 2010a. Sites of Special Scientific Interest. Available online at <http://www.snh.gov.uk/protecting-scotlands-nature/protected-areas/national-designations/sssis/> [Accessed 28/04/10]

SNH, 2010b. Special Protection Areas. Available online at <http://www.snh.gov.uk/protecting-scotlands-nature/protected-areas/international-designations/spa/> [Accessed 28/04/10]

SNH, 2010c. SNH interactive - Site Link. Available online at <http://www.snh.gov.uk/publications-data-and-research/environmental-data/map/> [Accessed 29/04/10]

SNH, 2009. National Scenic Areas. Available online at <http://www.snh.gov.uk/protecting-scotlands-nature/protected-areas/national-designations/nsa/> [Accessed 28/04/10]

Tasker, M. L., 1997. Seabirds. In: Barne, J.H., Robson, C.F., Kaznowska, S.S., Doody, J.P., Davidsen, N.C. and Buck, A.L. (eds) Coasts and Seas of the United Kingdom, Region 2 Orkney. Joint Nature Conversation Committee, Peterborough.

Tay Ringing Group & Orkney Ringing Group, 1984. The shore-birds of the Orkney Islands. A report on the numbers and distribution of shore-birds on the coasts of the Orkney Islands during the winters 1982-83 and 1983-84. Tay Ringing Group, Perth.

UKHO, 2008. Admiralty Chart 2584 - Approaches to Kirkwall.

6 MONITORING AND DATA SOURCES

6.1 Data Available From EMEC

EMEC recognises the importance of environmental monitoring for developers deployed at the intermediate scale test sites. Appendix A provides an outline of what monitoring has been undertaken to date, what monitoring is currently taking place and what monitoring is planned for the future. It also discusses who is funding the monitoring, how it is being analysed and identifies potential additional monitoring that might be appropriate for developers to investigate. Further requests for information regarding monitoring and data collection should be directed to Jenny Norris at EMEC.

Appendix B summarises the baseline surface wildlife monitoring data collected for the period 01/05/2010 to 28/02/2011.

The following and additional information as it is acquired will be made available to developers who have signed a Non Disclosure Agreement with EMEC.

- (1) Benthic Survey for the European Marine Energy Centre (EMEC) Ltd. For Crow Taing, Scapa Flow, and Head of Holland, Shapinsay Sound (BIOTIKOS LTD.). This report provides analysis of samples taken in the site area.
- (2) Navigation Safety Risk Assessment (NSRA) for Head of Holland, Shapinsay Sound (Anatec).
- (3) Geotechnical survey report.

6.2 Other Sources of Environmental Data

The following additional sources of information may be of use to developers:

- (1) 'Gates' set up at the Head of Holland site to monitor and record vessel traffic in the area. This data would be available to developers to purchase.
- (2) Table 6.1 below lists relevant organizations and data (in addition to the data referenced in this report).

Organisation	Information available
British Geological Society	Geological information and publications, hydrogeological information and publications. Seabed sediment reports and maps
Joint Nature Conservation Committee	Marine Nature Conservation Review – sublittoral and coastal survey data
Orkney Biodiversity Records Centre	Report from the OBRC wildlife records database

- (3) EMEC has ongoing consultations with the following organizations and appropriate contact details are available:
 - Scottish Natural Heritage
 - Sea Mammal Research Unit

- Royal Society for the Protection of Birds
- Scottish Environment Protection Agency
- Orkney Islands Council Marine Services
- Orkney Fisheries Association
- Orkney Dive Boat Operators Association
- Orkney Sea Angling Association

APPENDIX A: Monitoring Activities

The following table provides an outline of the monitoring that has taken place to date and that which is planned or in discussion for the future to support development at the intermediate scale test sites.

Monitoring Activity	Analysis	Comments
Completed		
<i>E.g. Benthic sampling</i>	<i>Survey samples sieved and analysed regarding species and abundance</i>	<i>Study undertaken to assist in setting up the scale site, no further work deemed necessary unless additional or different types of infrastructure are proposed</i>
Commenced		
<i>E.g. Marine mammal and bird monitoring</i>	<i>Power analysis on the ability to detect change in species and abundance using the site area</i>	<i>Commenced April 2010</i>
Potential		
<i>E.g. Marine archaeology and cultural heritage</i>	<i>Desk based assessment and review of known information and EMEC collected geotechnical data</i>	

APPENDIX B: Summary of Baseline Wildlife Observations at the Shapinsay Sound Scale Test Site

Table 1 below summarises the total sightings of the different species of marine mammal observed by month across the observational area for the period 01/05/2010 to 28/02/2011. The counts presented are sighting frequencies as opposed to sighting events and should not be taken as an indication of total abundance of each species at the site. No account has been taken at this stage of specific location of sightings within the test site or possible inaccuracies of sightings due to environmental variables. Figure 1 shows a graphical representation of this data. Detailed analysis of the data using various analytical techniques will be commissioned once a more comprehensive dataset is available.

	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Total
Basking Shark	0	0	0	1	1	0	0	0	0	0	2
Harbour Seal	0	40	14	23	7	22	20	9	2	0	137
Grey Seal	18	35	16	25	37	13	10	17	3	6	180
Harbour Porpoise	8	6	6	4	6	3	10	3	5	0	51
Killer Whale	2	0	0	0	0	0	0	0	0	0	2
Risso's Dolphin	0	0	0	8	0	0	0	0	0	0	8
Unidentified Seal	20	7	1	3	0	2	7	5	7	0	52

Table 1: Summary of Marine Mammal Sightings at the EMEC Shapinsay Sound Scale Test Site

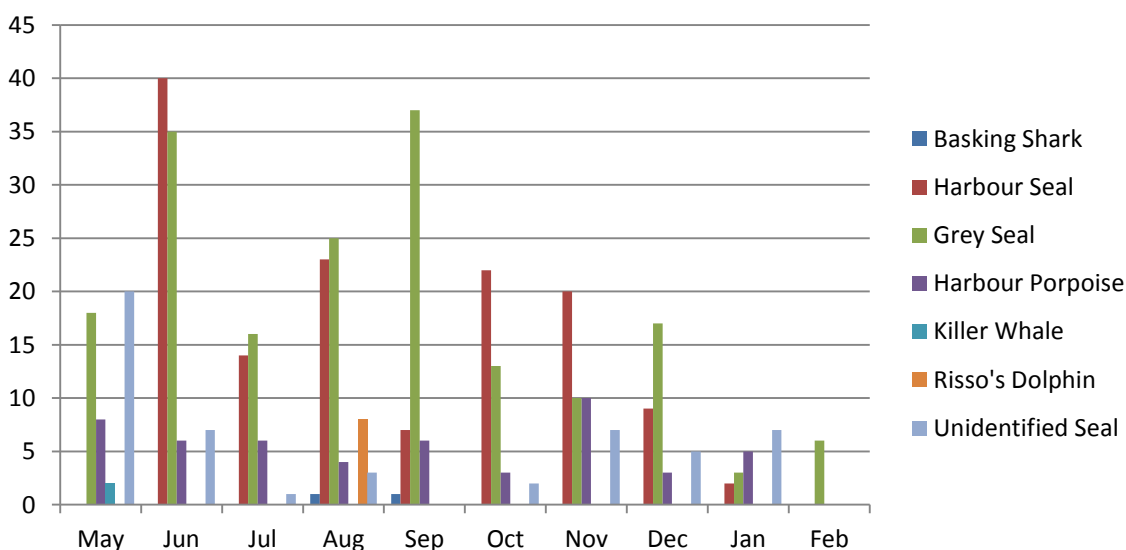


Figure 1: Summary of Marine Mammal Sightings at the EMEC Shapinsay Sound Scale Test Site

APPENDIX B: Summary of Baseline Wildlife Observations at the Shapinsay Sound Scale Test Site

Table 2 below summarises the total sightings of the different species of marine birds observed by month across the observational area for the period 01/05/2010 to 28/02/2011. The counts presented are sighting frequencies as opposed to sighting events and should not be taken as an indication of total abundance of each species at the site. No account has been taken at this stage of specific location of sightings within the test site or possible inaccuracies of sightings due to environmental variables. Detailed analysis of the data using various analytical techniques will be commissioned once a more comprehensive dataset is available.

	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Total
American Wigeon	0	0	0	0	0	1	0	0	0	0	1
Arctic Skua	0	3	5	6	0	0	0	0	0	0	14
Arctic Tern	32	66	54	2	0	0	0	0	0	0	154
Atlantic Puffin	1	2	4	3	0	0	0	0	0	0	10
Black Guillemot	93	447	467	864	511	667	425	298	336	281	4389
Black-headed Gull	0	0	0	14	55	25	4	11	0	32	141
Black-legged Kittiwake	0	4	10	9	4	36	39	5	0	1	108
Black Scoter	0	0	0	0	0	0	1	1	0	0	2
Black-throated Diver	0	0	0	0	0	0	0	0	0	1	1
Common Eider	30	351	518	828	675	816	2004	4423	2178	3791	15614
Common Goldeneye	0	0	0	0	0	0	4	15	23	7	49
Common Guillemot	58	364	286	62	98	57	9	6	1	23	964
Common Shelduck	0	23	24	0	0	0	0	0	0	0	47
Eurasian Teal	0	0	0	0	29	301	294	165	5	5	799
Eurasian Wigeon	0	0	0	0	487	1478	3643	4751	3361	1238	14958
European Shag	32	354	346	689	1333	1775	2956	1373	764	471	10093
Great Black-backed Gull	0	263	50	95	85	133	104	146	175	94	1145
Great Cormorant	4	0	7	8	6	127	37	390	417	26	1022
Great Crested Grebe	0	0	0	0	0	0	1	0	0	0	1
Great Northern Diver	25	1	2	0	3	93	447	370	282	393	1616

	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Total
Great Skua	0	11	10	18	14	0	0	0	0	0	53
Greylag Goose	7	114	526	378	2261	69	225	553	4	200	4337
Herring Gull	7	38	16	25	30	48	107	161	51	78	561
Iceland Gull	0	0	0	0	0	0	0	1	0	0	1
Lesser Black-backed Gull	6	11	2	1	0	0	0	0	0	0	20
Little Auk	0	0	0	0	0	0	1	0	0	0	1
Long-tailed Duck	5	0	0	0	0	31	261	1125	931	1116	3469
Mallard	0	0	0	0	16	25	43	35	12	2	133
Mew Gull	0	42	18	72	336	514	241	144	432	156	1955
Mute Swan	0	1	0	9	0	0	0	0	0	0	10
Northern Fulmar	77	209	168	164	79	5	243	451	844	687	2927
Northern Gannet	1	8	31	27	48	123	4	0	0	1	243
Northern Shoveler	0	0	0	0	0	0	0	5	1	0	6
Razorbill	41	19	10	0	0	6	1	0	1	1	79
Red-breasted Merganser	0	27	3	69	49	93	197	132	82	71	723
Red-throated Diver	7	16	9	14	13	114	103	18	3	15	312
Sandwich Tern	1	0	0	0	0	0	0	0	0	0	1
Slavonian Grebe	0	0	0	0	1	108	200	147	106	38	600
Surf Scoter	0	0	0	0	0	0	0	2	0	0	2
Unidentified Auk Species	23	15	5	16	5	14	7	2	0	10	97
Unidentified Diver Species	1	0	0	0	0	0	0	0	0	0	1
Unidentified Gull species	0	0	0	0	0	3	0	80	45	0	128
Velvet Scoter	3	1	0	0	1	56	92	63	51	39	306

Table 2: Summary of Marine Bird Sightings at the EMEC Shapinsay Sound Scale Test Site

Discussion of Key Environmental Sensitivities

Table 4.1 describes the seasonal variations of key environmental sensitivities at the Shapinsay Sound scale test site. Any months highlighted in red or orange will be particularly sensitive for each corresponding species and may require appropriate mitigation to be in place by any developer intending to install a device within these periods.

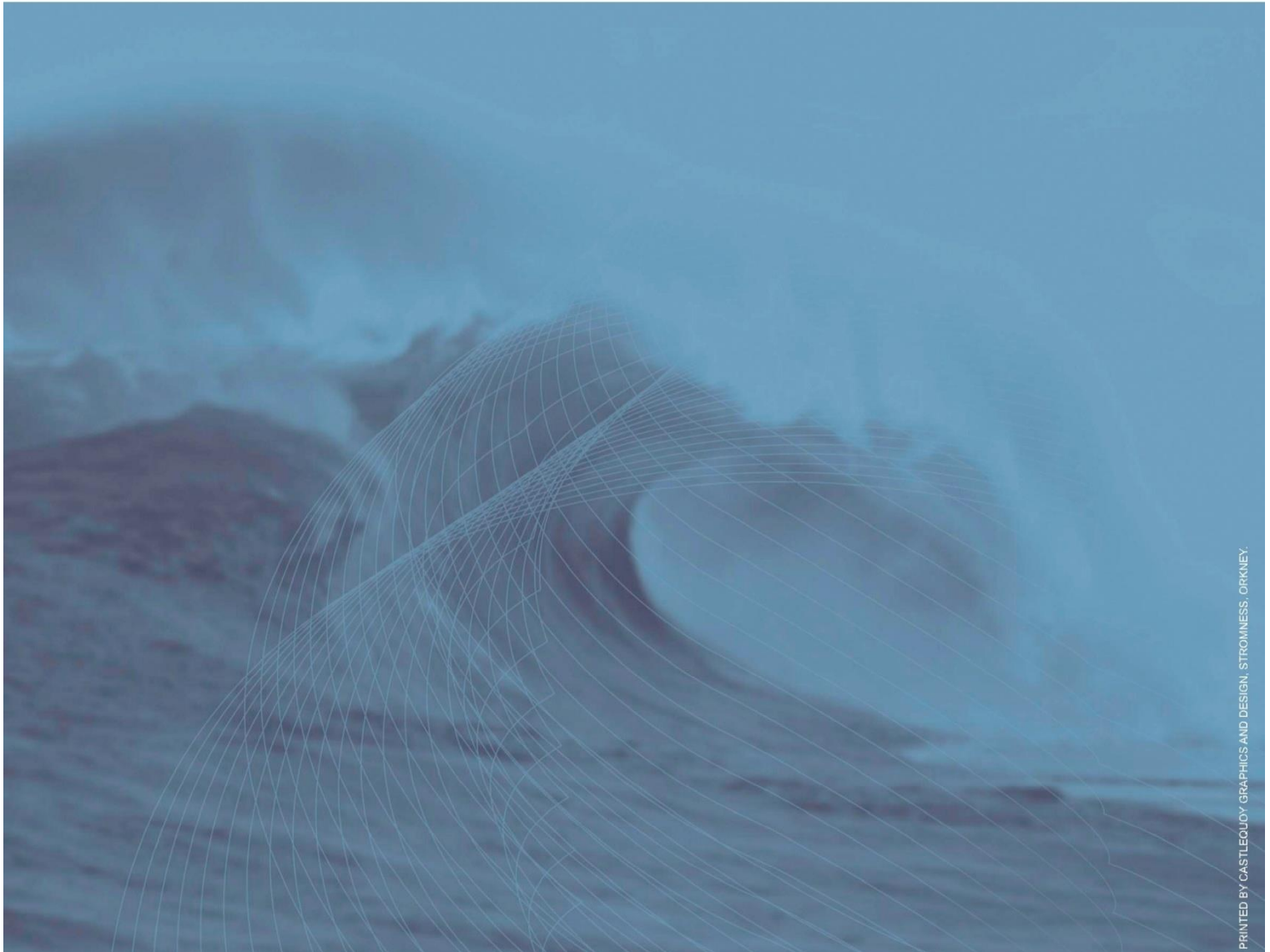
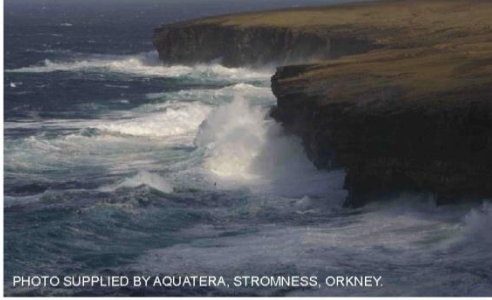
Both Harbour Seals and Grey Seals have been frequently sighted within the area of the site, and developers should be aware of sensitive time periods for both of these species when planning their projects. There have been sporadic sightings of cetaceans within the observation area, in particular Harbour Porpoise, Risso's Dolphin, and Killer Whale. Developers would also need to recognise the presence of basking sharks in the area and include mitigation/monitoring in their EMP.

Shapinsay Sound is an important wintering area for many species of marine bird, and this can be seen from the increase in observed numbers of some species within the site from September – February.

In relation to these species at the sensitive periods, the key issues to be addressed within the developer's environmental monitoring plan are:

- Displacement due to noise (during installation, maintenance, operation and decommissioning of device)
- Displacement due to physical presence of device
- Physical harm caused by collision
- Physical harm caused by entanglement in device moorings
- Physical harm caused by noise

EMEC aims to continue with its wildlife observation programme at the Shapinsay Sound scale test site, and will also commence a study to determine the baseline acoustic characteristics of the site in April 2011. Outputs from both of these Scottish Government funded programmes will be made available to developers to inform production of their EMP.



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