

**SCOTTISH
NATURAL
HERITAGE**



**Dornoch Firth and Morrich More
Special Area of Conservation**

Advice under Regulation 33(2)
of The Conservation (Natural Habitats, &c.) Regulations 1994
(as amended)

30 March 2006

About this Package:

Section 1 of this document provides a general introduction and Sections 2 and 3 fulfil Scottish Natural Heritage's duties under Regulation 33(2) of The Conservation (Natural Habitats, &c.) Regulations 1994 (Habitats Regulations) (as amended by The Conservation (Natural Habitats, &c.) Amendment (Scotland) Regulations 2004). This requires that SNH advises other relevant authorities as to the conservation objectives of the site (see Section 2) and any operations which may cause deterioration of natural habitats or the habitats of species, or disturbance of species, in so far as such disturbance could be significant, for which the site has been designated (see Section 3).

Annexes A and B provide supplementary, non-statutory information. Annex A gives information on the sensitivity and vulnerability of the marine qualifying interests: 'Estuaries'; 'Mudflats and sandflats not covered by seawater at low tide'; 'Reefs'; 'Sandbanks which are slightly covered by seawater all the time'; 'Common seal *Phoca vitulina*' and 'Otter *Lutra lutra*'. Annex B gives some indication as to the extent, distribution, structure, function and processes that affect the qualifying interests. It should be noted that this is indicative and not definitive, and as more site information is gathered these sections may be updated.

Dornoch Firth and Morrich More was designated by Scottish Ministers as a Special Area of Conservation (SAC) on 17th March 2005. This site is also referred to as a 'European site' (Regulation 10(1)). A 'European marine site' is a 'European site' which is wholly or in part marine (Regulation 2(1)) and is hereafter referred to as a marine SAC.

Although the following statutory information is for the benefit of relevant authorities (see below for explanation of their role), it can also be used by other competent authorities when assessing plans or projects.

1 Introduction

1.1 Background

The Conservation (Natural Habitats, &c.) Regulations 1994 (as amended by The Conservation (Natural Habitats, &c.) Amendment (Scotland) Regulations 2004), commonly referred to as the Habitats Regulations, transpose the EC Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora (Habitats Directive) into domestic legislation. Regulation 33(2) gives Scottish Natural Heritage a statutory responsibility to advise other relevant authorities as to the conservation objectives for marine SACs in Scotland, and any operations which may cause deterioration of natural habitats or the habitats of species, or disturbance of species for which the site has been designated.

This document presents the Regulation 33 advice, plus supporting information, for the Dornoch Firth and Morrich More SAC to assist relevant and competent authorities, local interest groups and individuals in considering management of the site. This advice, plus supporting information, will also help to determine the scope and nature of any “appropriate assessment”, which the Habitats Directive requires to be undertaken for proposed plans and projects that are not connected to the conservation management of the site and are considered likely to have a significant effect. Where necessary Scottish Natural Heritage will also provide more detailed advice to relevant, and other competent, authorities to inform assessment of the implications of any such plans or projects.

1.2 Relevant and competent authorities

Within the context of a marine SAC, a relevant authority is a body or authority that has a function in relation to land or waters within or adjacent to the site (Regulation 5) and include: a nature conservation body; a local authority; water undertakers; a navigation authority; a harbour authority; a lighthouse authority; a river purification board (SEPA); a district salmon fishery board; and a local fisheries committee. *All relevant authorities are competent authorities.*

A competent authority is defined in Regulation 6 as “any Minister, government department, public or statutory undertaker, public body of any description or person holding a public office”. In the context of a plan or project, the *competent authority* is the authority with the power or duty to determine whether or not the proposal can proceed.

1.3 The role of relevant authorities

The Habitats Regulations require relevant authorities to exercise their functions so as to secure compliance with the Habitats Directive. A management scheme may be drawn up for each marine SAC by the relevant authorities as described under Regulation 34. For marine SACs with overlapping interests, a single management scheme may be developed.

Where a management scheme is in place the relevant authorities must ensure that all plans for the area integrate with it. Such plans may include shoreline

management plans, Sites of Special Scientific Interest (SSSI) management plans, local Biodiversity Action Plans (BAPs) and sustainable development strategies for estuaries. This must occur to ensure that only a single management scheme is produced through which all relevant authorities exercise their duties under the Habitats Regulations.

1.4 Responsibilities under other conservation designations

Other designations within or adjacent to the Dornoch Firth and Morrich More marine SAC are: Dornoch Firth SSSI; Morrich More SSSI; Dornoch Firth and Loch Fleet Special Protection Area (SPA) and Ramsar site; River Oykel SAC, Ledmore Wood SSSI & SAC, Moray Firth SAC and Dornoch Firth National Scenic Area (NSA). The obligations of relevant, and other competent authorities and organisations under such designations and legislation are not affected by the advice contained in this document.

1.5 Conservation objectives

Section 2 of this document contains the conservation objectives for the marine components of the Dornoch Firth and Morrich More SAC, a site which consists of both marine and terrestrial qualifying interests. The conservation objectives have been developed to ensure that the obligations of the Habitats Directive are met.

1.6 Advice as to operations

The operations, set out in Section 3, are those which SNH advise may cause deterioration of natural habitats or the habitats of species, or disturbance of species, for which the site has been designated. This does not necessarily mean that the operations are *presently* ongoing or, if they are, that they are at levels incompatible with the conservation objectives.

1.7 Plans and projects

The Habitats Regulations require that, where an authority concludes that a development proposal is unconnected with the nature conservation management of a Natura site and is likely to have a significant effect on that site, it must undertake an appropriate assessment of the implications for the qualifying interest for which the area has been designated.

1.8 Review of Consents

Competent authorities are required by the Habitats Regulations to undertake a review of all consents and permissions for activities affecting the site as soon as reasonably practicable after it becomes a European site. This will have implications for discharge and other consents, which will need to be reviewed in the light of the conservation objectives.

2 Statutory advice given by SNH under Regulation 33(2) Conservation Objectives

2.1 Introduction

This section provides conservation objectives, which have been developed by SNH in agreement with the Scottish Executive and are to be provided to the relevant authorities in fulfilment of the requirements under Regulation 33(2) of The Conservation (Natural Habitats, &c.) Regulations 1994 (as amended by The Conservation (Natural Habitats, &c.) Amendment (Scotland) Regulations 2004).

The conservation objectives ensure that the obligations of the Habitats Directive are met; that is, there should not be deterioration or significant disturbance of the qualifying interest. This will also ensure that the integrity of the site is maintained and that it makes a full contribution to achieving favourable conservation status for its qualifying interests.

The Dornoch Firth and Morrich More marine SAC has been designated for the marine habitats 'Estuaries'; 'Mudflats and sandflats not covered by seawater at low tide'; 'Reefs' and 'Sandbanks which are slightly covered by seawater all the time', which are listed on Annex I of the Habitats Directive. In addition this SAC has been designated for species 'Common seal *Phoca vitulina*' and 'Otter *Lutra lutra*', which are listed on Annex II of the Habitats Directive. It should be noted that although otters within the SAC feed in the marine environment they are also dependent on adjacent terrestrial habitats.

The Dornoch Firth and Morrich More SAC also includes terrestrial qualifying interests, which are listed below the conservation objectives (see the SNH website www.snh.org.uk for more information).

The conservation objectives for the marine qualifying interests of the Dornoch Firth and Morrich More SAC are as follows:

To avoid deterioration of the qualifying habitats (Estuaries, Mudflats and sandflats not covered by seawater at low tide, Reefs and Sandbanks which are slightly covered by seawater all the time) thus ensuring that the integrity of the site is maintained and the site makes an appropriate contribution to achieving favourable conservation status for each of the qualifying interests.

To ensure for the qualifying habitats that the following are maintained in the long term:

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| • Extent of the habitat on site |
| • Distribution of the habitat within site |
| • Structure and function of the habitat |
| • Processes supporting the habitat |
| • Distribution of typical species of the habitat |
| • Viability of typical species as components of the habitat |
| • No significant disturbance of typical species of the habitat |

To avoid deterioration of the habitats of qualifying species (Otter <i>Lutra lutra</i> and Common seal <i>Phoca vitulina</i>) or significant disturbance to the qualifying species, thus ensuring that the integrity of the site is maintained and the site makes an appropriate contribution to achieving favourable conservation status for each of the qualifying interests.
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To ensure for the qualifying species that the following are maintained in the long term:
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| • Population of the species as a viable component of the site |
| • Distribution of the species within site |
| • Distribution and extent of habitats supporting the species |
| • Structure, function and supporting processes of habitats supporting the species |
| • No significant disturbance of the species |

The terrestrial qualifying interests of the Dornoch Firth and Morrich More SAC are as follows:

- Coastal dune heathland
- Atlantic salt meadows
- Dunes with juniper thickets
- Lime-deficient dune heathland with crowberry
- Shifting dunes
- Dune grassland
- Humid dune slacks
- Glasswort and other annuals colonising mud and sand
- Shifting dunes with marram

3 Statutory advice given by SNH under Regulation 33(2) Operations

The following advice as to operations to be considered by relevant authorities is provided by SNH with respect to the Dornoch Firth and Morrich More marine SAC in fulfilment of the requirements under Regulation 33(2)(b) of The Conservation (Natural Habitats, &c.) Regulations 1994 (as amended by The Conservation (Natural Habitats, &c.) Amendment (Scotland) Regulations 2004). The advice identifies those operations, either on or affecting the SAC, which may cause deterioration of the marine natural habitats or the habitats of species, or disturbance of species, for which the site has been designated. These include operations that may not be currently affecting the Dornoch Firth and Morrich More marine SAC.

Operations (in alphabetical order)

Aquaculture

Finfish farming
Shellfish farming

Coastal Development

Agriculture
Civil engineering
Forestry operations

Discharges / Waste Disposal

Discharge of commercial effluent
Discharge of sewage

Fishing

Mobile gear: Dredging
Mobile gear: Trawling
Static gear: Netting

Gathering / Harvesting

Bait gathering
Diver collection of shellfish
Intertidal collection of shellfish

Marine Traffic

Commercial vessels

Military Activity

Military training, exercises and range maintenance

Recreational Activities

Boat anchorages
Boat moorings
Charter / recreational vessels
Other recreational activities

Scientific Research

Scientific research

Annex A

Non-statutory advice given by SNH

Sensitivity and Vulnerability of the Dornoch Firth and Morrich More SAC 'Estuaries', 'Mudflats and sandflats not covered by seawater at low tide', 'Reefs', 'Sandbanks which are slightly covered by seawater all the time', 'Common seal *Phoca vitulina*' and 'Otter *Lutra lutra*' to activities listed in Section 3

The comments below are general and should not be considered to be definitive. They are made without prejudice to any comments SNH may provide or any assessment that may be required for specific proposals to be considered by a relevant authority. The level of any impact will depend on the location and intensity of the relevant activity. This advice is provided to assist and focus the relevant authorities in their consideration of the management of these operations.

NB. References to deterioration in the comments section below should be taken to mean *deterioration of all the qualifying interests*. If specific qualifying interests are particularly at risk they may be referred to individually where relevant.

Operations	Comments
Aquaculture	
Finfish farming	<p>Habitats: Finfish farming has the potential to cause deterioration of qualifying habitats and communities through changes in water quality, smothering from waste material and physical disturbance from mooring systems. There is potential for accidental introduction of new non-native species and increasing the spread of existing non-native plants and animals (e.g. <i>Caprella mutica</i> Japanese skeleton shrimp), which are already widely distributed in the UK. Invasive species have the potential to cause deterioration of the qualifying interest by altering community structure and quality.</p> <p>Species: The development of finfish farming sites has the potential to cause disturbance to resident otter individuals or populations in the vicinity of such farms, mainly as a result of human activities such as noise and boat usage and through the use of acoustic deterrent devices (ADDs). The construction, use and maintenance of shore bases built to support finfish farms have the potential to disturb otters and cause deterioration of their habitats through destruction and physical damage to shoreline holts.</p> <p>Finfish farming has the potential to cause disturbance, injury or mortality to seals through entanglement in anti-predator nets or nets used to re-capture escaped fish, shooting (legal only outwith the close season) to protect fish farm stock from seal damage, or using ADDs. Chemical treatments associated with finfish farming have the potential to adversely affect seals.</p> <p>Boat activity associated with finfish farming has the potential to cause disturbance to seals, particularly during breeding and pupping (late May to end June) and moulting (August) seasons.</p>

Aquaculture contd.	
Shellfish farming	<p>Habitats: This activity has the potential to cause deterioration of the qualifying habitats and communities through physical damage (e.g. installation of mooring blocks and continued scouring by riser chains) and changes in community structure caused by smothering from pseudo-faeces (undigested waste products) and debris (including dead shells) falling from the farm. There is also potential for accidental introduction of new non-native species and increasing the spread within the UK of existing non-native plants and animals (e.g. <i>Sargassum muticum</i> Wireweed), through importation or translocation of shellfish stocks. Invasive species have the potential to cause deterioration of the qualifying interest by altering community structure and quality.</p> <p>Species: The development of shellfish farming sites has the potential to cause disturbance to resident otter individuals or populations in the vicinity of such farms, mainly through human activities such as noise and boat usage and through the use of ADDs. The construction, use and maintenance of shore bases built to support shellfish farms have the potential to disturb otters and cause deterioration of their habitats through destruction and physical damage to shoreline holts.</p> <p>Shellfish farming has the potential to cause disturbance, injury or mortality to seals through the use of ADDs or other predator control methods (e.g. sonic canon, boat chasing).</p> <p>Boat activity associated with shellfish farming has the potential to cause disturbance to seals, particularly during breeding, pupping and moulting seasons.</p>
Coastal Development	
Agriculture	<p>Habitats: Diffuse run-off from agricultural practices has the potential to cause deterioration of qualifying habitats and communities through the smothering of qualifying interests, and / or altering water quality through discharge of organic and inorganic pollutants.</p>
Civil engineering	<p>Habitats: The construction and maintenance of structures, both within and adjacent to the sea have the potential to cause direct loss of qualifying habitat and deterioration of adjacent habitats and communities as tidal currents and therefore coastal processes are affected. For example coastal structures such as linear coastal defences or erosion control measures (e.g. gabions) can affect local sediment suspension and deposition patterns and therefore have the potential to cause deterioration of qualifying habitat, particularly reefs, through smothering. Installation, replacement and maintenance of undersea cables have the potential to cause direct loss of qualifying habitat as well as local deterioration of qualifying habitats and communities.</p> <p>Species: Civil engineering has the potential to disturb otters and cause deterioration of their habitats through destruction and physical damage to shoreline holts.</p> <p>The construction and maintenance of structures, both within and adjacent to the sea, have the potential to cause disturbance during the seal breeding, pupping and moulting seasons. This activity also has the potential to cause loss or deterioration of the habitats upon which the seals depend during the same critical periods.</p>
Forestry operations	<p>Habitats: Increased concentrations of dissolved nutrients from fertiliser run-off has the potential to cause deterioration of qualifying habitats and communities. Large-scale run-off of terrestrial sediment, from forestry operations, has the potential to cause deterioration of qualifying habitats, particularly reefs, through smothering.</p>

Discharges / Waste Disposal	
Discharge of commercial effluent	Habitats: Commercial effluent has the potential to cause deterioration of qualifying habitats and communities. This would be through the effects of pollution and / or nutrient enrichment, which may cause subsequent changes in community structure.
Discharge of sewage	Habitats: Sewage effluent (whether treated or untreated) has the potential to cause deterioration of qualifying habitats and communities. This would be through the effects of pollution and / or nutrient enrichment, which may cause subsequent changes in community structure.
Fishing	
Mobile gear: Dredging	Habitats: Benthic dredging has the potential to cause deterioration of qualifying habitats and communities e.g. biogenic reefs (reef created by living organisms) through direct contact with dredge gear, and sedimentation when dredging occurs close to the qualifying interests, particularly reefs.
Mobile gear: Trawling	Habitats: Benthic trawling has the potential to cause deterioration of qualifying habitats and communities e.g. biogenic reefs through direct contact with trawling gear, and sedimentation when trawling occurs close to the qualifying interests, particularly reefs.
Static gear: Netting	Habitats: The use of stake-nets for salmon has the potential to cause deterioration of qualifying habitats and communities, particularly fragile and erect reef species, mainly during installation.
	Species: The use of nets such as gill nets in water shallower than 10m has the potential to cause injury or mortality to otters through entanglement as this will normally result in drowning. The use of tangle nets, bottom-set nets or salmon stake nets has the potential to cause seal injury or mortality through entanglement. The legal shooting of seals that occurs as a result of protecting salmon stake net equipment has the potential to cause disturbance, injury and mortality to seals.
Gathering / Harvesting	
Bait gathering	Habitats: Bait gathering on the foreshore has the potential to cause deterioration of qualifying habitats and communities through physical damage and disturbance of intertidal habitats and communities. This may cause deterioration of the qualifying interests by indirect impact through loss or imbalance of associated species, communities and ecosystems.
	Species: Bait gathering on the foreshore has the potential to cause disturbance to otters in the vicinity of the collection area, as a result of intense and prolonged human presence. Bait gathering on the foreshore has the potential to cause disturbance to seals (particularly during breeding, pupping and moulting seasons) and physical damage and disturbance to associated habitats.
Diver collection of shellfish	Habitats: Collection of shellfish by diving has the potential to cause deterioration of the reef habitats and communities where the target species is a key component of that community, or where the collection method involves the use of invasive techniques (e.g. hydraulic equipment). Diving amongst reefs could cause deterioration and physical damage, in particular to erect and fragile species.
Intertidal collection of shellfish	Habitats: Collection of shellfish from intertidal areas has the potential to cause deterioration of qualifying habitat and communities through physical damage and disturbance to (trampling and turning stones), and removal of the target species, which can cause an imbalance of communities and ecosystems.

Gathering / Harvesting contd.	
Intertidal collection of shellfish contd.	<p>Species: Collection of shellfish from intertidal areas has the potential to cause disturbance to otters in the vicinity of the collection area, mainly caused by intense and prolonged human presence.</p> <p>Collection of shellfish from intertidal areas has the potential to cause disturbance to seals (particularly during breeding, pupping and moulting seasons), mainly caused by intense and prolonged human presence.</p>
Marine Traffic	
Commercial vessels	<p>Habitats: The pumping of bilges, discharge of ballast, accidental grounding, or accidental oil (or other chemical) spillage from commercial vessels could occur within or close to this SAC. Such incidents have the potential to cause deterioration of qualifying habitats and communities e.g. biogenic reefs through direct and / or indirect impacts. Local authority emergency plans and oil spill contingency plans should take into account specific qualifying interests and recognise the importance of marine SACs should such incidents occur.</p> <p>Species: Oil spills have the potential to cause damage to seal haul outs and otters. Seals and otters generally leave an area in which oil is spilled but a small number of individuals may suffer from respiratory problems and die as a result of the spillage of a large amount of oil. Oil tankers do not pass close to the coastal waters of Dornoch Firth and Morrich More but there is always a risk that a fishing boat or other commercial vessel may run aground in the area spilling diesel and fuel oil. Local authority oil spill contingency plans should take into account the qualifying interests of Dornoch Firth and Morrich More and the importance of the marine SAC, particularly during the seal's breeding, pupping and moulting seasons, should such incidents occur.</p>
Military Activity	
Military training, exercises and range maintenance	<p>Habitats: The use of terrestrial vehicles in the intertidal regions have the potential to cause deterioration of qualifying habitats and communities through physical damage and disturbance.</p> <p>Species: The use of terrestrial vehicles on intertidal areas, prolonged human presence, aircraft noise from low flying jets or helicopters, or noise from explosives have the potential to cause disturbance to seal and otter populations, and deterioration of otter habitats through destruction and physical damage to shoreline holts.</p>
Recreational Activities	
Boat anchorages	<p>Habitats: Anchors and continual scouring by riser chains have the potential to cause deterioration of qualifying habitats and communities through direct contact with the qualifying interests.</p>
Boat moorings	<p>Habitats: Moorings and continual scouring by riser chains have the potential to cause deterioration of qualifying habitats and communities through direct contact with the qualifying interests.</p>
Charter / recreational vessels	<p>Habitats: Boats have the potential to cause deterioration of qualifying habitats and communities through repeated launching and recovery in specific areas, accidental grounding, and accidental fuel spillages.</p> <p>Species: Charter / recreational vessels have the potential to cause disturbance to foraging or resting otters if appropriate guidelines are not adhered to. Such disturbance may cause temporary displacement of otters from their territory.</p> <p>Charter boats, especially on trips specifically designed to visit seal colonies, have the potential to disturb seals (particularly during the sensitive breeding, pupping and moulting periods) if appropriate guidelines for watching seals are not adhered to.</p>

Other recreational activities	<p>Habitats: The use of motorised vehicles (e.g. trail bikes and 4-wheeled bikes) on the foreshore has the potential to cause deterioration of qualifying habitats and communities through physical damage and disturbance of intertidal habitats and communities. This may cause deterioration of the qualifying interest by indirect impact through loss or imbalance of associated species, communities and ecosystems.</p> <p>Species: Fast, manoeuvrable craft such as jet skis have the potential to cause disturbance, injury and mortality to otters and seals due to noise, erratic speed and direction and collision.</p>
Scientific Research	
Scientific Research	<p>Habitats: Research activities have the potential to cause deterioration of qualifying habitats and communities through direct alteration, removal or manipulation of this qualifying interests and their associated species.</p> <p>Species: Otters are a European Protected Species and some research will require a licence. Advice should be sought from SNH if there is any doubt as to whether a licence is required.</p> <p>Research activities have the potential to cause disturbance to seals, particularly during the breeding, pupping and moulting seasons.</p>

Annex B

Non-statutory Advice given by SNH Site account

Site description

The Dornoch Firth is the most northerly large estuary on the east coast of Scotland. It is a geomorphologically complex estuary incorporating a series of generally shallow basins or bays.

The marine component of the Dornoch Firth and Morrich More SAC extends from Bonar Bridge to the mouth of the estuary between Dornoch Point on the north shore and to the west of Portmahomack on the south shore. The Dornoch Firth and Morrich More SAC encompasses excellent examples of generally undisturbed transitions from estuarine to coastal habitats. Sandflats and saltmarsh at Whiteness Sands extend inland to form the large, low-lying dune system of Morrich More.

The Dornoch Firth is largely sheltered from wave action and areas that are exposed to strong tidal currents are mainly confined to the narrows. The site encompasses the full salinity gradient and all the elements of the estuary that are necessary to preserve its integrity, structure and function are represented. The rivers Oykel, Shin and Carron discharge into the upper estuary and the resultant low salinity, high turbidity waters support predominantly brackish floral and faunal communities. The permanent channels are typically around 2 m deep, with a maximum depth of 6 m at Ardjachie.

The distribution of sediments and associated communities is highly complex, reflecting the gradients of exposure and salinity along the estuary. Mudflats characterise the small sheltered inlets and the innermost reaches of the Dornoch Firth. Below Bonar Bridge, the input of sediments from the Kyle of Sutherland and shelter from wave action promote the development of extensive sediment flats. In contrast wide sandy beaches dominate near the mouth of the estuary where the marine environment is influenced by increased exposure to wave action. The abundance, distribution and composition of the associated plant and animal communities within the Dornoch Firth are typical of estuarine communities and ecologically representative of northern North Sea estuaries.

Qualifying marine interests

This complex site is listed under Annex I 'Estuaries' habitat and contains a number of important biological features recognised as sub-features which are listed as Annex I and Annex II qualifying interests in their own right. The wide variety of marine habitats that the estuary supports include the qualifying Annex I habitats 'Mudflats and sandflats not covered by sea water at low tide', 'Sandbanks which are slightly covered by sea water all the time' and 'Reefs'. The estuary also supports the qualifying Annex II species 'Otter *Lutra lutra*' and 'Common seal *Phoca vitulina*'.

Annex I Habitats: Estuaries

The Dornoch Firth is of national and international importance for wildlife conservation and has been selected to represent the most northerly of the geographical and ecological range of estuaries in the UK. The physical characteristics of the estuary range from predominantly wave-exposed marine conditions on the open coast to a very sheltered, low salinity environment at its head. Similarly, there is a continuous gradient in the physical structure of intertidal and sublittoral sediments from wide, sandy beaches at the entrance to stable mudflats further inland. The sediments are colonised by estuarine communities that display a particularly fine series of transitions from predominantly brackish to fully marine species. The composition of associated plant and animal assemblages are determined by a variety of factors including salinity, exposure to wave action and tidal currents, substrate type and the level of habitat heterogeneity, the flora and fauna found being typical of estuarine habitats.

The site encompasses some important estuarine habitats including reefs (biogenic reefs of the common mussel *Mytilus edulis* and bedrock reefs), intertidal mudflats and sandflats and sublittoral sandbanks, which are identified as Annex I interests in their own right, as well as supporting important populations of common seals (*Phoca vitulina*) and otters (*Lutra lutra*), which are listed as Annex II species.

Mudflats and sandflats not covered by sea water at low tide

The Dornoch Firth is characterised by extensive mudflats and sandflats which dominate the northern and southern shores of the estuary. The flats are representative of a range of environmental conditions; there is a continuous gradient in the physical structure of the flats from medium-sand beaches on the open coast to stable mudflats and muddy sands. Mudflats and muddy sandflats are generally confined to the upper reaches of the estuary and include soft anoxic mud, which is colonised by numerous amphipods (*Corophium* spp.) and catworms (*Nephtys* spp.). Intertidal sediments in the middle reaches of the estuary are composed of medium sand and patches of fine sand, gravel and mixed sediments. These areas occasionally support patches of ephemeral green algae along with typical estuarine burrowing fauna such as cockles, dense beds of the lugworm (*Arenicola marina*), the bivalve (*Macoma balthica*) and polychaete worms.

The mid-estuary intertidal sediments are principally composed of medium sand that support populations of *Hydrobia* snails and amphipods (*Corophium* spp.) as well as narrow-leaved eelgrass (*Zostera angustifolia*), which extend across the mid-shore. The dwarf eelgrass (*Zostera noltii*) is present on the upper shore as small, dense patches or in mixed stands with *Zostera angustifolia* occasionally interspersed with the salt-marsh plant *Salicornia* sp.. The intertidal mudflats and sandflats are an essential food source for predator communities including motile macrofauna, juvenile fish, and over-wintering and migrating wading birds.

Reefs

Reefs are widespread in northern and southern Europe and occur widely around the UK coast. They are very variable in form and in the communities that they support. Two main types of reef can be recognised, those where the main structure is created by the animals themselves (biogenic reefs) and those where animal and plant communities grow on raised or protruding rock. Only a few invertebrate species are able to develop biogenic reefs, which are therefore restricted in distribution and extent. Rocky reefs are generally sublittoral but may extend as an unbroken transition to the intertidal zone, where they are exposed to the air at low tide.

Well-developed biogenic reefs of the common mussel *Mytilus edulis* are present at shallow sites exposed to strong tidal currents between Meikle Ferry and the mouth of the estuary. These reefs are characterised by an abundant and species-rich flora and fauna that is more diverse than the adjacent sediment biotopes. The habitat is characterised by brown algae including occasional sporelings of the kelp *Laminaria* sp. and numerous red algae, edible crabs (*Cancer pagurus*), shore crabs (*Carcinus maenas*), hermit crabs (*Pagurus bernhardus*), whelks (*Buccinum undatum*) and starfish (*Asterias rubens*). Towards the mouth of the estuary the *M. edulis* reefs are also colonised by an abundance of the soft coral, dead men's fingers (*Alcyonium digitatum*), sea urchins (*Echinus esculentus*) and horse mussels (*Modiolus modiolus*).

Small outcrops of predominantly intertidal bedrock reef occur along the shores of the upper estuary. Yellow and grey lichens such as *Xanthoria parietina* and *Caloplaca maritima* are common on the upper shore whereas brown algae, including the egg wrack *Ascophyllum nodosum* and the serrated wrack *Fucus serratus*, dominate the mid- and lower shore. Below low tide the reef community is characterised by a dense forest of the kelps *Laminaria hyperborea* and *Laminaria digitata*, epiphytic red algae, hydroids, bryozoans, occasional anemones (*Urticina felina*) and sea squirts.

Sandbanks which are slightly covered by sea water all the time

Sublittoral sandbanks are characterised by soft sediments that are permanently covered by shallow seawater. There is a continuous gradient in the physical structure of sublittoral sediments in the Dornoch Firth, from sandy muds and muddy sands in the upper estuary to medium and coarse sands at the entrance and adjacent to the open coast.

Highly mobile fine sands and muds in the upper estuary are colonised by assemblages of motile invertebrates typical of upper estuarine communities, that are tolerant of low and fluctuating salinities, and including brackish-water fauna. The species diversity increases towards the middle reaches of the estuary although the fauna remains brackish in character. In areas of fast tidal currents, coarse stable materials such as shells are colonised by a mixed-substrate community including epifaunal foliose algae, hydroids, bryozoans, sea squirts and the anemone *Urticina felina*. The sublittoral sandbanks in the outer estuary are characterised by animals that are adapted

to coarse or sandy substrates including high numbers of the sand mason *Lanice conchilega*, and the banded wedge-shell *Donax vittatus*.

Annex II Species:

Otter *Lutra lutra*

The Dornoch Firth and Morrich More SAC encompasses a large area of marine habitat that is important for the otter, which can have a large home range. The SAC also supports some terrestrial otter habitat that is suitable for resting places and holts, some of which are accessible to freshwater for bathing. The site also supports extensive intertidal and shallow sublittoral coastal habitats, which are particularly important as otter foraging grounds. Otters tend to forage for small benthic prey species in water less than 8m in depth, and usually in much shallower waters, so the site incorporates a large area of potential foraging habitat within its boundary.

Common seal *Phoca vitulina*

Common seals are found in a wide variety of coastal habitats throughout their range. On the east coast of Scotland, common seals habitually utilise sandbanks and sand bars exposed by the falling tide and are usually scattered along the coast in small groups of around fifty animals. Adult common seals can remain very faithful to particular haul-out areas, moving around the same group of favoured locations on a seasonal basis and over a number of years. The intertidal sandflats of Dornoch and Whiteness Sands and the intertidal sand bars of the Gizzen Briggs consistently support around 600 common seals (based on data collected between 1992 and 2000).

The data above were used for site evaluation purposes. Since then the Seal Mammal Research Unit (SMRU) has carried out further surveys, which indicate that the population has declined.

Pupping is highly synchronous and usually takes place on remote exposures of sandbank; most births occur in early to mid-June and newly born pups are able to swim within one hour of birth. Common seals undergo a complete annual moult soon after the breeding season and the seals remain ashore for significant periods at this time. Relatively little is known about the feeding behaviour of common seals but they appear to spend a high proportion of their time close to haul-out areas during the breeding and moulting seasons. The adjacent marine habitats are important in maintaining a food supply for the seals. They are known to have a varied diet comprising a wide range of fish species, octopus, squid and various shellfish.