

# Scapa Flow Scale Test Site – Environmental Description

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## Document History

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## Contents

1	Introduction	1
1.1	Purpose and Scope	1
1.2	Context	1
2	Location	2
3	Seascape	3
4	Seabed Habitats	4
4.1	Surveys	4
4.2	Physical	4
4.3	Biological	5
4.3.1	Regional context	5
4.3.2	Site-specific information	5
5	Plankton	8
6	Fish & Shellfish	9
6.1	Finfish	9
6.2	Shellfish	10
7	Ornithology	11
8	Marine Mammals	14
8.1	Seals	14
8.1.1	Grey seals	14
8.1.2	Harbour seals	15
8.1.3	Designated seal haul-out sites	15
8.2	Cetaceans	18
8.3	Otter	19
8.4	Turtles	19
9	Conservation Sites	20
10	Other sea users	27
10.1	Fisheries	27
10.2	Aquaculture	27
10.3	Commercial and recreational traffic	27
10.4	Recreation	29
10.5	Archaeology	29
11	Key Environmental Sensitivities	31
12	Monitoring and Data Sources	32
12.1	Other Sources of Environmental Data	32
13	References	33
	Appendix A: Fisheries Sensitivity Maps for Orkney	38
	Appendix B: Conservation Designations	42

## List of Figures

Figure 1. Location of the Scapa Flow wave test site.....	2
Figure 2. View from Burray across Scapa Flow to the eastern end of Scapa Flow .....	3
Figure 3. Summary of select environmental sensitivities and survey information.....	5
Figure 4. Images from Marine Scotland survey within the Scapa Flow test site (Moore, 2009) .....	7
Figure 5. Special Protection Areas in the Orkney Isles (Source: SNH 2017d) .....	11
Figure 6. Summer and winter counts of bird species observed at the Scapa Flow test site, April 2011 - March 2012 (Source: EMEC 2012) .....	13
Figure 7. August counts of harbour seals in Scottish Seal Management Areas, 1996-2016. Data from the Sea Mammal Research Unit (Source: Duck et al., 2017) .....	15
Figure 8. Designated seal haul-out sites in Seal Management Area subdivision 4b (Orkney) as set out in an order made under section 117 of the Marine (Scotland) Act 2010 (Source: Scottish Government (2017b)) .....	16
Figure 9. Summer and winter counts of marine mammal species observed at the Scapa Flow scale test site, April 2011 - March 2012 (Source: EMEC 2012). .....	18
Figure 10. Location of the Pentland Firth pSPA (Source: Marine Scotland, 2017b).....	21
Figure 11. Important foraging areas for breeding Arctic tern within the Pentland Firth proposed SPA (Source: SNH, 2017e) .....	22
Figure 12. Orkney's Internationally & Nationally Designated Natural Heritage Sites (Source: OIC (2017b)).....	23
Figure 13. AIS vessel tracks by type passing the Scapa Flow site (Summer 2009).....	28
Figure 14. AIS vessel tracks by type passing the Scapa Flow site (Winter 2010).....	29

## List of Tables

Table 1. Boundary coordinates (WGS 84) for Scapa Flow scale test site .....	2
Table 2. Summary of Marine Scotland survey results within and around the Scapa Flow test site (Moore, 2009) and Aquatera (2015).....	6
Table 3. Designated haul out sites near Scapa Flow per the Marine (Scotland) Act 2010 (Source: Marine Scotland (2017b)). .....	17
Table 4. Observed grey seal breeding sites close to the Scapa Flow site (Source: Marine Scotland (2017b)) .....	17
Table 5. Details of conservation areas within 15 km of the Scapa Flow site (Sources: OIC, 2018b, RSPB, 2018b, SNH, 2017c) .....	24
Table 6. Details of conservation designations within close proximity to the Scapa Flow test site (Source: SNH, 2017a; 2017b; OIC 2018) .....	42

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# 1 Introduction

## 1.1 Purpose and Scope

The function of this environmental description is as supporting documentation to inform consent and licensing applications for the Scapa Flow scale wave test site. In addition, the document can be used as a reference material to inform potential developers coming to the European Marine Energy Centre (EMEC) to test their prototype devices of the environment within which the scale test site is located. This document should be used by potential developers to inform them 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 situated in close proximity to the Scapa Flow test site. The following sections provide background and a detailed description of each important environmental characteristic.

## 1.2 Context

EMEC's scale test sites were established following securing funding from the UK Department for Energy and Climate Change (replaced by the Department of Business Energy and Industrial Strategy). These have been sited and designed to allow developers to trial scale marine energy devices or device components – as well as full size prototypes – in less challenging sea conditions than those experienced at EMEC's full-scale test sites at Billia Croo and the Fall of Warness.

The key purposes for the scale test sites have been outlined below:

- Sites must be in benign conditions;
- Sites must be capable of use for testing of scale prototype wave and tidal devices in real-sea conditions
- Sites must be capable for use during rehearsal of wave and tidal operations and deployment techniques;
- Sites are equipped with ancillary equipment to enable monitoring of devices in situ and 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 scale test sites will not be connected to the grid and there will be no cabling from the test berths to shore nor will there be any onshore infrastructure provided by EMEC in close proximity to the test site. Therefore, a description of the intertidal or coastal habitats has not been included in this report.

## 2 Location

The Scapa Flow wave test site is located offshore from Howequoy Head near St Mary's in Scapa Flow; the site is shown in Figure 1 in context with the wider area. The site is within Harbour Authority Limits, with Orkney Islands Council (OIC) Marine Services being the Competent Harbour Authority.

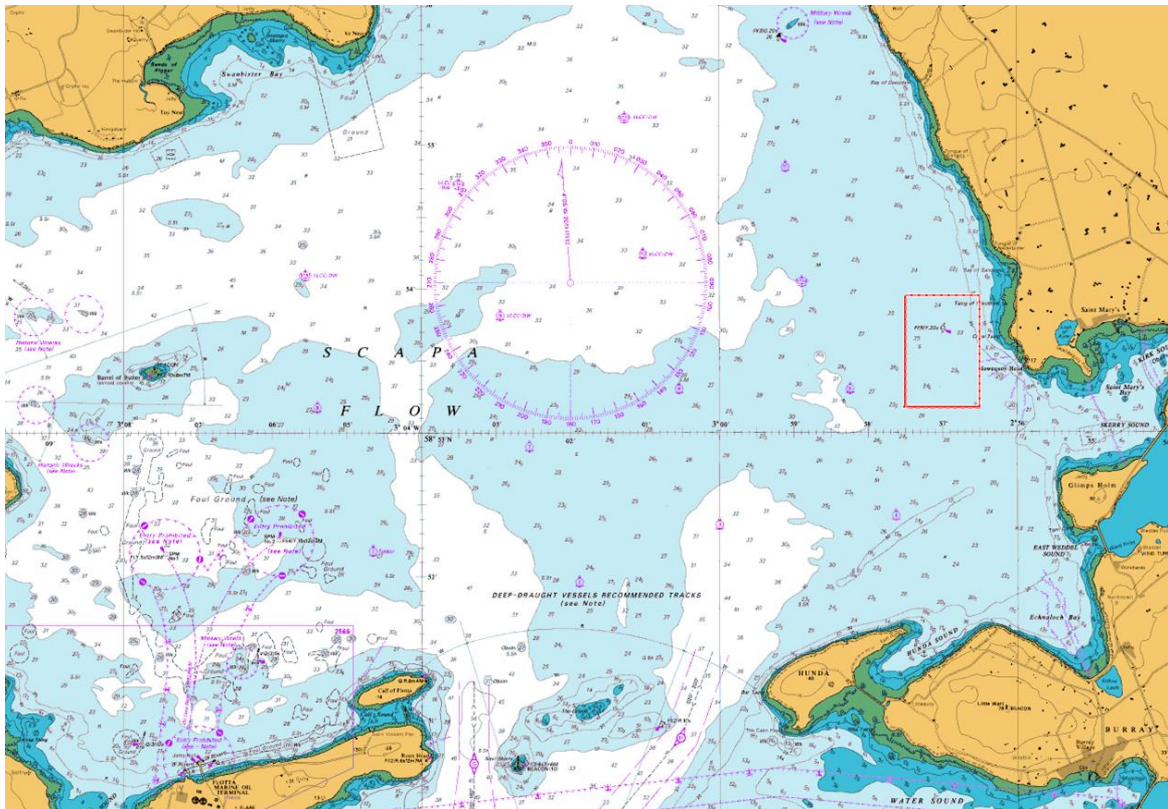


Figure 1. Location of the Scapa Flow wave test site

The following table provides the coordinates for the boundary corners of the site.

Table 1. Boundary coordinates (WGS 84) for Scapa Flow scale test site

Test Site	Corner A	Corner B	Corner C	Corner D
Scapa Flow	58° 53.950'N	58° 53.170'N	58° 53.170'N	58° 53.950'N
	002° 56.500'W	002° 56.500'W	002° 57.500'W	002° 57.500'W



### 3 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. Whilst the west coast of Orkney is particularly renowned for cliffs, arches, stacks and geos, the lower lying coastal features likely to be found in the vicinity of Scapa Flow (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 Scapa Flow) and the outer isles comprises 'Type 12: Deposition Coasts of Islands' and 'Type 1: Remote High Cliffs'. The key characteristics of a type 12 classification of seascape is 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. The key characteristics of Type 1 classifications are high cliffs with occasional sandy or stony bays, contained by rocky headlands. Stacks, caves, collapsed cliffs and high moorlands are often present in this coastline. Semi-natural heathland is the dominant landcover on these landscapes (Scottish Natural Heritage (SNH, 2017d). Scott *et al.* (2005) state that the east Orkney area, in which Scapa Flow is situated, 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 2 illustrates the general nature of the seascape in the vicinity of the scale test site (see caption for photograph location).



Figure 2. View from Burray across Scapa Flow to the eastern end of Scapa Flow

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## 4 Seabed Habitats

### 4.1 Surveys

The seabed sediments and communities of the Scapa Flow area have been the subject to a number of site surveys. As part of the original site selection process during site establishment, EMEC 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 from this area of Scapa Flow 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 Scottish Natural Heritage (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 Scapa Flow test site.

### 4.2 Physical

Scapa Flow is a relatively shallow inland sea, with maximum water depths in the centre of the Flow of 30 - 40 metres. Deeper waters are found in the area, but these are located on the opposite side of the Flow to Howequoy Head in Bring Deeps, and in Hoxa Sound at the southeasterly entrance to Scapa Flow. The seabed in Scapa Flow exhibits a pronounced shelf. There are relatively shallow areas approximately 5 m deep along the coasts of the Orkney Mainland (and some of the smaller islands) but water depths drop off to approximately 10 – 20 m within a few metres of the coast (United Kingdom Hydrographic Office, 2018).

The Scapa Flow area was surveyed on 22<sup>nd</sup> January and 23<sup>rd</sup> January 2010 by Netsurvey Ltd (2010) (Figure 3). Water depths across the area ranged from approximately 15 to 30 m, approximately 1 m deeper than charted depths. A sand wave lying WSW-ENE across the south section of the area was found to rise up to a depth of 14.8 m. The survey also identified a number of contacts across the area which are assumed to be boulders or rocks.

British Geological Survey Charts (BGS, 1982) for Scapa Flow show the Scapa Flow site to comprise of undifferentiated old red sandstone covered by slightly gravelly muddy sand (BGS, 1987). The site also consists of upper old red sandstone, extrusive mafic rock and igneous intrusions (BGS, 2018).

The site-specific survey conducted at the Scapa Flow site (Biotikos, 2010) reports that samples indicate a moderately low energy site that is characterised by stable sands of quite fine consistency. Some mud and appreciable amounts of uniform sized shell fragments are present also, in addition to small stones and patches of red macroalgae that are found at intervals across the site. The habitat may be broadly classified as “Sheltered Muddy Gravels” and subcategorised as “Subtidal Mixed Sediments”. The locations of sediment samples are illustrated in Figure 3.



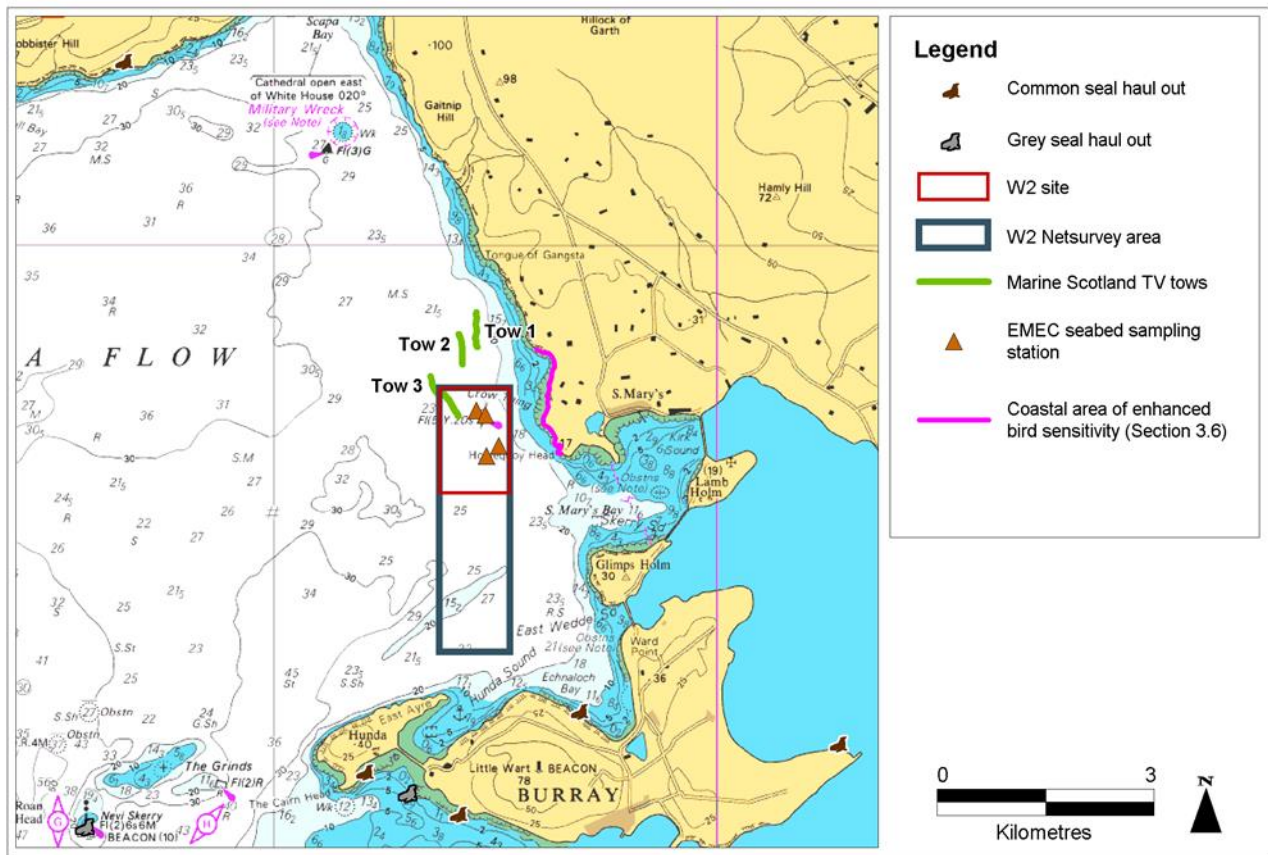


Figure 3. Summary of select environmental sensitivities and survey information

## 4.3 Biological

### 4.3.1 Regional context

Habitats around Orkney are predominantly sandy, sand-scoured rock or mixed substrates of sand and stones. The beaches of Orkney are found to contain relatively high amounts of strandline onshore seaweed deposits (British Trust for Ornithology, 2017b).

Moore (2009) and Want (2014) report that most sites examined in the Pentland Firth and Orkney area display a community typical of circalittoral tide-swept rocky communities, which are well adapted to the high tidal flows. However, the test site is located within the relatively sheltered Scapa Flow and thus a substantially different habitat would be expected (Shields *et al.*, 2011). As such, the dominance by a fauna of the acorn barnacle *Balanus crenatus* and the Dahlia anemone *Urticina felina* may not apply, although the diversity is expected still to be low.

### 4.3.2 Site-specific information

Aquatera (2015) report the results of several ROV surveys conducted to the west of St. Mary's on the eastern side of Scapa Flow. Whereas, Moore (2009) reports the results of three sample sites surveyed to within and around the Scapa Flow test site (marked as Marine Scotland surveys on Figure 3). Aquatera (2015) results are mostly consistent with the surveys conducted by Moore (2009). The site transects at St. Margaret's Hope were mostly composed of fine sandy mud with small quantities of shell debris and fine gravel, mostly flat and lacking undulations in the sediment. A patchy mat of loose-lying red algae blanketed all sites, consisting mostly of the red seaweed *Phyllophora crispa* and occasional balls of *Trailliella*, a

life phase of the red algae *Bonnemaisonia hamifera*. This corresponds to the ‘Loose-lying mats of *Phyllophora crispera* on infralittoral muddy sediment’ biotope (SS.SMP.KSwSS.Pcri) that the Joint Nature Conservation Committee (JNCC, 2015) report to occur in very sheltered conditions such as those found in sea lochs and voes. This biotope at the Scapa Flow site is not currently listed as an Annex I habitat (on the UK Biodiversity Action Plan or on the Scottish Biodiversity List) and no benthic species of conservation importance were identified at the test site during surveying.

The infauna reported included a large number of tube-dwelling, filter-feeding annelids (such as sand masons, *Lanice conchilega*) and bioturbative mounds, although these were rare. The tube anemone *Cerianthus lloydii* and terebellid worms were also observed during surveys. Epifauna included occasional harbour crab *Liocarcinus depurator*, queen scallop *Aequipecten opercularis* and the common starfish *Asterias rubens*. Burrow-like holes in the sediment were observed, as evidenced by the presence of the bivalves - razor shells on the seabed. Serpulid worms occupied ocean quahog, *Arctica islandica*, and scallop shells.

The results of the Marine Scotland surveys and SNH analysis are summarised in Table 2. Selected images made available by Marine Scotland are shown in Figure 4. As noted in Section 8.4, the biotope recorded at the Scapa Flow site is not listed on the UK Biodiversity Action Plan or the Scottish Biodiversity List.

**Table 2. Summary of Marine Scotland survey results within and around the Scapa Flow test site (Moore, 2009) and Aquatera (2015)**

Site	Substrate	Biota	Biotope
SF/1	Flat muddy sand.	Sediment covered with patchy mat of loose-lying algae, composed principally of <i>P. crispera</i> , with balls of <i>Trilliella</i> . Infauna includes large patches of <i>L. conchilega</i> . Epifauna includes <i>L. depurator</i> , <i>A. rubens</i> and <i>A. opercularis</i> . <i>Turritella communis</i> shells on sediment surface.	SS.SMP.KSwSS.Pcri
SF/2	Flat muddy sand.	Sediment covered with patchy mat of algae. Epifauna includes portunid crabs and <i>A. rubens</i> .	SS.SMP.KSwSS.Pcri
SF/3	Flat muddy sand with scattered shells and pebbles.	Sediment covered with patchy mat of loose-lying <i>P. crispera</i> . Epifauna includes <i>L. depurator</i> , <i>A. rubens</i> , the sea mouse <i>Aphrodita aculeata</i> and Gobiidae. Infauna includes Terebellidae.	SS.SMP.KSwSS.Pcri



Site SF/1 (Tow 1 at the Scapa Flow site) showing flat muddy sand and loose algae



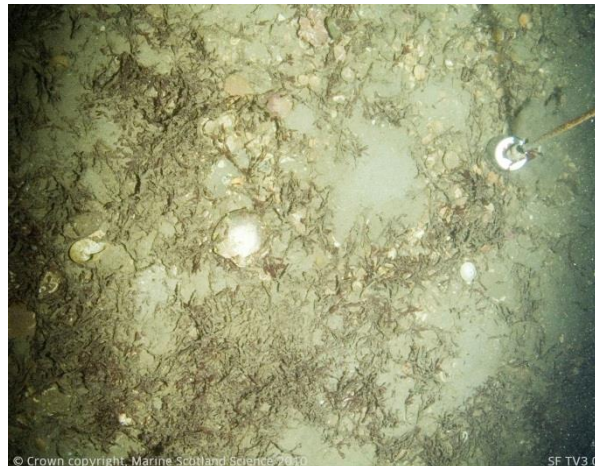
Site SF/1 (Tow 1 at the Scapa Flow site) showing flat muddy sand and loose algae



Site SF/1 (Tow 1 at the Scapa Flow site) showing flat muddy sand and loose algae



Site SF/3 (Tow 3 at the Scapa Flow site) showing flat muddy sand, pebbles and loose algae



Site SF/3 (Tow 3 at the Scapa Flow site) showing flat muddy sand, pebbles and loose algae



Site SF/3 (Tow 3 at the Scapa Flow site) showing flat muddy sand, pebbles and loose algae



Figure 4. Images from Marine Scotland survey within the Scapa Flow test site (Moore, 2009)

## 5 Plankton

Plankton around Orkney is likely to be characterised by coastal (neritic) and mixed (intermediate) water species that are largely influenced by the inflow of Atlantic water (De Dominicis *et al.*, 2017). The inflow from the Atlantic Ocean along the western edge of the North Sea in late summer/autumn may introduce more oceanic species. Island regions like Orkney tend to have higher annual salinity measurements than those of sea lochs on the West Coast of Scotland due to the continuous influence of the North Atlantic which provide a unique habitat for certain species of plankton which are absent on the West Coast (Bresnan *et al.*, 2016).

The plankton assemblages in Scapa Flow exhibit the cyclical patterns that are typical of temperate waters; a spring increase of phytoplankton (mainly diatoms) begins in March and peaks between April and May (which are consistent with other surveys conducted on the East Coast by Marine Scotland). The spring species seen most frequently include, *P. 'delicatissima type' cells*, *Skeletonema marinoi*, *Guinardia delicatula*, *Chaetoceros* and *Thalassiosira spp* (Bresnan *et al.*, 2016). 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). The autumn community is dominated by *Pseudo-nitzschia 'seriata type' cells* and *Rhizosolenia spp* (Bresnan *et al.*, 2016). Bresnan (2012) reports fairly large fluctuations in zooplankton taxa occurring that are considered to be linked to environmental conditions that vary interannually. Fluctuations in weather patterns can also lead to different progressions of plankton species through the year. On a number of occasions, coccolithophores have become particularly dominant in the early summer, resulting in the waters of Scapa Flow turning a turquoise colour. These incidents are apparently transient, and the bloom subsides after a period of only a week following changes in weather and hydrographic conditions. Despite these short-term changes, 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. However, 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 to be involved in paralytic shellfish poisoning (PSP), which has occurred in Orkney regular since 1968 (e.g. Bresnan and Davidson, 2009). In the winter months, numbers decline as the water column gets more agitated and nutrients in the water column increase. 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).



## 6 Fish & Shellfish

### 6.1 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. Fish species that are commonly found in Scapa Flow are typical of north Scottish waters and include pollack (*Pollachius pollachius*), saithe (*Pollachius virens*), ling (*Molva molva*), ballan wrasse (*Labrus bergylta*) and cuckoo wrasse (*Labrus mixtus*). Less abundant species include poor cod (*Trisopterus minutus*), goldsinny (*Ctenolabrus rupestris*), conger eel (*Conger conger*) and cod *Gadus morhua* (which is widely distributed around Orkney in the summer months). Mackerel (*Scomber scombrus*), present during their migratory passage past Orkney, may also be found in the more energetic waters of Hoxa Sound in the south of Scapa Flow. Other species that may be present, albeit seasonally, include juvenile and non-spawning adult monkfish (*Lophius piscatorius*) and gurnard (*Triglidæ spp.*). The Royal Society for the Protection of Birds (RSPB) report that there is a sand eel population within Scapa Flow around the Scapa Flow test site (Ellis *et al.*, 2012).

Orkney Biodiversity Records Centre (OBRC) report the presence of butterfish (*Poronotus triacanthus*) around the Scapa Flow test site (Gauld, *pers. comm.*), whilst the Marine Scotland survey of the benthos within and around the Scapa Flow test site incidentally recorded the presence of gobies.

Scapa Flow 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*) 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; Aires *et al.*, 2014).

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. Whilst the amount of time that salmon spend in the coastal zone is limited (and thus they are unlikely to be found around the Scapa Flow test site), sea trout spend much longer periods in coastal waters (Brown *et al.*, 2018) and there is consequently a higher likelihood of being recorded at the Scapa Flow test site. Numerous sea lochs, small burns and surrounding coastal seas of Orkney are reported to contain populations of the sea trout (Atlantic Salmon Trust, 2018); sea trout spawn in freshwater during the months of October to January and then migrate out to sea to mature. In addition, they often remain within 80 km of their home river and may rarely make long distance migrations, unlike the typical behaviour exhibited by salmon. The migratory periods of salmon appear to be much shorter than those of sea trout and the environmental factors that initiate migration differ for the two species (Thorstad *et al.*, 2016). Although there are some smaller burns running into Scapa Flow close to the Scapa Flow test site, Orkney Trout Fishing Association (OTFA, 2009) does not list any of the burns in the vicinity of Scapa Flow as having a demonstrable trout population. The closest burn with a possible presence of trout is the St Mary's Burn located within 1 km to the east of the test site, but this presence is currently described as tenuous (OTFA, 2009). This same burn has been recorded by Marine Scotland to be an area where salmon are most likely present (Marine Scotland, 2018).

## 6.2 Shellfish

Scapa Flow is of commercial importance for shellfish species, and the commercial shellfishery is described in greater detail in Section 10.1. Marine Scotland (2016) report the following commercial species landed within Orkney:

- periwinkles (*Littorina littorea*);
- Queen scallops (*Aequipecten opercularis*);
- common scallops (*Pecten maximus*);
- whelks (*Buccinum undatum*);
- lobster (*Homarus gammarus*);
- edible/brown crab (*Cancer pagurus*);
- velvet crab (*Necora puber*);
- green crab (*Carcinus maenas*);
- shrimp (*Nephrops norvegicus*)

Indeed, portunid crabs have been reported from surveys undertaken at the test site (Moore, 2009). Additionally, cockles, common mussels (*Mytilus edulis*) and flat oyster (*Ostrea edulis*) are reported by the OBRC (per comms.).



## 7 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 European total for that species (Tasker, 1997). Populations around the United Kingdom have greatly decreased since 1988, as much as 64% in some locations (JNCC, 2016). In recent years, seabird populations around Orkney have been vastly reduced (RSPB, 2018a) and 2013 it was reported to have been a particularly poor breeding season (JNCC, 2018).

Breeding and resident seabirds, ducks and divers around Scapa Flow use the marine environment (including the area surrounding the scale test site) for feeding. A number of important breeding seabird colonies are found around Scapa Flow (designated sites are marked in Figure 5) and it is anticipated the birds within such colonies will particularly use Scapa Flow.

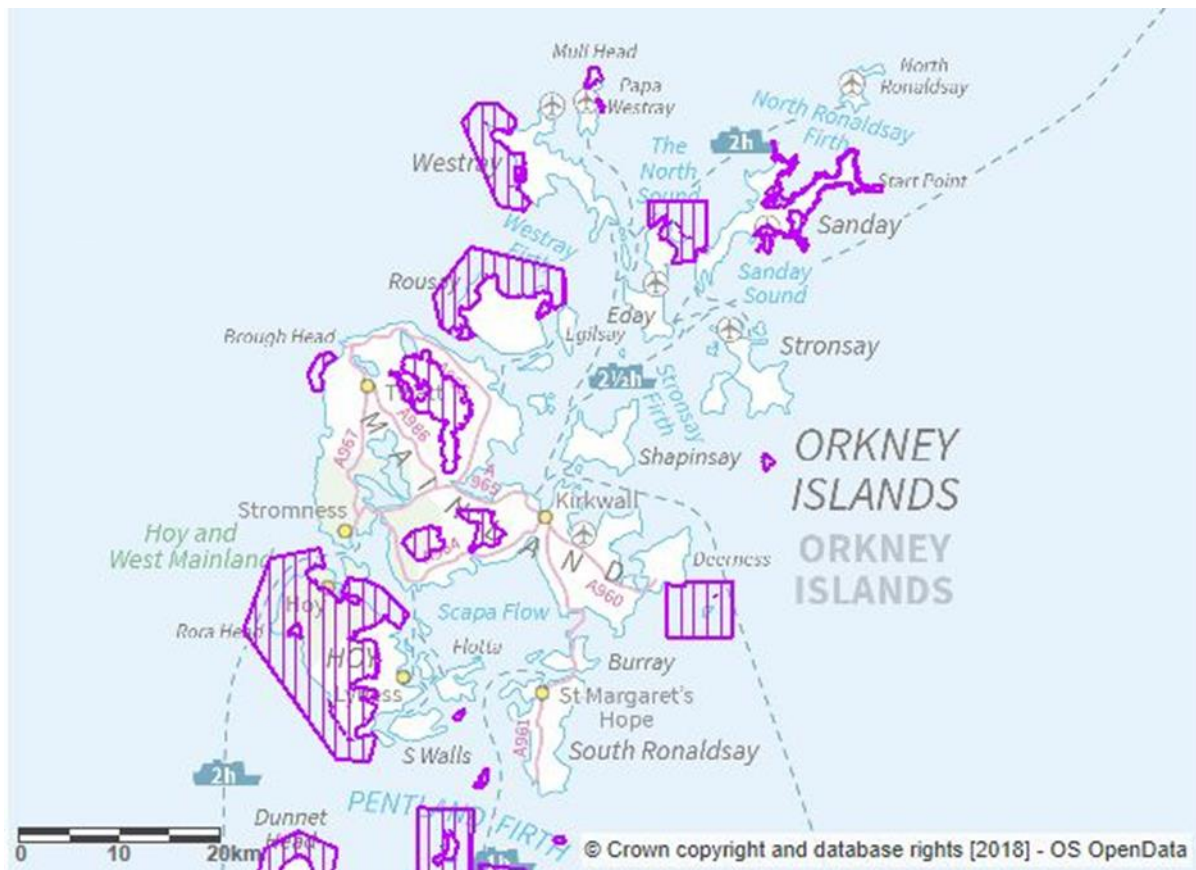


Figure 5. Special Protection Areas in the Orkney Isles (Source: SNH 2017d)

RSPB reported, during pre-screening for the scale test sites, that Scapa Flow is a wintering area for a number of species, particularly the Slavonian grebe (*Podiceps auratus*) and great northern diver (*Gavia immer*). This is confirmed by SNH who state that St Mary's Bay is a very important location within Scapa Flow for wintering wildfowl, particularly the Slavonian grebe, great northern diver, red-necked grebe (*Podiceps grisegena*) and long-tailed duck (*Clangula hyemalis*). Sightings of various gulls and waterfowl would also be expected in the area (BTO, 2017). BTO provided information on species sightings in the vicinity of the Scapa Flow site (Mellan, 2018, pers. comm.). This data indicates that numerous bird species have been recorded in the waters around the Scapa Flow test site and onshore in the vicinity of the coast.

In accordance with what would be expected, the following lists the key species sighted within the area:

- gull species (e.g. black-headed gull (*Chroicocephalus ridibndus*), herring gull (*Larus argentatus*));
- auk species (e.g. little auk (*Alle alle*), guillemot (*Uria aalge*), razorbill (*Alca torda*));
- diver;
- grebe; and
- duck species (e.g. eider (*Somateria mollissima*), long-tailed mallard (*Anas platyrhynchos*), merganser, scoter, teal (*Anas crecca*), tufted duck (*Aythya fuligula*)).

It is likely that the majority of these birds will be present (to varying degrees) at comparable habitat across the much of the rest of the coastline around Scapa Flow and the wider mainland Orkney.

Lawson *et al.* (2015) report numbers of inshore water birds using Scapa Flow during the winter season collected as part of an assessment of the area's potential for qualification as a marine SPA (still under consideration, see Section 3.9). The results of the survey are consistent with the EMEC Wildlife Observation Programme, concluded in 2012. The species recorded during aerial surveys are shown in Figure 6. In addition, land and boat-based counts frequently sighted black and common guillemots and fulmars. Velvet scoters (*Melanitta fusca*), goosanders (*Mergus merganser*), black-throated divers (*Gavia arctica*), little grebes (*Tachybaptus ruficollis*), red-necked grebes (*Podiceps grisena*) and Slavonian grebes were also observed.

Aquatera (2008) report that boat-based bird surveys conducted in Scapa Flow between June and August 2008 recorded that guillemots, black guillemots and fulmars were the species most often recorded, with greylag geese and European storm petrels in the dominant group of species on some survey occasions. Scapa Flow held the highest populations of red-breasted merganser, red-necked grebe, Slavonian grebe and European shag of all areas of search in Scotland according to Lawson *et al.* (2015).

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 area of Scapa Flow; for example the following species have all been sited on numerous occasions:

- black throated diver (*Gavia arctica*);
- great northern diver (*Gavia immer*);
- red throated diver (*Gavia stellata*);
- common tern (*Sterna hirundo*);
- Arctic tern (*Sterna paradisaea*);
- Sandwich tern (*Sterna sandvicensis*); and,
- whooper swan (*Cygnus Cygnus*).

Other Annex I bird species that have been reported but on fewer occasions include:

- little tern (*Sterna albifrons*)
- roseate tern (*Sterna dougallii*)
- European storm petrel (*Hydrobates pelagicus*)

SNH reported, during the consultation process, that the wider Scapa Flow area is within the foraging range of seabirds breeding at Hoy Special Protection Area (SPA). RSPB highlight that the area from the Bay of Sandoyne to Howquoy is the main area of ornithological interest.

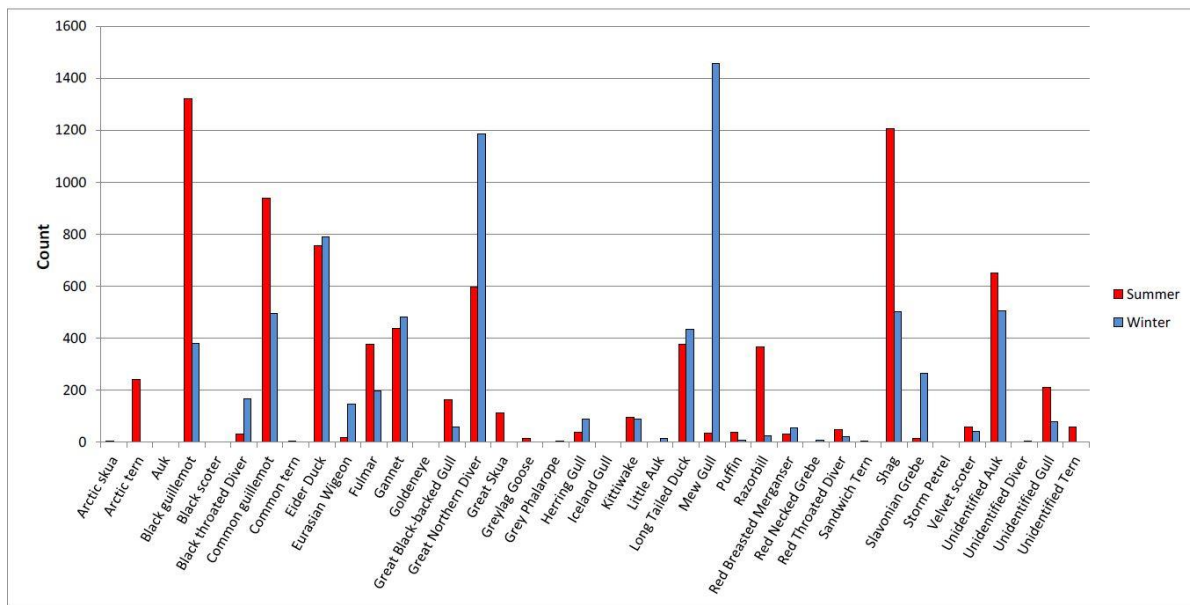


Figure 6. Summer and winter counts of bird species observed at the Scapa Flow test site, April 2011 - March 2012 (Source: EMEC 2012)

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 overwinter in the region and thus sensitivity for these groups will be highest during that time (as illustrated in Figure 6).

## 8 Marine Mammals

### 8.1 Seals

Grey seals are the largest species of seal found in British waters. Around 88% of the UK's population of grey seals (*Halichoerus grypus*) are found in Scotland, with the majority in the Hebrides and Orkney. They are generalist generalist feeders, foraging mainly on the seabed at depths up to 100m although they are probably capable of feeding at all depths across the continental shelf. Approximately 38% of the world's grey seal population breed in the UK. Approximately 34% of the world's grey seal pup production is in the UK. These seals are widespread around British coasts, with other breeding populations near Shetland, SW England and Wales. In the UK, grey seals typically breed on remote uninhabited islands or coasts and in small numbers in caves during the autumn. Preferred breeding locations allow females with young pups to move inland away from busy beaches and storm surges. Pupping occurs mainly between September and late November.

Scotland holds around 79% of the UK's population of harbour seals (*Phoca vitulina*) and the UK holds around 30% of Europe's harbour seals. They are widespread around the west coast of Scotland and throughout the Hebrides and Northern Isles, with a more limited distribution restricted to concentrations in the major estuaries on the east coast such as the Firth of Tay, Moray Firth, The Wash and the Thames. Harbour seals normally feed within 40-50 km around their haul out sites and eat less prey than grey seals. They normally haul out in sheltered waters, often on sandbanks and in estuaries, but also in rocky areas. These seals give birth to their pups in June and July and moult in August. During the pupping season, as well as other times, harbour seals haul out in a pattern that is related to the tidal cycle.

#### 8.1.1 Grey seals

The Natural Environment Research Council's (NERC) Special Committee on Seals (SCOS, 2017) report that approximately 38% of the world's grey seals, *Halichoerus grypus*, breed in the UK and 88% of these, breed at colonies in Scotland with the main concentrations in the Outer Hebrides and in Orkney. An estimated 5,900 pups were born in 2014 from SCOS annual ground counted survey. There was projected to be 141,000 seals in the UK. The main breeding season for British grey seals is autumn, but pupping does not occur until September and lasts until late November. Growth has been levelling off in Orkney (as with some other colonies in the northern North Sea) since the late 1990s. The rate of increase in Orkney has been minimal since 2000 although pup production has been relatively constant since 2004. The rate has most recently increased to ~6% between 2009 and 2012. In 2016, a total of 9,300 grey seals were counted in Orkney.

Female grey seals tend return to the same colony in successive years and use the same haul sites to breed as their mother. The most recent estimate of pup production at bi-annually surveyed colonies is 23,800 in 2014. As shown in figure 2 of the SCOS report (included as Figure 7 in this document), according to the seal management unit for the North Coast and Orkney, the overall grey seal count at haul out sites has increased 15.5% between 2009 – 2016. The nearest known grey seal haul-out is 5.2 km south at West Burray (Figure 8).

The sheltered waters of Scapa Flow act as ideal haul-out sites for these seals; the closest grey seal pupping site (Figure 3.9) is located on Flotta, 7.6 km to the south west. The possible causes of harbour seal decline include; prey quality and availability, competition with other marine predators (most notably the increasing grey seal population), predation and toxins from harmful algae.

### 8.1.2 Harbour seals

SCOS (2017) report that major declines have been documented in harbour seal, *Phoca vitulina*, populations around Scotland with declines of up to 76% since 2001 in Orkney (illustrated in Figure 7). SCOS (2017) state that these latest results suggest the Orkney harbour seal population declined by 78% since the late 1990s and has been falling at an average rate of over 10% annually since 2001. In 2016, there were thought to be 1,349 harbour seals in Orkney. This number is the lowest count of harbour seals in Orkney since 1985.

The harbour seal population in Orkney has seen a decline of 76% since 2001, as highlighted by the Special Committee on Seals (SCOS, 2017). Although declines have been reported in certain areas (Orkney, Shetland, Firth of Tay, etc) in Scotland, the declines are not universal, with observations of populations increasing on the west coast of Scotland and England. Consequently, the SACs within the Orkney region that have harbour seals as a qualifying feature are in an unfavourable condition.

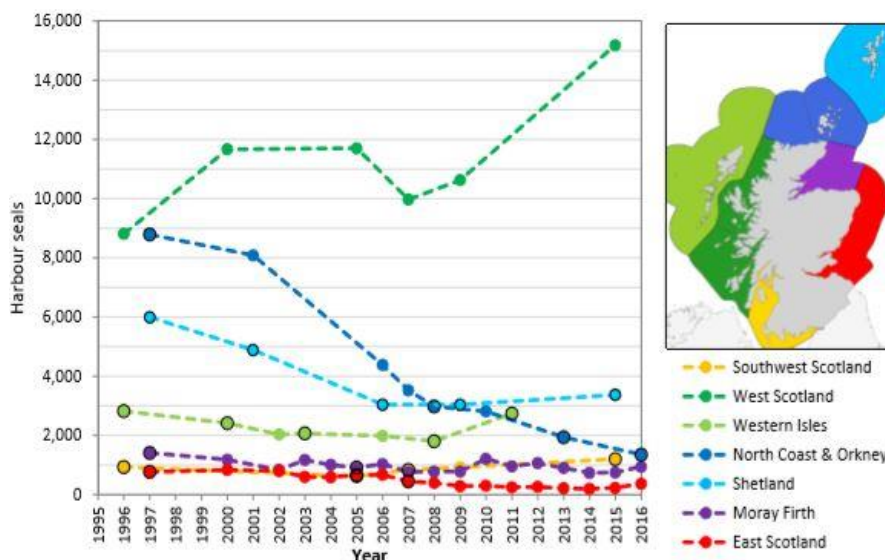


Figure 7. August counts of harbour seals in Scottish Seal Management Areas, 1996-2016. Data from the Sea Mammal Research Unit<sup>1</sup> (Source: Duck et al., 2017)

During the screening process for the scale test site, Scottish Natural Heritage commented that, although some seals may be present within the test site, they appear infrequently enough as to not cause concern. During the period of the EMEC Observation programme (April 2011 – March 2012), only 47 harbour seals and 31 grey seals were observed in the Scapa Flow area.

### 8.1.3 Designated seal haul-out sites

Under Section 117 of the Marine (Scotland) Act 2010, Scottish Ministers have been permitted to designate specific seal haul-out sites to provide additional protection for seals from intentional or reckless harassment. When vessels are transiting to and from site, there are several designated haul-out sites situated in close proximity to the potential transiting routes,

<sup>1</sup> Please note: these data points represent counts of harbour seals over large areas, so individual data points may not be solely from one specific year. Points are shown for years with a significant survey count. Points with a black outline represent data obtained in a single year.



these are provided in Figure 8 and Table 3. In addition to haul out sites, the Marine (Scotland) Act 2010 has also included observed grey seal breeding colonies which can be found in Table 4. The closest harbour seal haul-out to the Scapa Flow site is 3.5 km south at West Burray.

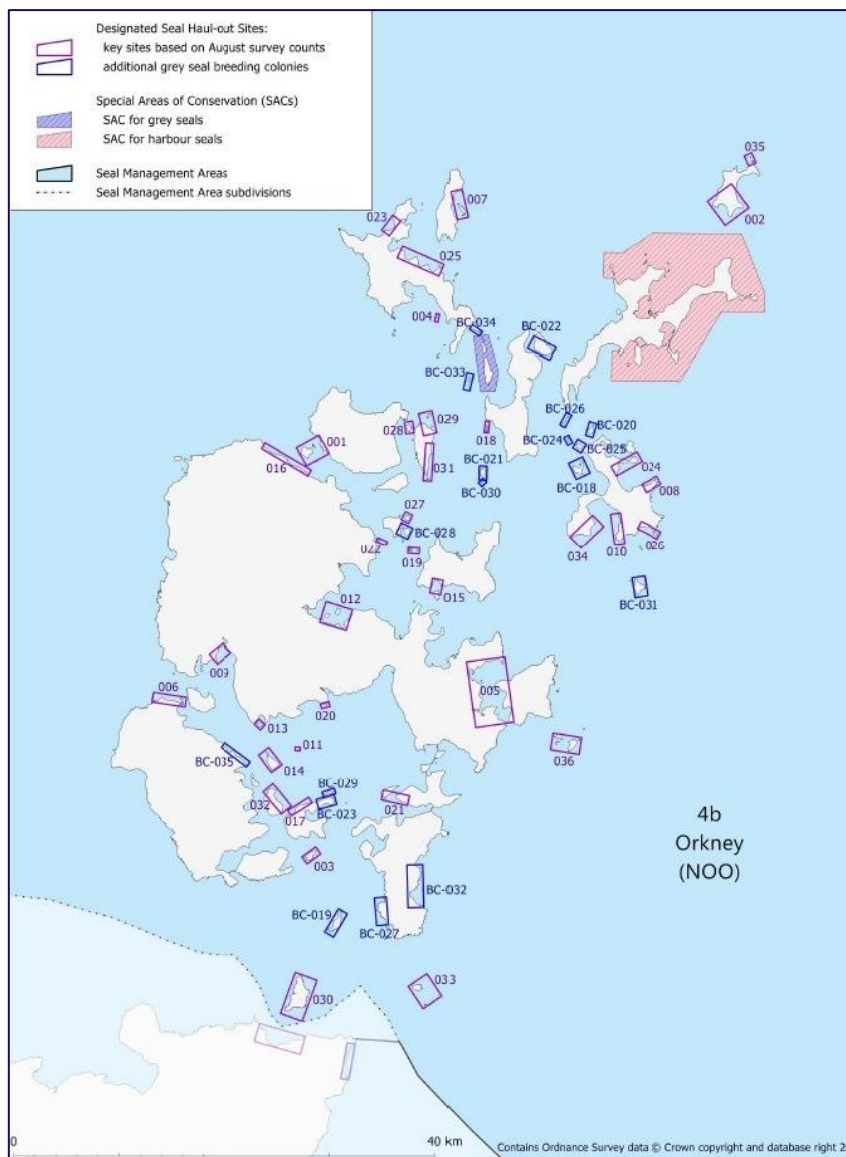


Figure 8. Designated seal haul-out sites in Seal Management Area subdivision 4b (Orkney) as set out in an order made under section 117 of the Marine (Scotland) Act 2010 (Source: Scottish Government (2017b))

Site ID	Site Name	Location	Details
NOO-003	Switha	East of Hoy	Entire Island of Switha.
NOO-006	Selwick	North Hoy	Rocky coastline between Muckle Head and Middle Skerry and associated rocky outcrops.
NOO-011	Barrel of Butter	West Scapa Flow	Entire Skerry of Barrel of Butter.
NOO-013	Damsay & Holm of Grimbister	Mainland central	Intertidal sandbanks and mudbanks and rocky coastline between Holm Point and the coast north of Burnt Mound on the south shore of the Bay of Firth and intertidal



Site ID	Site Name	Location	Details
			sandbanks and rocky coastlines of Holm of Grimbister and Damsey.
NOO-014	Cava	West Scapa Flow	Intertidal sandbanks and rocky coastline of the Isle of Cava.
NOO-017	Flotta Oil Terminal	North Flotta	Intertidal sandbanks and rocky coastline between the pier at Sutherland and a point one kilometre east of the jetty in Golta.
NOO-020	Ve Ness	South Mainland, Scapa Flow	Rocky coastline extending for 250 metres on either side of the Lash and associated rocky outcrops.
NOO-021	North West Water Sound	West Burra	Intertidal sandbanks and rocky coastline between The Hope and Lang Taing, including the southern side of Hunda Reef.
NOO-030	Stroma	Stroma, Pentland Firth	Intertidal sandbanks and rocky coastline and neighbouring grassy areas around the entire coast of the Isle of Stroma.
NOO-032	North & East Fara	East of Hoy, Scapa Flow	Rocky coastline of north and east of Fara between Peat Bay and Ayre Point and neighbouring grassy areas between Peat Bay and Kirka Taing.
NOO-033	Pentland Skerries	Pentland Firth East	Rocky coastline of Muckle Skerry and entire islands of Little Skerry, Louth Skerry and Clettack Skerry.
NOO-036	Copinsay	East of South East Mainland	Intertidal sandbanks and rocky coastline of Copinsay and neighbouring grassy areas on the north and west coasts of Copinsay and the entire skerries of Corn Holm and Black Holm and their associated skerries.

**Table 3. Designated haul out sites near Scapa Flow per the Marine (Scotland) Act 2010 (Source: Marine Scotland (2017b)).**

Site ID	Site Name	Location	Details
BC-019	Swona	South West of South Ronaldsay	Entire island of Swona.
BC-023	North Flotta	North East Flotta, Scapa Flow	Rocky coastline and neighbouring grassy areas of Golta between Row Taing on the south coast and the area opposite the west end of Calf of Flotta on the north coast.
BC-027	South Ronaldsay West	South West South Ronaldsay	Rocky coastline between Greenvale and Castle Skerry.
BC-029	Calf of Flatta	Off North East Flotta, Scapa Flow	Entire island of Calf of Flotta.
BC-032	South Ronaldsay East	South East South Ronaldsay	Rocky coastline between Newark Bay and Lay Taing.
BC-035	North East Hoy	North East Hoy	Rocky coastline between Candle of the Sale and Green Head.

**Table 4. Observed grey seal breeding sites close to the Scapa Flow site (Source: Marine Scotland (2017b))**

## 8.2 Cetaceans

All species of cetacean that are present in British waters are designated as European Protected Species (EPS). Evans (2012) reports 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. Evans (2012) states that, since 1980, seventeen species of cetacean have been recorded along the coast or in nearshore waters, of these, seven species 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 regards to odontocetes, the Seawatch Foundation (2018) has reported that the killer whale, *Orcinus orca*, is widely distributed throughout Orkney waters, occurring in all months of the year (peak inshore June – October). A similar pattern exists 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. 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 Scapa Flow as the waters in the Flow are shallower and the large shoals of fish upon which numerous cetaceans’ prey are likely to be ordinarily absent in such inshore waters. Whilst EMEC’s observation data for the period of 2010 – 2013, shows that the majority of the above species have been sighted in the immediate vicinity of the Scapa Flow site, it is likely that the harbour porpoise (the most commonly sighted cetacean in Orkney waters) and other small cetaceans are the most likely species to be regularly sighted in the vicinity of the Scapa Flow test site.

Although there are no known resident populations of cetaceans within Scapa Flow or the wider Orkney area, cetaceans and other marine mammals were observed during the EMEC Wildlife Observation Programme (as shown in Figure 9).

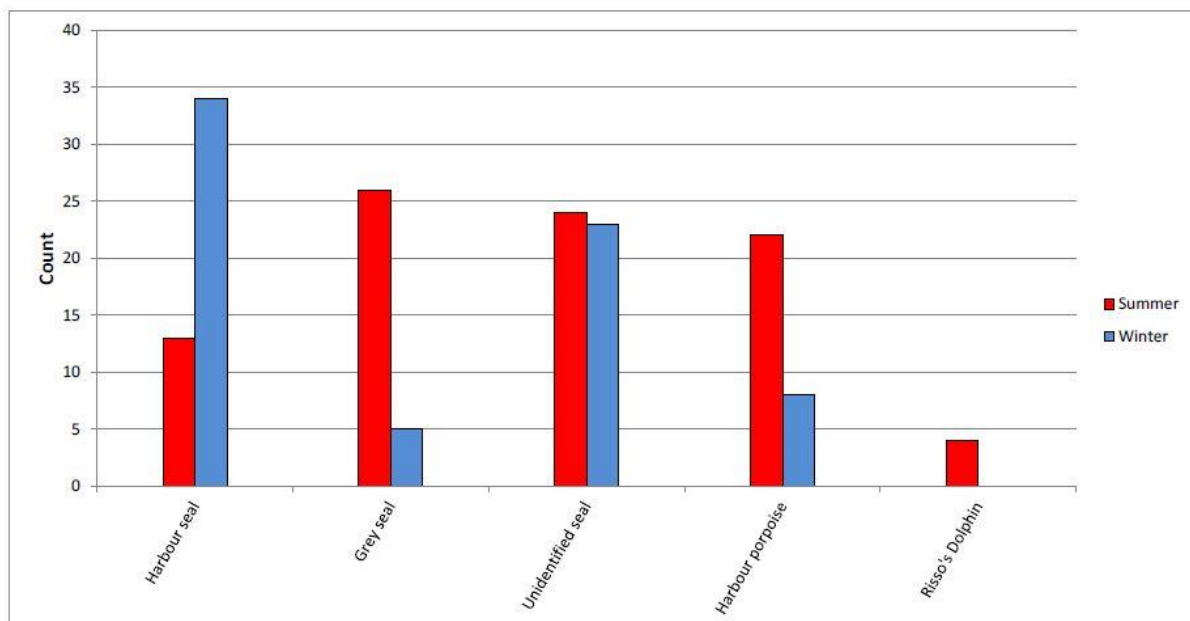


Figure 9. Summer and winter counts of marine mammal species observed at the Scapa Flow scale test site, April 2011 - March 2012 (Source: EMEC 2012).

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### 8.3 Otter

The European otter is classified as a European Protected Species, however is not expected to occur within the test site area. Typically, otters utilise shorelines, near burns and offshore to approximately 10 metres water depth. The absence of any associated landfall with the scale test site and the depth of around 20-30 m suggests it is unlikely the European otter will use the area of water at Scapa Flow.

### 8.4 Turtles

The National Biodiversity Network (2017) report that of the five species of turtles recorded in UK waters, the vast majority of records (nearly 80%) are of the leatherback turtle, *Dermochelys coriacea*. Although they are not classified as mammals, the turtles have similar life histories to that of mammals. 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 likely accidental. The NBN report sightings of this species from Scapa Flow as being in the single figures. The species is most likely to be sighted between August and November. Orkney Biodiversity Research Center data for the Scapa Flow site do not show the presence of any turtle species.

## 9 Conservation Sites

The Scapa Flow test site is located within the Pentland Firth proposed special protection area. The nearest sites are Keelylang Hill and Swartabeck Burn SSSI and the Orkney Mainland Moors SPA, both of which are situated 7.6 km from the test site. Figure 12 provides the overall context for the test site showing that the Scapa Flow site is within 15 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 Scapa Flow site and wider Scapa Flow area for foraging. A number of Local Nature Conservation Sites (LNCS) which are relevant to areas around Scapa Flow (on and/or offshore) have been designated as part of the updated Orkney Islands Council Local Development Plan (OIC, 2017). LNCS is a non-statutory designation given by local authorities to areas of locally important natural heritage interest. LNCS are regarded as being worthy of protection due to their ornithological, botanical or geological/geomorphological interest.

It is also important to acknowledge that the Scapa Flow test 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), proposed Special Protection Areas (pSPAs) and National Scenic Areas (NSAs) amongst others, which is illustrated by Figure 12. The Orkney Local Plan (OIC, 2017) identifies some areas onshore as being important sites of local nature conservation importance under policy LP/N1. These sites are representative of important Orkney nature conservation areas and the diversity of habitats and nature interests in the archipelago.

Scapa Flow meets the criteria for SPA status but has not yet been designated as such. To be designated as an SPA, an area has to support rare and vulnerable species listed in Annex I of the Birds Directive, as well as regular migratory species. SPAs are intended to protect selected species habitats and to protect the birds from significant disturbance.

The Scapa Flow meets these criteria both in winter and summer. In winter, two species, Great Northern Diver and Slavonian Grebe, are present in Scapa Flow in internationally important concentrations while a further 7 species are there in nationally important numbers. In summer, observational work has shown that the Scapa Flow is the most important feeding area for the Red-throated Divers that nest within the Hoy SPA.

The Pentland Firth proposed Special Protection Area (pSPA) (Figure 10) is located within the Orkney Islands. Scapa Flow is an enclosed sea area, sheltered by Orkney Mainland to the north, Hoy, South Walls and Flotta to the west and south and Burray and South Ronaldsay to the east. The Flow is linked to the Pentland Firth on the south through the Sound of Hoxa, and to the Atlantic Ocean on the west through Hoy Sound. The site also includes nearshore waters to the east of Orkney, extending from South Ronaldsay to Deerness and including the sheltered shallow waters of Holm Sound, between Burray and East Mainland. Prior to construction of the Churchill Barriers in World War II, there were openings between Scapa Flow and Holm Sound to the North Sea.

The area included within the pSPA supports a population of European importance of the following Annex 1 species:

- Great northern diver (*Gavia immer*)
- Red-throated diver (*Gavia stellata*)
- Black-throated diver (*Gavia arctica*)
- Slavonian grebe (*Podiceps auritus*)

It also supports migratory populations of European importance of the following species:

- European shag (*Phalacrocorax aristotelis*)
- Common eider (*Somateria mollissima*)
- Long-tailed duck (*Clangula hyemalis*)
- Common goldeneye (*Bucephala clangula*)
- Red-breasted merganser (*Mergus serrator*)

Diving activity varies among species but average foraging dive depths for most are shallower than 15m. However, substantially greater maximum dive depths have been recorded for some species, particularly shag and great northern diver.

The presence of high densities of wintering waterfowl in Scapa Flow and adjacent waters is indicative of the importance of these sheltered, shallow and productive waters at this time of year when frequent storms affect the surrounding North Sea and eastern Atlantic. For instance, the SPA supports 2% of Britain's Arctic tern population during the breeding season.

The pSPA also encompasses spawning/nursery grounds for sandeels (Ellis et al 2012). Sandeels are small and nutritious fish of particular value to seabirds such as Arctic terns, guillemots and Arctic skua during their summer breeding seasons when chicks require abundant supplies of high energy food.

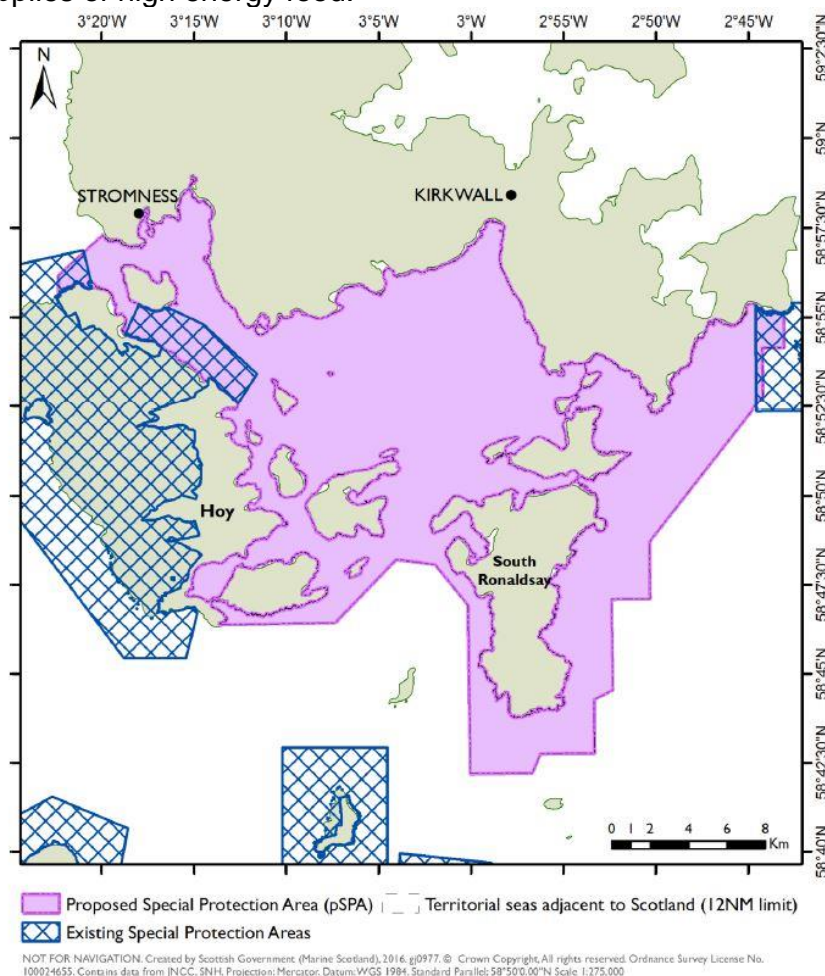


Figure 10. Location of the Pentland Firth pSPA (Source: Marine Scotland, 2017b)



The Pentland Firth pSPA fully encompasses the whole of the Scapa Flow scale test site. The distributions of qualifying species (listed prior in the section) are of particular relevance to developers due to the high densities of the qualifying species which appear at the site. Any future activities at the scale test site will have to be consulted with SNH for an assessment of the impacts of any device testing. The impacts would also be measured further by surveys conducted in the context of the site (SNH, 2017e).

Any future activities at the scale test site will have to be consulted with SNH for an assessment of the impacts of any device testing. These activities would also be informed further by surveys conducted in the SPA. Any developers should be aware and tailor their activities accordingly to ensure that they are abiding by conservation measures which protect the foraging habitat used by important numbers of Arctic terns (shown in Figure 11), guillemots and Arctic skua from nearby breeding sites including terrestrial SPAs.

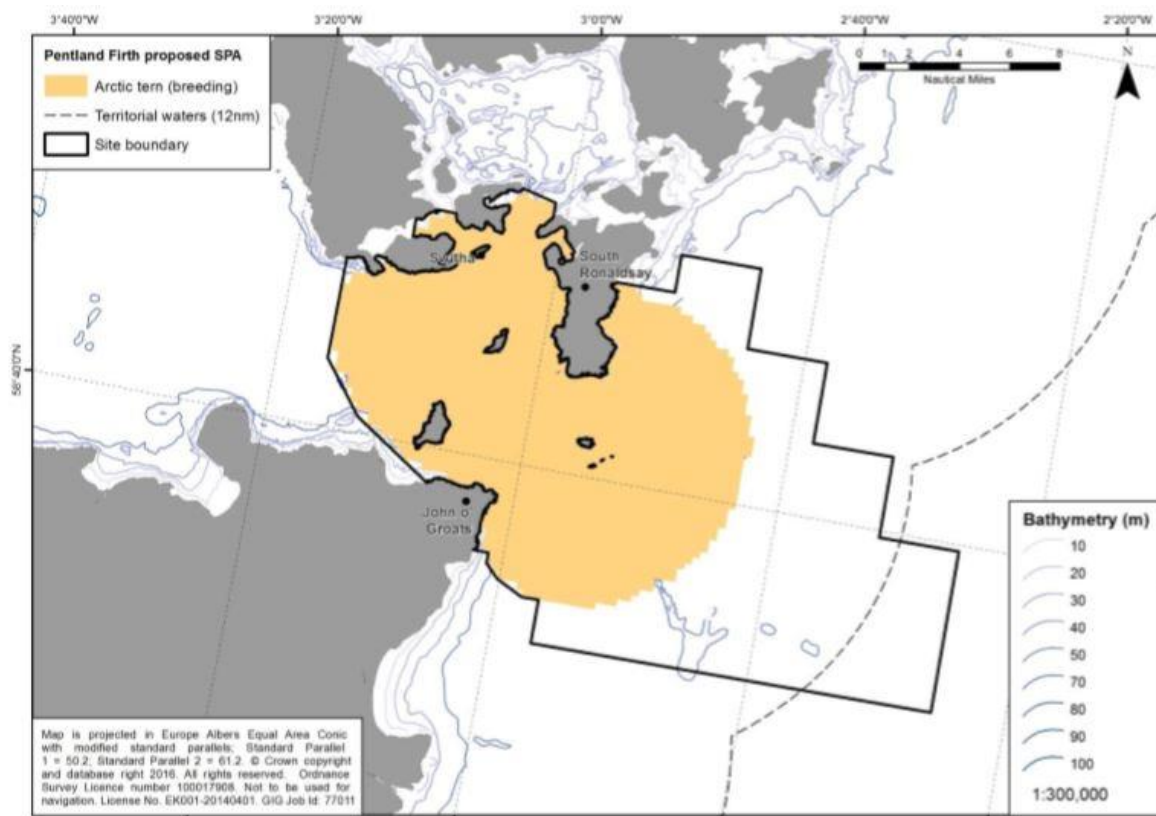


Figure 11. Important foraging areas for breeding Arctic tern within the Pentland Firth proposed SPA (Source: SNH, 2017e)



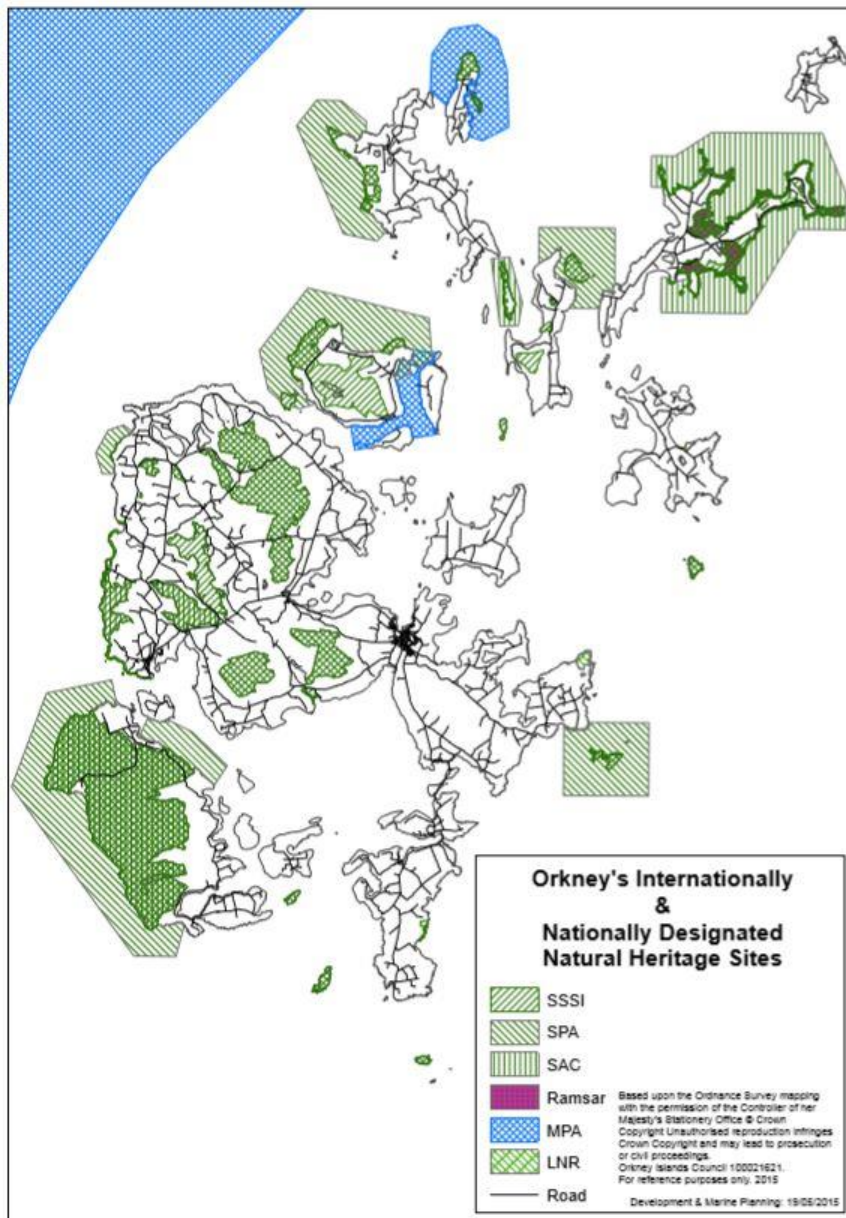


Figure 12. Orkney's Internationally & Nationally Designated Natural Heritage Sites (Source: OIC (2017b))

Figure 10, Figure 12, Table 5 and Appendix B describe the conservation areas shown in the vicinity of the Scapa Flow site.

Table 5. Details of conservation areas within 15 km of the Scapa Flow site (Sources: OIC, 2018b, RSPB, 2018b, SNH, 2017c)

Site and Distance from the Scapa Flow test site	Details
Hoy SAC – 15 km W	This site contains a myriad of features unique to freshwater, upland and coastal habitats. Base-rich fens, blanket bog, dry heaths, hard water springs and alpine and subalpine heaths are a part of the upland habitat. Vegetated sea cliffs and acid peat-stained lakes and ponds are characteristic of coastal and freshwater habitats, respectively.
Copinsay SPA – 11.6 km E	This SPA consists of the main island and three holms which are accessible at low tide. All of the islands have a cliff abundant, rocky coastline and sub-maritime vegetation that support large colonies of breeding seabirds. The boundary encompasses a seaward extension approximately 2 km into the marine environment to include the seabed, water column and surface. Qualifying interests include regularly supporting in excess of 20,000 individual seabirds. It regularly supports 70,000 seabirds including nationally important populations of a number of species including the common guillemot, <i>Uria aalge</i> , black-legged kittiwake, <i>Rissa tridactyla</i> , greater black-backed gull, <i>Larus marinus</i> , and Northern fulmar, <i>Fulmarus glacialis</i> .
Hoy SPA – 13.3 km W	The site supports an extremely diverse mixture of mire, heath and alpine vegetation, and also Britain's most northerly native woodland. Cliffs provide important breeding sites for a number of seabird species, especially gulls and auks, whilst moorland areas support large numbers of breeding birds. The divers and seabirds feed in the rich waters around Hoy, outside the SPA.
Orkney Mainland Moors SPA – 7.6 km NNW	The 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 regularly supports populations of European importance of the Annex I species hen harrier, red-throated diver and short-eared owl, due to the extensive moorland. The hen harrier population on this site is one of the largest in Britain. The Orkney Mainland Moors is one of few sites to support significant numbers of short-eared owl.
Switha SPA – 11.9 km SW	Switha has a rocky coastline with cliffs along the north, east and west shores, and is almost totally covered by maritime grassland, with smaller areas of heath and bog. Switha is of importance as a winter roosting site for Greenland Barnacle Goose.
Copinsay SSSI – 13.8 km E	These cliffs support a nationally important seabird colony with guillemots and Kittiwakes, representing a relatively significant proportion of the British and Irish population. Smaller numbers of Razorbills, Fulmar and Puffin are present also. The rocky north coast has an abundance of Sea Aster, <i>Aster tripolium</i> , and other grasses. On the adjoining island of Corn Holm is a large colony of Oysterplant, <i>Mertensia maritima</i> , and breeding Black Guillemots occur.
Den Wick SSSI – 13.9 km NE	Designated for its geological interest, Den Wick represents one of the best examples of a multiple till section (from a glacial deposit) in Orkney.
Keelylang Hill and Swartabeck Burn SSSI – 7.6 km NNW	Moorlands important for the density and diversity of the bird community and for the variety and numbers of birds of prey and upland breeding birds. Hen Harriers, merlin and short-eared owl are the most frequently sited species. Blanket bog dominates the landscape where heather, bog cotton and Sphagnum moss grow.

Site and Distance from the Scapa Flow test site	Details
Orphir and Stenness Hills SSSI – 11.6 km WNW	The area supports a typical moorland breeding birds' community at unusually high density. The most notable species is the hen harrier. Botanically the area is characterised by a range of plant communities typical of the Orkney moorland Dales with two colonies of the rare Pyramidal Bugle <i>Ajuga pyramidalis</i> are known to occur.
Switha SSSI – 11.9 km SW	The small grassy island of Switha supports the 3 <sup>rd</sup> largest wintering population of Greenland barnacle geese, <i>Branta leucopsis</i> in the UK. The island's coastline supports an assemblage of breeding seabirds.
Waulkmill SSSI – 7.6 km NW	This sandy bay 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. The various species in the saltmarsh include sea milk-wort and sea arrow-grass. 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.
Mull Head LNR – 14.4 km NE	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 – 7.5 km NW	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.
Hoy and West Mainland NSA – 13.2 km WNW	The ice-rounded hills of North Hoy dominate the Orkney scene. Their shape, fine grouping, cliffs and headlands, including the stack of the Old Man of Hoy, are almost as important to the Caithness scene as they are in that of Orkney.

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 4 and 7) but the Scapa Flow area is not thought to be integral to significant groups of any such species.

Scapa Flow and the western extent of Orkney's mainland moors (Figure 1) have been designated as Important Bird Areas by Birdlife International. The mainland moor area is considered important for breeding raptors and other moorland birds whilst Scapa Flow is determined to be important for overwintering water birds.

In addition to the conservation of animals, the conservation of the seabed is also crucial to consider. Moore (2009) gives a preliminary assessment and summary of the seabed habitats around the scale site using the information collected by Marine Scotland. This report concludes that there are three species (*Nucella lapillus*, *Modiolus modiolus* and *Echinus esculentus*) of Recognised Conservation Importance (according to Annex V of the Oslo and Paris Convention) recorded in the Pentland Firth. The biotope recorded at the Scapa Flow test site is considered to be of low significance at Scottish or UK conservation levels. As a result, the biotope is not listed on either the UK Post-2010 Biodiversity Action Plan or the Scottish Biodiversity List.

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## 10 Other sea users

### 10.1 Fisheries

There is no commercial white fish industry in Scapa Flow, and fishing activity is based around the important shellfish stocks of the area. Scallops (king scallop and queen scallop) are collected either by divers or mechanical dredging. Dredging for the scallops occurs mainly in the centre of Scapa Flow and through Hoxa Sound and diving for scallops occurs mainly around the north and west coasts of Scapa Flow including the Scapa Flow area (see below). Shellfish are landed in three harbours around Scapa Flow, none of which are in close proximity to the Scapa Flow site.

Satellite information from 2017 the Scapa Flow site indicates that, as would be expected considering its position within Scapa Flow, the Scapa Flow site is isolated from fishing grounds worked by vessels greater than 15 m in length and does not sit on any apparent steaming routes for fishing vessels.

The Orkney Fisheries Association (OFA), however, states that some activity may occur in the south of the site. It is known that approximately six smaller creeling vessels make use of the area in which the Scapa Flow site sits. Possible target species for these creelers include lobster, edible crab, green crabs, velvet crabs, king scallop and buckies. It is used by a handful of small creel boats, with activity highest in the summer months.

### 10.2 Aquaculture

Currently, a large number of aquaculture sites (mainly used for the farming of Atlantic salmon) are located within Scapa Flow. In total, 23 salmon fish farms are in operation in Scapa Flow and the Northern Isles of Orkney. In addition to salmon farming, the commercial shellfish sector is closely monitored by Orkney Sustainable Fisheries (OSF) in order to conduct research on the local shellfish populations. Most recently, the OSF have collected data on the Brown Crab, European Lobster and Velvet Crab populations. The majority of data collected by aquaculture organizations is via creel deployment (mainly on the fringes of Scapa Flow). There are a number of active seawater and freshwater finfish and shellfish sites close to the Scapa Flow site, with the closest active fish farm, Westerbister, approximately 1.4 km away from the site. The closest active shellfish farm at Lamb Holm Quarry is 3.2 km from the site (Marine Scotland, 2018b).

### 10.3 Commercial and recreational traffic

Scapa Flow is a designated harbour area under the Orkney County Council Act 1974. Key activities in the Scapa Flow Harbour Area include oil tanker traffic to and from the Flotta Oil Terminal, ship-to-ship transfer operations, gas tankers and ship bunkering operations. Other vessel traffic is likely to include regular ferry traffic, coastal fuel tankers, cargo vessels, and small commercial craft including salmon farm workboats, dive charter vessels and fishing vessels.

The Navigational Risk Assessment (NRA) conducted as part of the site selection process analysed six weeks of Scapa Flow vessel data from summer 2009 and six weeks from winter 2010 (total of 12 weeks). Plots of the vessel tracks in the vicinity of the Scapa Flow site



showed a total of three tracks<sup>2</sup> passing through the Scapa Flow site boundary during the summer period. Two of these were the OIC's Orkney Towing Company tug *Harald* and the third was the yacht *TS Ocean Spirit*. There were no transits of the site in winter, although the pilot vessel *Scapa Pathfinder* passed close inshore on one occasion. The majority of the AIS tracks within Scapa Flow were associated with the Flotta Marine Oil Terminal (mainly tankers and supporting vessels, such as tugs and pilot vessels). There is an anchor position located 0.72 km to the west of the site boundary, which was in use by the tanker *Maersk Neptune* during the summer survey. There is also a ship-to-ship position located 1.3 km to the West North West of Scapa Flow.

Marine Scotland data (2012) indicated a relatively small amount of shipping traffic in the area nearest the site.

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 recording box covering the Scapa Flow site but extending further south. The box was defined based on the larger Scapa Flow survey area and therefore the count will over-estimate small vessel activity. A total of 10 vessel tracks crossed the box, corresponding to an average of 2 – 3 per week. This indicates small vessel activity at Scapa Flow is low, although it is noted that the data currently only cover the spring period.

Figure 13 and Figure 14 provide an indication of vessel tracks passing the Scapa Flow test site through Summer 2009 and Winter 2010. Please note, update vessel traffic analysis has been completed in 2018 and will be published early in 2019.

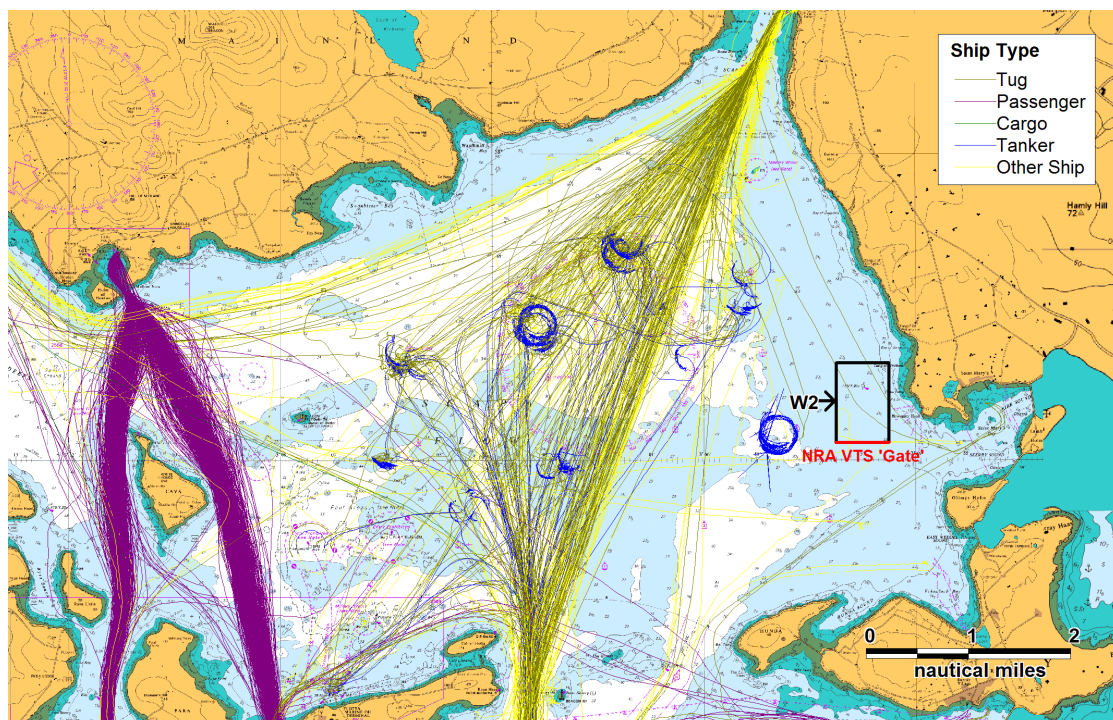


Figure 13. AIS vessel tracks by type passing the Scapa Flow site (Summer 2009)

<sup>2</sup> Shipping in the vicinity of the Scapa Flow 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.



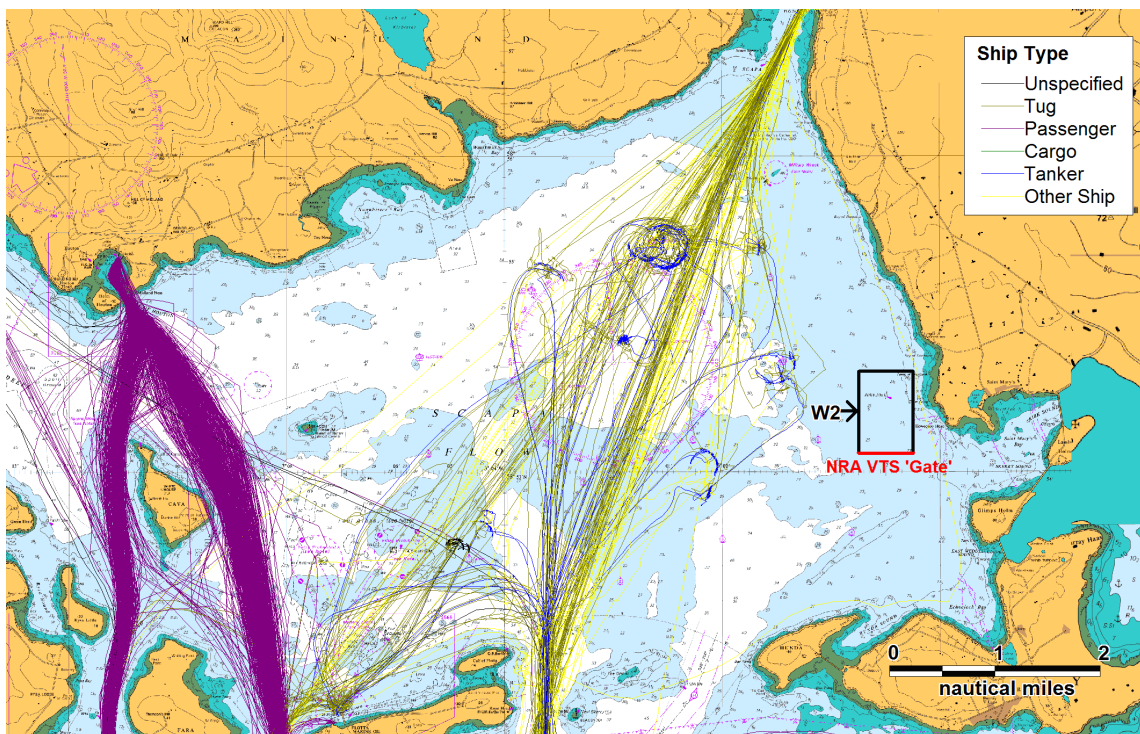


Figure 14. AIS vessel tracks by type passing the Scapa Flow site (Winter 2010)

Admiralty charts show a lack of pipelines, cables, foul grounds or wrecks in the Scapa Flow area (UKHO, 2018). There are no sea surface military practice and exercise areas (PEXA) in the vicinity of the Scapa Flow site, although the area is located in an Air Force PEXA.

## 10.4 Recreation

The Scapa Flow site and surrounding waters are not a major location for recreational diving, with the Orkney Dive Boat Operators Association stating that the Scapa Flow area is not used by dive boats. The NRA notes that dive boats visit wrecks in Kirk Sound and use the pier at Lamb Holm; the Scapa Flow site allows access from the south for these activities, which mostly take place in summer months. Sailing vessels are known to pass through the area on passage to and from Stromness marina, but these are occasional movements related to races and are not likely to occur the majority of the time. Recreational vessels, ranging from dinghies to yachts, use Scapa Flow. Indeed, some vessels will transit within or near the Scapa Flow site; the RYA indicate this is a lightly-used route. Occasional races also pass through or near the area. The site sits on a popular kayaking route from Scapa to St Mary's Holm but these trips tend to be only in good weather during daylight hours. Some other inshore vessel movements may occur across the south of the site. There is no surfing reported at or near this site.

## 10.5 Archaeology

Scapa Flow was the base for the Royal Navy Home Fleet in both the first (WWI) and second (WWII) World Wars and, as such, several both WWI and WWII military remains can be found at points around the coast. As the German High Seas Fleet was scuttled in Scapa Flow at the end of WWI, the remains of relatively intact wrecks are in the south and west of the Flow, much to the south of Scapa Flow. Of more site-specific interest relative to Scapa Flow, the remains of HMS Royal Oak are located approximately 4 km to the north.

There is the potential for the presence of submerged landscapes preserved by the accumulation of sediment (OIC, 2015). However, interrogation of the RCAHMS, Historic Scotland and Local Authority Sites and Monuments Records database (Pastmap, 2018) shows that, whilst there are sites of archaeological interest along the nearby coast, there are no known archaeological sensitivities in the Scapa Flow offshore area.

## 11 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 the closest harbour seal haul-out is 3.2 km south at West Burray. The key issues to consider are collision risk and construction/operation/decommissioning disturbance (although SNH comment that although some seals may be present in area this is not a site of concern).</p>												
Grey Seals	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
<p>Grey seals begin to arrive at the main breeding beaches in August, 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 4.3 km south at West Burray where 5 animals have been observed. The closest grey seal pupping site is located on Flotta, 7.6 km to the south west. The key issues to consider are collision risk and construction/operation/decommissioning disturbance (although SNH comment that despite some seals being present in area this is not a site of concern).</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, Seawatch International data shows the harbour porpoise to be the most commonly sighted cetacean in the vicinity of the Scapa Flow site. 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>The minke, long-finned pilot, fin, humpback, sperm and killer whale, Risso's, white-beaked and Atlantic white-sided dolphin, humpback and sperm whales have been sighted in Orkney waters. 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, 2012). SNH, during the screening process, commented that Risso's and Atlantic white-sided dolphins have been sighted in the area. The key issues to consider are collision risk and construction/operation/decommissioning disturbance, although it should be noted that there are no known resident populations of cetaceans in the area.</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. Scapa Flow is a wintering area for species such as Slavonian Grebe and Great Northern Divers, as well as many others. The Bay of Sandoyne to Howquoy is the main area of interest (see Figure 3.9).</p>												
Finfish & Shellfish	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
<p>As with much of Orkney, Scapa Flow 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>The NRA showed that fishing activity was low, with activity highest in the summer months. Regarding vessel traffic, the NRA showed few tracks traversing the site in summer but none in winter. Summer months are key for recreational activities. Aquaculture is present in locations relatively close to the site.</p>												
Key:	High			Moderate				Low				

## 12 Monitoring and Data Sources

EMEC recognises the importance of environmental monitoring for developers deployed at the scale test sites. Information regarding monitoring and data collection conducted at EMEC's scale test site, Scapa Flow, can be acquired from EMEC.

Appendix A summarises the baseline surface wildlife monitoring data collected for the period 01/06/2010 to 29/03/2013.

### 12.1 Other Sources of Environmental Data

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

- (1) The table below lists relevant organisations 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

- (2) EMEC has ongoing consultations with the following organisations 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

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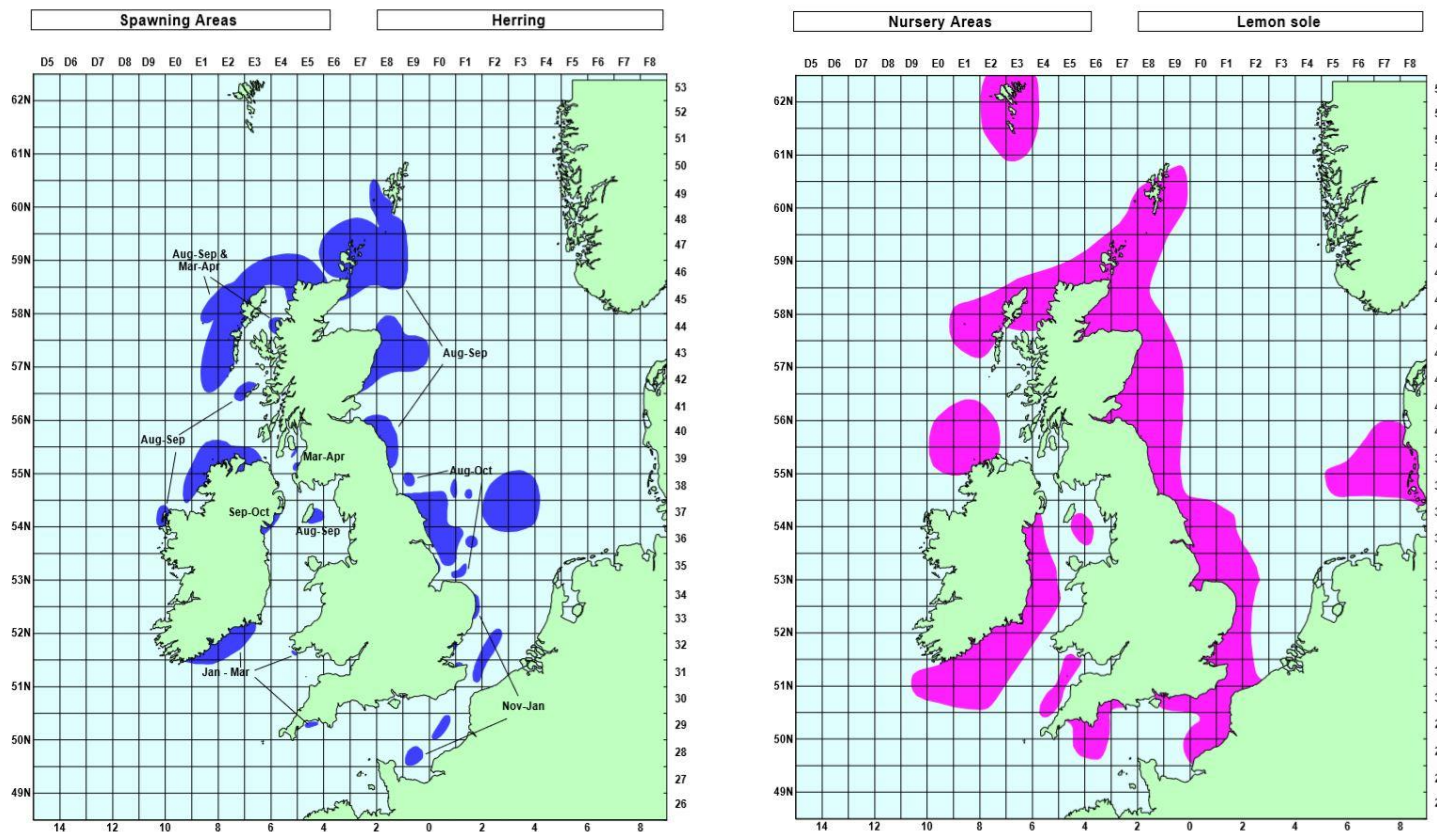
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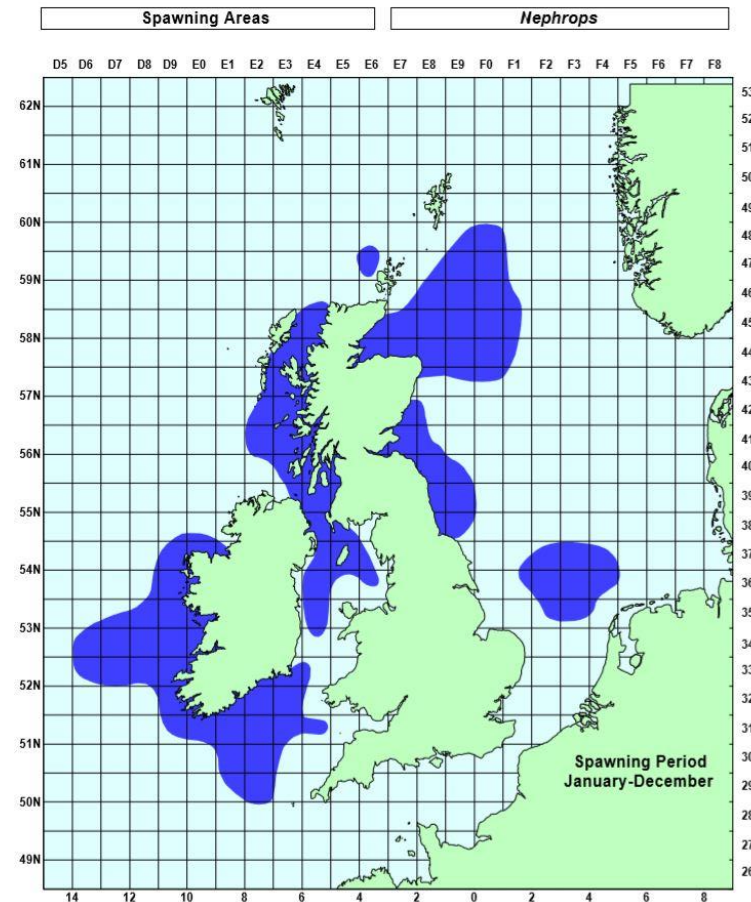
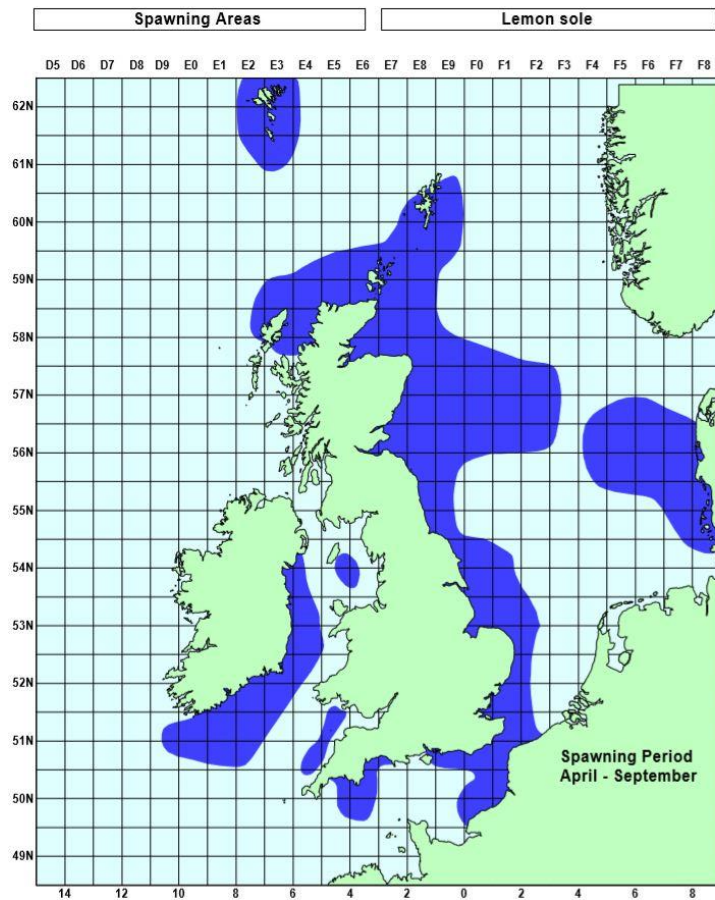


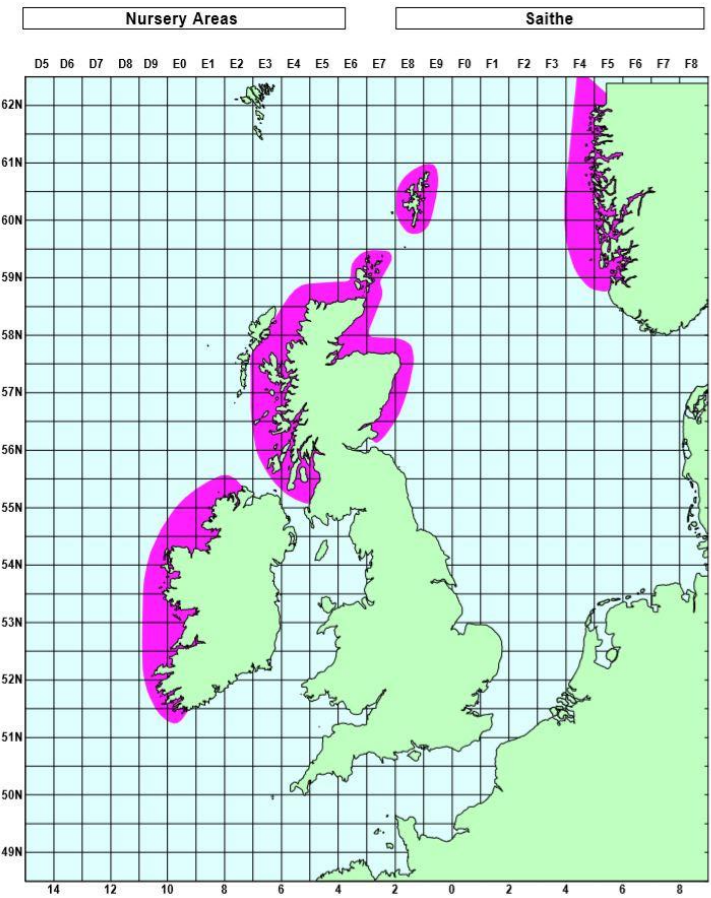
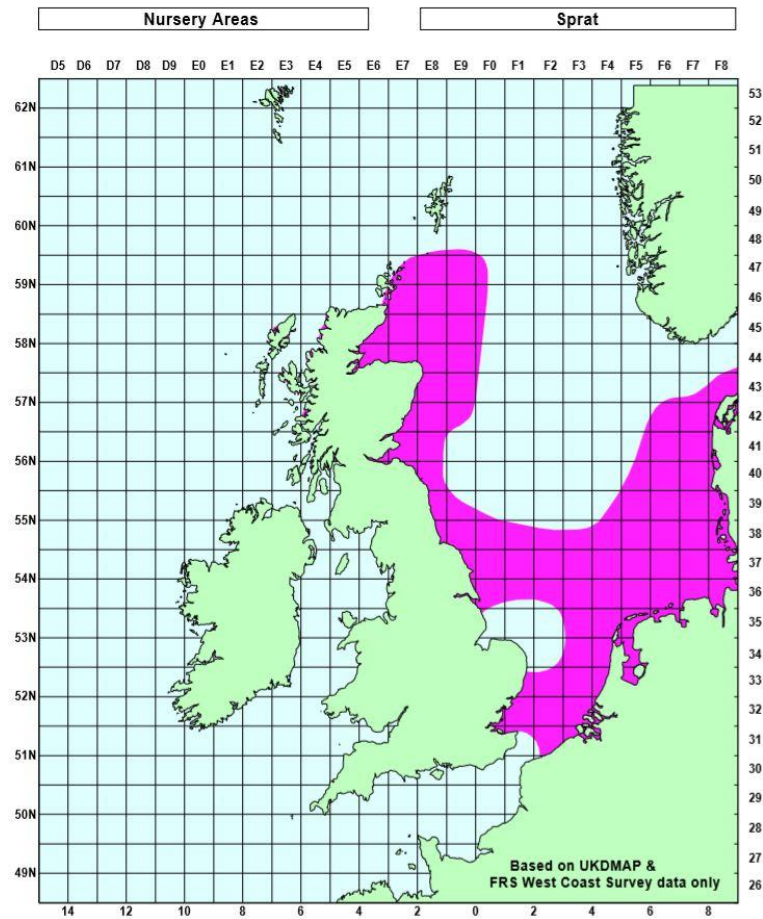
## Appendix A: Fisheries Sensitivity Maps for Orkney

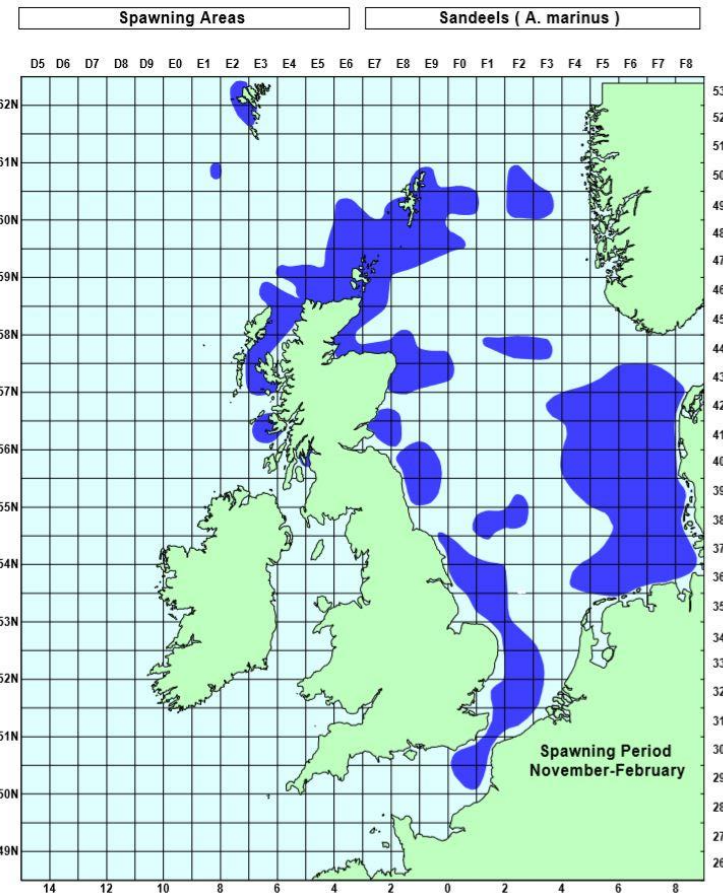
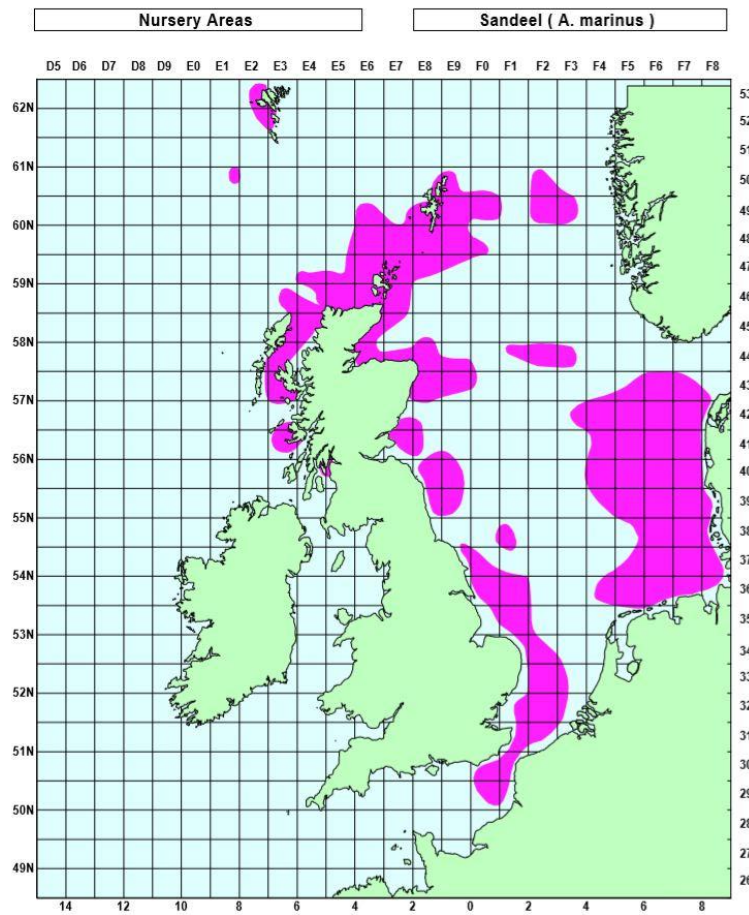
This appendix provides a summary of the fisheries sensitivity maps for Orkney Waters (Coull *et al.*, 1998). The following maps produced from averaged data collected and collated by Fisheries Research Services (FRS) and The Centre for Environment, Fisheries & Aquaculture Science (CEFAS) in the years 1991 – 1996. These maps are provided to aid developers to assess the potential environmental impact associated with their project across installation, testing and decommissioning activities.













## Appendix B: Conservation Designations

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 several rare, threatened or vulnerable bird species listed in Annex I of the Birds Directive, and for regularly occurring migratory species.
Special Area for Conservation (SACs)	A SAC is an area classified under the Habitats Directive for the protection of several rare, endangered or vulnerable habitats and species of plants or animals, both terrestrial and marine.
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 combination 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.
National Scenic Area (NSA)	NSAs are Scotland's only national landscape designation. They are those areas of land considered of national significance on the basis of their outstanding scenic interest which must be conserved as part of the country's natural heritage. They have been selected for their characteristic features of scenery comprising a mixture of richly diverse landscapes including prominent landforms, coastline, sea and freshwater lochs, rivers, woodlands and moorlands. Recent legislation (Planning Etc (Scotland) Act 2006 – Part 10) has given a new statutory basis to the National Scenic Area designation.

Table 6. Details of conservation designations within close proximity to the Scapa Flow test site (Source: SNH, 2017a; 2017b; OIC 2018)

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