ENGLISH NATURE

WASH AND NORTH NORFOLK COAST

European marine site

English Nature_s advice given under Regulation 33(2) of the Conservation (Natural Habitats &c.) Regulations 1994

14th June 2000

English Nature_s advice for the Wash and North Norfolk Coast European marine site given under Regulation 33(2) of the Conservation (Natural Habitats &c.) Regulations 1994

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Preface

This document provides English Nature_s advice to other relevant authorities as to (a) the conservation objectives and (b) any operations which may cause deterioration of natural habitats or the habitats of species, or disturbance of species for the Wash and North Norfolk Coast European marine site. This advice is being prepared to fulfill our obligations under Regulation 33(2) of the Conservation (Natural Habitats &c.) Regulations 1994.

The Wash and North Norfolk Coast European marine site is part of a candidate Special Area of Conservation. It is Government policy that such sites should be protected as if they were already designated and, where appropriate, it is desirable to establish voluntary management schemes at an early stage, before the formal statutory obligations apply, and to act in the spirit of the Directive in the meantime (DETR & The Welsh Office 1998). In light of this policy, we have worked with many of you to develop this advice in advance of statutory obligations applying. It should be noted, however, that amendments to the Habitats Regulations for England are now in force, which will result in the statutory obligations within the Regulations being applied to candidate SACs earlier in the process than previously.

European marine sites are defined in the Conservation (Natural Habitats &c.) Regulations 1994 as any part of a European site covered (continuously or intermittently) by tidal waters or any part of the sea in or adjacent to Great Britain up to the seaward limit of territorial waters. European sites include Special Areas of Conservation under the Habitats Directive, which support certain natural habitats and species of European importance, and Special Protection Areas under the Birds Directive which support significant numbers of internationally important wild birds. In many instances, as in the case of the Wash and North Norfolk Coast European marine site, these designations may coincide and our advice is being prepared to cover both the SAC and SPA interests.

This _Regulation 33 package_ is designed to help relevant and competent authorities, who have responsibilities to implement the Habitats Directive, to:

- understand the international importance of the site, underlying physical processes and the ecological requirements of the habitats and species involved;
- develop a management scheme to ensure that the ecological requirements of the site_s interest features are met; and
- set the standards against which the condition of the site_s interest features can be determined and undertake compliance monitoring to establish whether they are in favourable condition.

In addition, the Regulation 33 package will provide a basis to inform the scope and nature of _appropriate assessment_ required in relation to plans and projects (Regulations 48 & 50 and by English Nature under Regulation 20). English Nature will keep this advice under review and may update it every six years or sooner, depending on the changing circumstances of the European marine site. In addition, we will provide more detailed advice to competent and relevant authorities to assess the implications of any given plan or project under the Regulations, where appropriate, at the time a plan or project is being considered. There is also a European Union moderation process which aims to verify the list of qualifying features at each site. Any changes that may be required for the Wash and North Norfolk Coast are likely to be minor in nature and are not likely to create any new interests that are not already covered within this advice. If during the European Union_s moderation process qualifying interest features are added to this European marine site, English Nature will add to this advice, as appropriate.

Tim Bines
General Manager
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14th June 2000

English Nature_s advice for the Wash and North Norfolk Coast European marine site given under Regulation 33(2) of the Conservation (Natural Habitats &c.) Regulations 1994

1. Introduction

1.1 Natura 2000

The European Union Habitats[1] and Birds[2] Directives are international agreements which set out a number of actions to be taken for nature conservation. The Habitats Directive aims to promote the maintenance of biodiversity, taking account of economic, social, cultural and regional requirements, and sets out measures to maintain or restore, natural habitats and species of European Union interest at favourable conservation status[3]. The Birds Directive protects all wild birds and their habitats within the European Union, especially migratory birds and those that are considered rare or vulnerable.

The Habitats and Birds Directives include requirements for the designation of conservation areas. In the case of the Habitats Directive these are Special Areas of Conservation (SACs) which support certain natural habitats or species, and in the Birds Directive, Special Protection Areas (SPAs) which support wild birds of European Union interest. These sites will form a network of conservation areas to be known as _Natura 2000". Where SACs or SPAs consist of areas continuously or intermittently covered by tidal waters or any part of the sea in or adjacent to Great Britain up to the limit of territorial waters, they are referred to as European marine sites.

Further guidance on European marine sites is contained in the Department of the Environment Transport and Regions/Welsh Office document: *European marine sites in England & Wales: A guide to the Conservation (Natural Habitats &c.) Regulations 1994 and to the preparation and application of management schemes.* However, the following paragraphs taken from this Document are of particular relevance to this package:

> *"Sustainable development is one of the fundamental principles of the Habitats Directive. As stated in the preamble, the Directive makes a general contribution to the general objective of sustainable development. The maintenance of biodiversity may, in certain instances, require the maintenance, indeed the encouragement, of human activities. In other words the aim is not to exclude human activities from European sites, but rather to ensure that they are undertaken in ways which do not threaten the nature conservation interest, and wherever possible, in ways which support it.*
>
> *Much of our wildlife and important habitats can be sustained alongside human activities. It is assumed that, where they do not cause deterioration or significant disturbance, activities and management practices which have coexisted with nature conservation interests will continue when they become European marine sites. When this is not the case the Directive requires appropriate action to ensure that any continuation is compatible with the nature conservation objectives of the site.*
>
> *The principle objective of conserving the nature conservation interest of European sites will not be realised without the co-operation and commitment of those who own, live, work or take pleasure in or around the areas. To enable the activities of local individuals and enterprises and of statutory users of marine areas to be sustained, together with the conservation of habitats and species, it is essential to promote understanding between all relevant bodies."*

1.2 English Nature_s role

1 Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora

2 Council Directive 79/409/EEC on the conservation of wild birds

3 A habitat or species is defined as being at favourable conservation status when its natural range and the areas it covers within that range are stable or increasing and the specific structure and functions which are necessary for its long term maintenance exist and are likely to continue to exist for the foreseeable future.

The Conservation (Natural Habitats &c.) Regulations 1994 translate the Habitats Directive into law in Great Britain. It gives English Nature a statutory responsibility to advise relevant authorities as to the conservation objectives for European marine sites in England and to advise relevant authorities as to any operations which may cause deterioration of natural habitats or the habitats of species, or disturbance of species for which the sites has been designated. This information will be a key component of any of the management schemes which may be developed for these sites.

This document is English Nature's advice for the Wash and North Norfolk Coast European marine site, issued in fulfilment of Regulation 33(2) of the Conservation (Natural Habitats &c.) Regulations 1994 (the _Regulation 33 package_). Copies of key references quoted in this document are held at the English Nature Local offices in Grantham and Norwich.

In addition to providing such advice, the Regulation 33 package will inform on the scope and nature of _appropriate assessment_ which the Directive requires to be undertaken for plans and projects (Regulations 48 & 50 and by English Nature under Regulation 20). In the future, English Nature may also provide more detailed advice to competent and relevant authorities to assess the implications of any such plans or projects.

1.3 The role of relevant authorities

The Conservation (Natural Habitats &c.) Regulations 1994 require relevant authorities to exercise their functions so as to secure compliance with the Habitats Directive. The single management scheme which the relevant and competent authorities are drawing up under Regulation 34 for the Wash and North Norfolk Coast European marine site will provide the framework through which this will be done and it should be based on the advice in this package. In this respect, relevant authorities must, within their areas of jurisdiction, have regard to both direct and indirect effects on an interest feature of the site. This may include consideration of issues outside the boundary of the European marine site.

Relevant authorities should ensure that all plans for the area integrate with the management scheme for the European marine site. Such plans may include shoreline management plans, local Environment Agency plans, SSSI management plans, local BAP plans 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 Conservation (Natural Habitats &c.) Regulations 1994.

Relevant authorities also need to have regard to changing circumstances of the SAC and SPA and may therefore need to modify the management scheme and/or the way in which they exercise their functions so as to maintain the favourable condition of interest features concerned in the long term. There is no requirement for relevant authorities to take any actions outside their statutory functions.

Under certain circumstances, where another relevant authority is unable to act for legal reasons, or where there is no other relevant authority, English Nature is empowered to use its byelaw-making powers for Marine Nature Reserves (MNR) under the *Wildlife and Countryside Act* 1981 (as amended 1985) for use in European marine sites.

1.4 Activity outside the control of relevant authorities

Nothing within this Regulation 33 package will require relevant authorities to undertake any actions or ameliorate changes in the condition of interest features if it is shown that the changes result wholly from natural causes[4]. This also applies if the changes, although causing deterioration or disturbance to the interest features, are the result of human or natural events outside their control. Having issued Regulation 33 advice for European marine sites, English Nature will work with relevant authorities and others to agree, within a defined time frame, a protocol for evaluating all observed changes to baselines and to develop an understanding of natural change and provide further guidance as appropriate and possible.

On the Wash and North Norfolk Coast European marine site a SAC Management Group has already been set up and should be used to alert English Nature to such issues so that they may be assessed and any appropriate measures taken. This does not, however, preclude relevant authorities from taking action to prevent deterioration to the interest features, for example by introducing or promoting codes of practice.

1.5 Responsibilities under other conservation designations

In addition to its candidate SAC status and SPA status, the Wash and North Norfolk Coast is designated and subject to agreements under other conservation legislation (e.g. SSSIs notified under the Wildlife and Countryside Act 1981 as amended 1985). The obligations of relevant authorities and other organisations under such designations are not affected by the advice contained in this document.

1.6 Role of conservation objectives

Section 5 of this document sets out the conservation objectives for the Wash and North Norfolk Coast European marine site. They are the starting point from which management schemes and monitoring programmes are to be developed as they provide the basis for determining what is likely to cause a significant effect, and for informing on the scope of appropriate assessments of plans or projects. The conservation objectives set out what needs to be achieved and thus deliver the aims of the Directive**.**

1.7 Role of advice on operations

The advice on operations set out in Section 7 provides the basis for discussion about the nature and extent of the operations taking place within or close to the site and which may have an impact on its interest features. It is given on the basis of the working assumption that sites have been generally presumed to be in favourable condition at the time they were identified. This assumption will be tested during the 2000 - 2006 reporting period. The advice should also be used to identify the extent to which existing measures of control, management and use are, or can be made, consistent with the conservation objectives and thereby focus the attention of relevant authorities and surveillance to areas that may need management measures. These management measures could include the zoning of activities which affect those interest features with high vulnerability to such activities.

This operations advice will need to be supplemented through further detailed discussions with the management and advisory groups in formulating and agreeing a management scheme, where required, to agreed time scales for the European marine site.

1.8 Traditional activities & the longshore economy

The pursuit of traditional activities, including those of common rights, such as samphire gathering, bait digging and wildfowling is widely recognised by English Nature and the other relevant authorities as a particularly important aspect of the local culture and economy at this site. Such activities are generally

4 Determination of what constitutes natural change will be based on the best available information and scientific opinion at the time.

seasonal in nature, localised in their occurrence, employ traditional methods and place a strong emphasis on the principles of sustainability. Sound management of such activities over many years is considered to have contributed to the long term maintenance of the site's condition. It is thus thought that such activities, including the common rights on the north Norfolk coast between Holme and Holkham as currently and historically practised under common law, are compatible and linked with the principle aims of the SAC, ie the long term maintenance of the condition of features of European importance.

As part of the development of the management scheme for the European marine site, the relevant authorities, advisory groups and local communities will need to examine present levels of all such activities in order to establish a baseline frame of reference. This will provide an essential mechanism for determining whether possible increased levels of such activities, in future, may constitute a threat to the interest features of the site.

2. Identification of interest features under the EU Habitats and Birds Directives

2.1 Introduction

The Wash and North Norfolk Coast marine site is one of the most important marine areas on the British and European North Sea coast. It is primarily comprised of extensive areas of sand and mudflats, ranging from estuarine to fully marine conditions, and from sheltered conditions in the west of the Wash to wave-exposed conditions on the North Norfolk coast.

The Wash is the largest marine embayment in Britain, with the second largest expanse of intertidal sediment flats in the country. These include extensive fine sands and drying banks of coarser sand which support a community characterised by large numbers of polychaetes, bivalves, and crustaceans. Subtidal sandbanks vary in composition and include coarse sand through to mixed sediment at the mouth of the embayment. Unusual subtidal communities include large areas of dense brittlestar beds and the small but extensive colonies of the _reef-building_ worm *Sabellaria spinulosa* (ross worm) which supports a diverse associated fauna. Other notable species which are common or widespread include polychaetes such as the sand mason worm *Lanice conchilega*, cumaceans (small crustaceans) and tellin bivalves. Communities in the deeper, central part of the Wash are particularly diverse.

The North Norfolk coast provides the only classic British example of a barrier beach system. Extensive areas of saltmarsh with characteristic creek patterns have developed behind sand and shingle bars. The open coast is characterised by large areas of clean mobile sand subject to fully marine conditions. Communities vary from typical estuarine examples characterised by the bivalve *Scrobicularia plana* (peppery furrow shell), to lugworm *Arenicola marina* dominated muddier sand in the lee of islands and spits, to a sparse infauna in more exposed open coast areas.

The area is important for breeding and moulting of one of Europe_s largest populations of common seal *Phoca vitulina*.

The area of the Wash and North Norfolk Coast contains a candidate Special Area of Conservation (SAC) and three Special Protection Areas (SPA). The marine components of all four sites qualify as European marine sites but for simplicity, and the purposes of this advice, both the SAC and SPA components are treated as a single European marine site - The Wash and North Norfolk European marine site. Accordingly, the advice in this document covers all the relevant SAC habitats and the SPA birds interests.

Where these habitats occur within the European marine site they are referred to as interest features. Sub-features have also been identified to highlight the ecologically important components of each

interest feature. The interest features of the Wash and Norfolk Coast European marine site are outlined below and discussed in more detail in Section 3. The boundary of the European marine site and the distribution and extent of these interest features and some of the sub-features are mapped in Maps 1-6.

2.2 Interest features under the EU Habitats Directive

The **Wash and North Norfolk Coast** qualifies as a SAC for the following Annex I habitats, as listed in the EU Habitats Directive:

- **Large shallow inlets and bays**.
- **Sandbanks which are slightly covered by seawater all the time** (referred to in this document as subtidal sandbanks).
- **Mudflats and sandflats not covered by seawater at low tide** (referred to in this document as intertidal mudflats and sandflats).
- **Samphire (glasswort) *Salicornia* spp. and other annuals colonising mud and sand**
- **Atlantic salt meadows *(Glauco-Puccinellietalia)***.
- **Mediterranean and thermo-Atlantic halophilous scrubs *(Arthrocnemetalia fructicosae)*** (Referred to in this document as Mediterranean saltmarsh scrubs).

The Wash and North Norfolk Coast also qualifies as a SAC for the following Annex II species, as listed in the EU Habitats Directive:

- **Common seal**

Although it is largely a terrestrial site, the **North Norfolk Coast and Gibraltar Point Dunes** candidate SAC also has a minor marine component. The Mediterranean saltmarsh scrub that it contains as one of its interest features overlaps with the boundary of the Wash and North Norfolk coast marine site. To avoid creating two sets of conservation objectives for the same interest feature, conservation objectives to maintain this feature, and the other terrestrial features of the site, in favourable condition will be found within English Nature's conservation objectives for the relevant SSSI within the SAC boundary and will be dealt with through procedures outlined in the Conservation (Natural Habitats &c.) Regulations 1994. Relevant authorities need to have regard to these adjacent European interests, as they might be affected by activities taking place within, or adjacent to, the European marine site.

2.3 Interest features under the EU Birds Directive

The three SPAs that occur within the area of the Wash and North Norfolk Coast European marine site are: The Wash SPA; North Norfolk Coast SPA; and Gibraltar Point SPA. The qualifying features of each site, as listed in the EU Birds Directive, are as follows:

2.3.1 Wash Special Protection Area

- **Internationally important populations of regularly occurring Annex I bird species**
- **Internationally important populations of regularly occurring migratory bird species**
- **Internationally important assemblage of waterfowl, including the internationally important populations of regularly occurring migratory bird species**

This site was classified in 1988 and it is upon this citation that this advice is based.

2.3.2 North Norfolk Coast Special Protection Area

- **Internationally important populations of regularly occurring Annex I bird species**.
- **Internationally important populations of regularly occurring migratory bird species**.
- **Internationally important assemblage of waterfowl, including the internationally important populations of regularly occurring migratory bird species**.

This site was classified in 1989 and it is upon this citation that this advice is based.

2.3.3 Gibraltar Point Special Protection Area

- **Internationally important populations of regularly occurring Annex I bird species**.
- **Internationally important populations of regularly occurring migratory bird species**.

This site was classified in 1993 and it is upon this citation that this advice is based.

3. SAC interest features

This section describes and explains the importance of each of the SAC interest features of the Wash and North Norfolk Coast European marine site.

3.1 Large shallow inlets and bays

3.1.1 General description

Large shallow inlets and bays are large indentations of the coast which are generally more sheltered from wave action than the open coast. They are relatively shallow and usually average less than 30 m in depth. Large shallow inlets and bays form complex systems interlinking the terrestrial and aquatic environments and are composed of an interdependent mosaic of subtidal, intertidal and surrounding terrestrial habitats. The selection of European marine sites favoured larger areas, which tended to encompass the greatest variety of habitat and community types (Brown *et al.*, 1997).

3.1.2 Importance of the Wash

The Wash is the largest embayment in the UK, and is connected via sediment transfer systems to the North Norfolk Coast. Together the Wash & North Norfolk Coast form one of the most important sedimentary marine areas in the UK and European North Sea coast and include extensive areas of varying, but particularly sandy sediments subject to a range of conditions. Communities in the intertidal zone include those characterized by large numbers of polychaetes, bivalves and crustaceans. Subtidal communities cover a diverse range from the shallow to the deeper parts of the embayment and include dense brittle star beds and areas of an abundant reef-forming worm (_ross worm_) *Sabellaria spinulosa.* The embayment supports a variety of mobile species, including a range of fish species and common seals *Phoca vitulina* (Brown *et al*, 1997).

3.1.3 Key sub-features

Subtidal boulder and cobble communities

Although the Bay is principally a region of soft sediments there are important areas of subtidal boulder and cobble communities within the Wash. There are two main types of communities that occur on these boulders and cobbles. The larger cobbles and boulders tend to be slightly scoured but relatively stable and as a result they are characterised by turfs of bryozoans such as *Flustra foliacea* and hydroids including *Nemertesia antennina, Abietinaria abietina, Halecium halecinum, Hydrallmania falcata* and *Obelia longissima* with the soft coral *Alcyonium digitatum* and anemones such as *Urticina felina.*

Where scouring is more intense, or the substratum is of a smaller size and therefore less stable, communities are dominated by encrusting species such as the keelworm *Pomatoceros lamarcki,* barnacles *Balanus crenatus,* encrusting bryozoans *Conopeum reticulum* and coralline algae. Short turfs of bryozoans (*Crisia* sp. and *Bugula* sp.) and the sea squirt *Dendrodoa grossularia* may also occur.

Hard subtidal substrates have recently been found to be important for the settlement of mussel larvae which are relayed by the fishing industry up onto intertidal areas (Eastern Sea Fisheries Joint Committee, Pers. Comm.) (**see Section 3.3.3**).

Subtidal mixed sediment communities (e.g. *Sabellaria spinulosa* reefs)

Mixed sediments (mixed muds, sands, gravels with shells and stones) are widespread in the Wash and as such they are a key component of the Bay. Such a substratum provides a relatively stable surface upon which species can settle and further stabilise the seabed. There are two main types of sublittoral mixed substrata communities in the Wash: *Sabellaria spinulosa* reef and *Modiolus modiolus* (horse mussel) beds.

Sabellaria spinulosa is a relatively common tube-dwelling polychaete worm, which often forms crusts on sand influenced rocks. In the mouth of the Wash, however, significant accumulations of this species are present such that they form reefs which stand 30-60 cm proud of the seabed and extend for hundreds of metres. (Foster-Smith & Sotheran 1999). This site is particularly important as it is the only currently known location of well developed stable *Sabellaria spinulosa* reef in the UK. The reefs are also particularly important components of the subtidal as they are highly diverse communities compared with the surrounding areas, and large number of mobile species such as polychaetes, mysid shrimps, the pink shrimp *Pandalus montagui*, and crabs are all associated with the *Sabellaria* reef. It is considered that the *Sabellaria spinulosa* is an important food source for the commercially important pink shrimp *Pandalus montagui* (see overview in Holt *et al.* 1998). Other areas of mixed sediment within the Wash are dominated by abundant, but low incrustations of *Sabellaria spinulosa*, often associated with the sand mason worm *Lanice conchilega* and a wide variety of epifaunal species.

Modiolus modiolus beds are also reported to occur on muddy shells & stones within the Wash (Foster-Smith & Sotheran, 1999). The clumping of the byssus threads of the *Modiolus* creates a stable habitat that allows colonisation by turfs of hydroids and bryozoans similar to those found in subtidal boulder and cobble communities. The stability of the substratum is also thought to lead to a very rich infaunal community though, to date, the infauna has been incompletely sampled because it is difficult to survey.

The following subfeatures also occur within the large shallow inlet and bay feature in the Wash, but are classified in the Directive as an interest feature in their own right and are therefore described separately below.

Subtidal sandbanks (see Section 3.2)

Intertidal mudflats and sandflats (see Section 3.3).

Samphire (glasswort) and other annuals colonising mud and sand (see Section 3.4).

Atlantic salt meadows (see Section 3.5).

Mediterranean saltmarsh scrubs (see Section 3.6).

3.2 Sandbanks which are slightly covered by seawater all the time

3.2.1 General description

The habitat type consists of soft sediment types that are permanently covered by shallow sea water, typically at depths of less than 20 metres below chart datum. The diversity and types of community associated with this habitat type are determined by sediment type and a variety of other physical factors, including geographical location, the relative exposure of the coast and differences in the depth, turbidity and salinity of the surrounding water.

The shallow sandy sediments are typically colonised by a burrowing fauna of worms, crustaceans, bivalve molluscs and echinoderms. Where coarse stable material is present epifaunal attached species may include foliose algae, hydroids, bryozoans and ascidians. Mixtures of sand and associated hard substrate can lead to the presence of very rich communities. Mobile fauna at the surface of the

sandbank may include shrimps, prosobranch molluscs, crabs and fish. Sandeels, an important food for birds, live in sandy sediments. Shallow sandy sediments may be important nursery areas for fish and feeding grounds for seabirds (Brown *et al*, 1997).

3.2.2 Importance of the Wash & North Norfolk Coast

In the Wash and North Norfolk coast European marine site, sandy sediments occupy most of the subtidal area, resulting in one of the largest expanses of this habitat type in the UK. It provides a representative example of this habitat type on the more sheltered east coast of England. The subtidal sandbanks vary in composition and include coarse sand through to mixed sediments at the mouth of the embayment. Subtidal communities present include large areas of dense brittle star *Ophiothrix fragilis* beds. Species include polychaetes such as the sand mason *Lanice conchilega* and the bivalve tellin *Angulus tenuis.* Benthic communities on sandflats in the deeper, central part of the Wash are particularly diverse. The sublittoral sandbanks also provide important nursery grounds for young commercial fish species, including plaice *Pleuronectes platessa,* cod *Gadus morhua* and sole *Solea solea* (Brown *et al*, 1997).

3.2.3 Key sub-features

Gravel and sand communities

The subtidal gravel and sand communities are a major component of the subtidal sandbanks and several different types occur in the site. In tide-swept areas mobile, rippled sand with occasional cobbles and pebbles are characterised by colonies of the hydroid *Hydrallmania falcata* which grow on the stones and are tolerant of periodic burial in the shifting sands. The infaunal component usually consists of spionid worms and deposit feeders. Such tide-swept shallow areas may also have dense beds of the sand mason worm, *Lanice conchilega* (which further stabilises the sediment) with other polychaetes such as *Scoloplos armiger* and *Chaetozone setosa*.

Muddy sand communities

Much of the subtidal of the Wash is composed of muddy sands and as such they constitute a major component of the subtidal sandbanks.

Within the Wash, there are quite extensive areas of muddy sand that are characterised by very dense aggregations of the brittlestars *Ophiura ophiura* with *Ophiura albida*. Brittlestar beds dominated by other species of brittlestars are found in a number of marine SACs, though the beds of *Ophiura ophiura* with *Ophiura albida* in the Wash are not represented elsewhere in the SAC series. Within the Wash, *Ophiura ophiura* appears confined to the south-east of the Bay on more silty substrata. Densities of up to 1,500 *Ophiura albida* m^{-2} have been recorded. There is evidence to suggest that massive aggregations of brittlestars can have an important effect on local water quality and whilst it is thought that the beds may therefore play an important role in the ecological functioning within such areas, little work has been carried out on such brittlestar beds (see review in Hughes, 1998).

In areas of silty fine sands such as found in the Boston Deeps, the community is characterised by a rich assemblage including the bivalve mollusc *Abra alba*, bristle worms *Scoloplos armiger* and *Spiophanes bombyx*, brittlestars *Ophiura ophiura* and *Ophiura albida* and sometimes dense populations of the peacock worm *Sabella pavonina*. *Sabella* tubes in turn often provide a substratum for thick growths of the hydroid *Clytia johnstoni*. In some areas where the muddy sand contains some gravel, a rich infaunal community exists within the Wash dominated by the another species of peacock worm *Sabella discifera* and the sand mason worm *Lanice conchilega*. Peacock worms are relatively long-lived species, living in permanent burrows, and the extent and distribution of the *Sabella* beds may provide a useful indicator of environmental change.
Extensive areas of shallower muddy sand in the Wash and along the Norfolk coast are characterised by extensive beds of razor shells *Ensis* spp. *Ensis* spp. are particularly long-lived species, living for up to 20 years, only reaching sexual maturity after about three years. They live in permanent burrows at and below the low tide mark. Because of their longevity, delayed sexual maturity and sessile nature

they are particularly vulnerable to over-exploitation by commercial fisheries. Shallow subtidal *Ensis* beds have also been observed to be susceptible to the effects of toxic contamination from a major oil spill (Covey & Hill, 1993) and as such this community may represent a useful community to serve as an indicator of the condition of the sandbanks as a whole.

3.3 Mudflats and sandflats not covered by seawater at low tide

3.3.1 General description

Intertidal mudflats and sandflats are submerged at high tide and exposed at low tide. They form a major component of estuaries and embayments in the UK but also occur along the open coast. The physical structure of the intertidal flats can range from the mobile, coarse sand beaches of wave-exposed coasts to the stable, fine sediment mudflats of estuaries and embayments. This habitat type can be divided into three broad categories: clean sands, muddy sands and muds, although in practice there is a continuous gradient between them. Within this range the plant and animal communities present vary according to the type of sediment, its stability and the salinity of the water.

Muddy sands tend to occur at the mouths of estuaries or behind barrier islands, where sediment conditions are more stable. A wide range of organisms, such as lugworms *Arenicola marina* and bivalve molluscs, can colonize these sediments. Substantial beds of mussels *Mytilus edulis* may develop on the lower shore. Beds of intertidal dwarf eelgrass *Zostera noltii* or narrow-leaved eelgrass *Zostera angustifolia* and eelgrass *Zostera marina* may also occur on the lower shore.

Mudflats form in the most sheltered areas of the coast, usually where large quantities of silt derived from rivers are deposited in estuaries. The sediment is stable and communities are dominated by polychaete worms and bivalve molluscs. Such soft mudflats typically support very high densities of the small snail *Hydrobia ulvae*. The high biomass of intertidal species in such sediments provide important feeding areas for waders and wildfowl.

Clean sand communities occur at mid- to low-tide levels on beaches on the open coast and in bays around the UK where wave action or strong tidal streams prevent the deposition of finer silt or where the supply of silt in suspension is low. Owing to mobility of sediment and consequent abrasion, species that inhabit clean sands tend to be mobile and robust and include amphipod crustaceans, such as sandhoppers *Bathyporeia* spp., some polychaete worms and bivalve molluscs (Brown *et al*, 1997).

3.3.2 Importance of the Wash & North Norfolk Coast

The Wash, on the east coast of England, is the second largest area of intertidal flats in the UK after Morecambe Bay. The sandflats in the embayment of the Wash include extensive fine sands and drying banks of coarse sand. This diversity of substrates, coupled with variety in the degree of exposure, means that there is a high diversity relative to other east coast sites. Along the North Norfolk coast, sandy intertidal flats predominate, with some soft mudflats, in the areas sheltered by barrier beaches and islands. The biota includes large numbers of polychaetes, bivalves and crustaceans. Salinity ranges from that of the open coast in most of the area (supporting rich invertebrate communities) to estuarine close to the rivers (Brown *et al*, 1997).

The Wash, in particular, is capable of supporting extensive beds of mussels and cockles. The sand mason *Lanice conchilega* forms dense, raised mounds on the lower shore, both within the Wash and along the North Norfolk coast. Associated with these dense aggregations of *Lanice* sp. is the less common anemone *Sagartia troglodytes.* The habitat so formed by *Lanice conchilega* is probably uncommon outside of East Anglia (Brazier, 1997). Smaller, sheltered and diverse areas of intertidal sediment, with a rich variety of communities with a high biomass of invertebrates provide vital feeding areas for huge numbers of waders and wildfowl. On the lower shore in these sheltered areas small beds of eelgrass *Zostera* spp. are found.

3.3.3 Key sub-features

Sand and gravel communities

Intertidal sand and gravel communities found within the Wash and along the North Norfolk coast are found in the more wave exposed areas of open coast. Such communities are characterised by species of burrowing amphipods and some polychaete worms that are able to tolerate the abrasive action of the mobile coarse sediment. These communities are particularly widespread on the North Norfolk coast and make up some 40 % of the intertidal area. Where the sediment consists of medium to fine-grained sand, which remains damp throughout the tidal cycle, amphipods and polychaetes increase in abundance and diversity and bivalves may be present. These richer amphipod and polychaete dominated communities are found in the mid and lower shore. Such communities form important feeding areas for birds especially at the mouths of the rivers and inlets.

Also of particular significance within this site are the dense beds of the sand mason worm *Lanice conchilega* which occur on the low shore and in the shallow sublittoral zone of exposed sandy beaches. On the North Norfolk coast, the sand mason forms dense raised mounds which have not been recorded from other sites. They have an important role in stabilising the sediment and providing crevices and attachment points for a range of other species, thereby increasing the diversity of otherwise fairly barren coarse sandy sediments. The species richness associated with these *Lanice* mounds provide a favoured feeding area for birds and a settlement site for mussel seed. Once formed into extensive mounds the *Lanice* mounds are relatively stable and may provide a useful indicator for monitoring the condition of the condition of the intertidal sandflats.

Mussel beds (*Mytilus edulis*) are found on areas of mixed mud, sand and pebbles throughout the site. In the past there were extensive intertidal mussel beds within the Wash which supported a major fishery. Mussel seed settles on hard subtidal substrates in the Wash (Eastern Sea Fisheries Joint Committee Pers. Comm.). Fishermen relay the subtidal Mussel seed areas using dredges, into mussel lays both within the Wash and in harbours along the North Norfolk Coast. Stocks of mussels have declined over the last decade due to poor settlement and recruitment of spat. A review is currently underway to determine, where possible, the factors responsible for failure in spat survival for the Wash and the knock-on impacts this has had on the shellfish dependent bird populations, such as Knot and Oystercatcher.

Muddy sand communities

In less exposed areas, muddy sand communities occur on flats that remain water-saturated throughout the tidal cycle. These communities are characterised by a variety of polychaetes and bivalves including the lugworm *Arenicola marina*, the Baltic tellin *Macoma balthica* and the cockle *Cerastoderma edule.* These communities are particularly important in the Wash and North Norfolk Coast European marine site as they occur over substantial areas of the intertidal and they play a key role in the food chain by providing food for both fish and wading birds. The intertidal flats of the Wash are capable of supporting huge stocks of the edible cockle, *Cerastoderma edule* which in the past has supported a major fishery. As with mussels, stocks of cockles have declined over the last decade due to poor settlement and recruitment of spat, although there have been two major settlements of cockle spat for the last two years (Eastern Sea Fisheries Committee, pers comm.). A review is currently underway to determine, where possible, the factors responsible for failure in spat survival for the Wash and the knock-on impacts this has had on the shellfish dependent bird populations, such as Knot and Oystercatcher.

Intertidal eelgrass beds, *Zostera* spp., occur on muddy sand, throughout the site, often close to cockle beds. Eelgrass is the only marine flowering plant in Britain and this community is considered to be nationally scarce. Eelgrass beds help to stabilise the sediment, they contribute towards primary productivity and they are an important food source for overwintering waterfowl, especially dark-bellied brent geese (*Branta bernicula bernicula*).

Mud communities

The invertebrate populations of intertidal mudflats and sand flats provide a rich food resource for waterfowl, fish species which come in to feed on the higher tides, and other invertebrate species, which make up the prey of higher organisms such as seals. Surveys of the intertidal zone have revealed that the features of greatest biological interest are found in the more sheltered, muddier areas, on account of their rich and abundant invertebrate fauna. As such these areas are particularly important areas for feeding waders.

There are several different sandy mud and mud communities found in the sheltered areas of the Wash and North Norfolk coast, though they are all characterised by the estuary ragworm *Hediste diversicolor*. This group of biotopes make up 20 % of the intertidal zone of the North Norfolk coast and as such they are particularly important components of the intertidal sand and mudflats. Sandy mud areas are characterised by *Hediste diversicolor* and the Baltic tellin *Macoma balthica* and may also include the lugworm *Arenicola marina*. In softer, muddier areas the Baltic tellin is replaced by the peppery furrow shell *Scrobicularia plana.* All of these mud communities provide a rich feeding ground for internationally important populations of birds which feed on the site.

3.4 Samphire (glasswort) and other annuals colonising mud and sand

3.4.1 General description

The feature described as glasswort, (*Salicornia* spp) and other annuals covering sand and mud is generally termed pioneer saltmarsh. This is composed of a small number of species of which glasswort (known locally as samphire) *Salicornia* spp is the most important. This vegetation occurs in a large number of saltmarshes in the UK and European marine sites were chosen to represent the geographical range of the habitat type. Generally the largest areas of pioneer saltmarsh have been selected, and since it occurs as an integral part of a sequence of habitats, from sand and mud flats to more stable saltmarsh vegetation preference is given to sites where it forms part of well developed successional sequences (Brown *et al*.,1997).

This pioneer saltmarsh develops at the lower reaches of saltmarshes where the vegetation is frequently flooded by the tide. Wave exposure is particularly important in determining whether pioneer saltmarsh will colonise an area as it may only do so in sheltered sites where it is protected from strong wave action. It is an important precursor to the development of more stable saltmarsh vegetation.

3.4.2 Importance of the Wash and North Norfolk coast

Pioneer saltmarsh covers extensive areas of both the Wash and North Norfolk coast. In the Wash it is mostly developed on the muddier substrate of the inner Wash where it is relatively sheltered. In the Wash it covers an estimated 294 ha out of a total saltmarsh of about 4157 ha. (Hill, 1988). In North Norfolk it often grows on sandier substrates both in sheltered situations behind barrier beaches and islands, as at Scolt Head Island and in Blakeney Harbour, but also in more exposed situations as between Wells and Blakeney. In North Norfolk it covers about 216 ha of the estimated 2127 ha. of salt marsh between Holme and Blakeney Point (Burd, 1989). This vegetation comprises of three separate saltmarsh (SM) communities described under the National Vegetation Classification (NVC). In addition in places *Salicornia* grows in mixed communities with the invasive common cord-grass *Spartina anglica*.

3.4.3 Key sub-features

Annual Salicornia saltmarsh community

Annual *Salicornia* community SM8. This is the most extensive community and is dominated by annual species of samphire (glasswort) *Salicornia*.

Annual seablite (*Sueada maritima*) saltmarsh community

The annual seablite *Suaeda maritima* community SM9. This is dominated by annual seablite with few associates and which covers a much smaller area.

Ephemeral saltmarsh vegetation with *Sagina maritima* saltmarsh community

Ephemeral saltmarsh vegetation with sea pearlwort *Sagina maritima* SM27 which is present in small disturbed areas.

3.5 Atlantic salt meadows (Lower, middle and upper saltmarsh)

3.5.1 General description

Atlantic salt meadows occur on North Sea, English Channel and Atlantic shores. There are more than 29,000 hectares of the habitat type in the UK, mostly in the large, sheltered estuaries of the south-east, south-west and north-west of England and in south Wales. These large sites provide the best examples of zonation.

Historically, large areas of saltmarsh, especially the upper zones, have been lost by enclosure and subsequent conversion to agricultural land. Sites with complete sequences of vegetation and transitions to other habitats, such as sand dunes, represent the range of variation of the habitat type; an important characteristic of the Atlantic salt meadows at this site.

Atlantic salt meadows develop when halophytic vegetation colonises soft intertidal sediments of mud and sand in areas protected from strong wave action. This vegetation forms the middle and upper reaches of saltmarshes, where tidal inundation still occurs but with decreasing frequency and duration. A wide range of community types is represented and the saltmarshes can cover large areas, especially where there has been little or no enclosure on the landward side. Grazing by domestic stock is particularly significant in determining the structure and species composition of the habitat type and also its relative value for plants, invertebrates and wintering and breeding waterfowl. Where grazing has taken place for many years it can be an important management technique to maintain the conservation interest of such areas at appropriate levels of management. The upper saltmarsh is regarded as particularly important and there is considerable variation in different parts of the UK. The upper saltmarsh has transitions to a number of habitats, including sand dune, coastal shingle, freshwater marshes and woodland. This part of the saltmarsh succession has been particularly vulnerable to destruction by enclosure, and remaining areas are particularly valuable.

At the lower levels of the saltmarsh, the vegetation is often species-poor and may form an open sward of common saltmarsh-grass *Puccinellia maritima.* Further up the marsh, the vegetation becomes more herb-dominated and red fescue *Festuca rubra* becomes more important. The upper saltmarsh shows considerable variation in species composition and structure, particularly where there are transitions to other habitats.

There are marked regional variations in the Atlantic salt meadow communities of the UK. In east and south-east England low to mid-marsh communities predominate, owing to extensive reclamation of the upper marsh (Brown *et al*, 1997).

3.5.2 Importance of the Wash and North Norfolk coast

This site is selected both for the extensive ungrazed saltmarshes of the North Norfolk Coast and for the contrasting grazed saltmarshes around the Wash.

The Wash saltmarshes represent the largest single area of the habitat type in the UK. Atlantic salt meadow covers over 3000 ha of the total of 4157 ha of saltmarsh vegetation (Hill 1988). In the Wash common saltmarsh-grass *Puccinellia maritima* occupies over half the saltmarsh area and diverse upper saltmarsh communities are very limited in extent (Hill 1988) as a result of land reclamations over the

centuries and the digging out of borrow pits for sea walls. Historically most of the saltmarshes have been grazed, mostly by cattle, but currently only 50% is managed in this way.

In North Norfolk saltmarshes form an almost continuous belt over 35km long covering about 2200 ha., of which at least 1600ha can be considered as Atlantic salt meadow (Burd 1989). The marshes are mostly accreting slowly with some localised areas of erosion as a result of changes in wave climate. Some of the North Norfolk saltmarshes are more than 6000 years old and are therefore more mature than others in Eastern England. Saltmarshes of North Norfolk are some of the most botanically rich in Britain and contrast markedly with the grass-dominated marshes of the Wash. The slow rate of vertical accretion and lack of successional changes in North Norfolk mean that plant communities have a high degree of stability. There is now almost no grazing which has maintained species diversity. A typical zonation is from the pioneer salt marsh with glasswort, common cord-grass *Spartina anglica* through a low-mid saltmarsh dominated by sea aster *Aster tripolium* and sea purslane *Atriplex portulacoides*. The mid upper saltmarsh frequently has a high cover of common sea lavender *Limonium vulgare* and thrift *Armeria maritima*. There are transitions to Mediterranean scrubs. In places where freshwater springs and seepages occur, notably at Brancaster and Titchwell, a tidal reed swamp community occurs with reed and associated species such as sea purslane *Atriplex portulacoides* and sea aster *Aster tripolium*.

The site was originally selected for Mediterranean saltmarsh meadow. However, a re-evaluation of this feature has concluded that the vegetation in which it was formerly included in the UK context is best accommodated within the Atlantic salt meadow. The saltmarshes associated with the barrier islands of North Norfolk e.g. Scolt Head Island, include a range of habitat types, which support transitions from upper salt meadows with sea rush *Juncus maritimus* to terrestrial habitats, occurring in association with a complete range of saltmarsh and other habitats. The most distinctive features of the vegetation are the tall tussocks of the sea rush *Juncus maritimus*. The associated plants are rather variable but may include sea arrowgrass *Triglochin maritimum*, common sea lavender *Limonium vulgare* and sea aster *Aster tripolium* (Rodwell in press).

3.5.3 Key sub-features

This vegetation within the site comprises of eight separate communities described under the National Vegetation Classification (see Appendix V for more details). These are:

Low marsh communities

Transitional low marsh vegetation with common saltmarsh-grass *Puccinellia maritima*, annual Glasswort, *Salicornia* species and annual seablite *Suaeda maritima* saltmarsh community SM10.

- Rayless sea aster, *Aster tripolium* var *discoideus* saltmarsh community SM11.
- Rayed sea aster *Aster tripolium* saltmarsh community SM12.
- Saltmarsh grass *Puccinellia maritima* saltmarsh community SM13.
- Sea purslane *Atriplex portucaloides* saltmarsh community SM14.

Mid and upper saltmarsh communities

- The sea rush *Juncus maritimus* - marsh arrowgrass *Triglochin maritimum* SM15
- Red fescue *Festuca rubra* and saltmarsh rush *Juncus gerardii* saltmarsh community SM16.
- Sea wormwood *Seriphidium maritimum* saltmarsh community SM17.

Transitional community

- Reed swamp community S4

3.6 Mediterranean saltmarsh scrubs

3.6.1 General description

In the EC this habitat is restricted to France, Greece, Italy, Portugal, Spain and the UK. In the UK it is restricted to the south and east coasts of England. Only three localities are known to support extensive examples of this habitat type, and these have been selected as SACs.

This scrubby, halophilous (i.e. salt-tolerant) vegetation develops in the uppermost levels of saltmarshes, often where there is a transition from saltmarsh to dunes, or in some cases where dunes overly shingle. The form that most closely resembles the scrub vegetation of the Mediterranean is restricted to the south and south-east of England and is formed predominantly of bushes of shrubby seablite *Suaeda vera*, sometimes over a metre high and often in tangled thickets, and sea purslane *Atriplex portulacoides.* This most frequently occurs at the upper limit of tidal inundation and is found in association with transitions to sand dunes or shingle. In a few sites on the south and east coasts of England a similar community develops, but with dense strands of perennial glasswort *Sarcocornia perennis* with small numbers of herbaceous species. Where the topography allows a more open vegetation may occur with more scattered shrubby seablite bushes and a greater abundance of herbaceous species, such as sea lavenders *Limonium* sp. and sea-heath *Frankenia laevis,* together with more common saltmarsh species, such as annual sea-blite *Suaeda maritima* or thrift *Armeria maritima* (Brown *et al,* 1997).

3.6.2 Importance of the Wash and North Norfolk coast

This habitat type forms the transition zone between the Wash & North Norfolk Coast marine cSAC and the North Norfolk Coast and Gibraltar Point Dunes SAC, which contains the priority Annex I fixed dune habitat. The site comprises the only area in the UK where all the more typically Mediterranean species that characterize this habitat type occur together and is by far the largest area of this type of vegetation occupying about 95ha., almost all on the North Norfolk coast and on Gibraltar Point. In strandline situations the community consists largely of bushes of shrubby seablite *Suaeda vera* and sea purslane *Atriplex portulacoides.* However, particularly where the shingle- saltmarsh transition is flatter nationally rare species such as matted sea lavender, *Limonium bellidifolium*, rock sea lavender, *L. binervosum,* sea heath *Frankenia laevis* and the lichen *Xanthoria parietina* form a very characteristic community.

3.6.3 Key sub-features

This vegetation within the site comprises of two communities described under the National Vegetation Classification (see Appendix IV for further details).

Shrubby seablite (*Suaeda vera*) saltmarsh community

Shrubby seablite (*Suaeda vera*) NVC saltmarsh community SM25 (see Appendix IV and V).

Shrubby seablite (*Suaeda vera*) and rock sea lavender *Limonium binervosum* saltmarsh community

Shrubby seablite (*Suaeda vera*) and rock sea lavender *Limonium binervosum* NVC saltmarsh community SM21 (see Appendix IV and V).

3.7 Common seals

3.7.1 General description

The UK holds some 32,800 common seals *Phoca vitulina*, approximately 45% of the EU population (SMRU, 1999). Although widespread in distribution, the population density of the common seal varies greatly from place to place, with low numbers at many sites. This means it can be difficult to define boundaries of specific sites. The census of the common seal populations is based on numbers hauling-out in coastal locations during the moulting period in August. Such haul-out areas are thought to be very important for the conservation of the species, as they tend to be the most important breeding colonies (Brown *et al*, 1997). In addition to pupping and suckling, these sites are also important for skin maintenance and moult, rest and sleep, energy saving and predator evasion (Brasseur *et al*, 1996).

Common seals typically show some seasonal and year to year movements between haul-out sites, but remain resident in the same geographical area throughout the year. During the winter, individuals may leave inshore waters to feed, returning to haul out and rest between feeding trips, but during the summer breeding and moulting season, the seals tend to forage within a few kilometres of the haul-out sites (Thompson, 1993).

Sites within the UK were selected for common seals using the most up-to-date population information available at the time, although populations at individual sites may fluctuate. Site selection has favoured sites that are important both for hauling-out and for breeding. The largest breeding colony has been selected, and this is in the south of the species range in the UK. As well as their importance in maintaining overall population size, such large sites are significant as sources of emigration to smaller or newly-established colonies (Brown et al, 1997).

3.7.2 Importance of the feature

The Wash and North Norfolk Coast European marine site holds some 9% of the total UK common seal population and is the largest colony of common seals in the UK. The extensive intertidal mud and sand flats of the Wash and the North Norfolk Coast provide ideal conditions for breeding and haul-out sites of the common seal (Brown et al 1997). The subtidal sandbanks provide important feeding areas for the seals during the summer breeding and moulting season when they tend to forage within a few kilometres of the haul-out sites (Thompson, 1993). Common seals are known to be opportunistic feeders, preferring relatively distinct feeding habitats rather than specific prey species (de Jong *et al*, 1997).

Common seal pups moult their white pre-natal coat in the uterus and are able to swim and dive for several minutes in their first hour of life (Thompson, 1989). Females haul out onto the intertidal sand and mud flats to give birth and suckle the pups principally between June and July. In August the mud and sand flats are also important as haul-out areas for seals which are moulting into fresh coats. Common seals are also found in the site throughout the year. In 1988 the phocine distemper virus is thought to have reduced the common seal population in the site by about two-thirds and numbers here have still not fully recovered, unlike populations of other areas (P. Hammond, pers. comm.). The current population stands at 82% of population prior to the viral outbreak.

English Nature_s conservation objectives at a site level focus on maintaining the condition of the habitats used by the qualifying species. Habitat condition will be delivered through appropriate site management including the avoidance of damaging disturbance. In reporting on Favourable Conservation Status, account will need to be taken both of habitat condition and the status of common seals in the SAC.

Accordingly, English Nature will use annual counts for the common seals, together with available information on population and distribution trends, to assess whether the SAC is continuing to make an appropriate contribution to the Favourable Conservation Status of the species. Count information will

be assessed in combination with information on habitat condition, at the appropriate time within the reporting cycle, in order to report to the European Commission.

Details on population size are given in Table 1.

In addition to focussing on avoiding deterioration to the habitats for the qualifying species, the Habitats Directive also requires that actions are taken to avoid significant disturbance to the species for which the site was designated. Such disturbance may include alterations in population trends and/or distribution patterns. Avoiding disturbance to species requirements is mentioned in the favourable condition table underpinning the conservation objectives for the common seals. In this context, annual count information on populations will be used as the basis for assessing whether disturbance is damaging.

3.7.3 Key sub-features

In recognition that common seal populations may change as a reflection of national or international trends or events, this advice on common seal interests focuses on the condition of the habitats necessary to support the common seal population within the Wash and North Norfolk Coast European marine site. As with SAC Annex I habitat interest features, sub-features are identified which describe the key habitats within the European marine site necessary to support the common seal population. Detailed information on targets for habitat condition are listed in the favourable condition table in Section 4.

Intertidal mudflats and sandflats

Intertidal mud and sand flats provide a crucial habitat for common seals throughout the Wash and at Blakeney Point on the North Norfolk Coast. With a preference for those intertidal flats which are least disturbed, common seals use these areas to moult, pup and haul-out, tending to use the scoured side of the bank where there is easy access to open water. During pupping and lactation from early June to July, females group together and use different haul-out sites from the males. Birth sites are usually situated near the top of the bank, often at a place where the slope of the bank changes. After weaning and breeding, common seals haul-out on the intertidal flats to begin their complete annual moult which can last through until mid September (Bonner, 1989; Thompson 1993). Intertidal mudflats and sandflats also provide an important habitat for common seals throughout the year as they spend 40 to 50% of their time hauled-out for various reasons including thermoregulation and skin maintenance (Neumann, 1999; Watts, 1992).

Table 1 Numbers of common seals counted in the Wash and North Norfolk Coast European marine site in August 1998 (Sea Mammal Research Unit (NERC), 1999).

Data are taken from fixed-wing aerial surveys carried out during the August moult.

Count site	Count 1	Count 2
Blakeney Point	535	738
The Wash	2367*	2381

* one area used by common seals was missed on this flight (100-150 seals)

4. SPA interest features

4.1 Background and context

A major aim of the Birds Directive is to take special measures to conserve the habitats of qualifying birds in order to ensure their survival and reproduction within the European Union. A key mechanism in achieving this is the classification by Member States of the most suitable sites as SPAs.

English Nature's conservation objectives at a site level focus on maintaining the condition of the habitats used by the qualifying species. Habitat condition will be delivered through appropriate site management including the avoidance of damaging disturbance. In reporting on Favourable Conservation Status, account will need to be taken both of habitat condition and the status of the birds on the SPA.

Accordingly, English Nature will use annual counts, in the context of five year peak means for qualifying species, together with available information on population and distribution trends, to assess whether an SPA is continuing to make an appropriate contribution to the Favourable Conservation Status of the species. Count information will be assessed in combination with information on habitat condition, at the appropriate time within the reporting cycle, in order to report to the European Commission

English Nature's advice focuses on the qualifying species for which the SPA was originally classified despite the fact that numbers and species composition may have changed on this site since that time. Such population and species composition changes are being documented through the UK SPA Network Review, led by JNCC, which will provide advice to Ministers on any changes in SPA citations required. Depending on the review and decisions from DETR, English Nature may reissue this advice on SPAs with updated bird information.

In addition to focussing on avoiding deterioration to the habitats of the qualifying species, the Habitats Directive also requires that actions are taken to avoid significant disturbance to the species for which the site was designated. Such disturbance may include alterations in population trends and/or distribution patterns. Avoiding disturbance to species requirements is mentioned in the favourable condition table underpinning the conservation objectives for the SPA. In this context, five year peak mean information on populations will be used as the basis for assessing whether disturbance is damaging.

Attention is, however, also directed to the inclusion of disturbance in the advice on operations provided in section 7. Where disturbance is highlighted in such advice, Relevant authorities need to avoid damaging disturbance to qualifying species when exercising their functions under the Directive.

4.1.1 General description

The British Isles, due to their geographical location on the eastern seaboard of the north Atlantic and the northwest edge of the great land mass of Europe, are of major importance for many species of birds. Some species are resident, living here throughout the year, whilst others come here only to breed in the summer months before leaving to spend the winter elsewhere. For some migratory species these islands are an important wintering ground and for others a stopping off point, on their route in spring to more northern or eastern breeding areas, or in autumn to their southern wintering grounds.

The importance of these habitats for birds has been recognised by the European Union which, in 1979, brought into force the EC Birds Directive. This Directive puts certain obligations on the Government of Member States to protect populations and habitats of all migratory and vulnerable birds. Under this Directive, protection is achieved through a variety of measures including the creation of a network of Special Protection Areas (SPAs), covering the most important areas in Britain and Europe for each

species, whether for breeding, feeding, wintering or migration. Those species which are considered (within the whole of the EU) to be vulnerable or at risk of decline within the countries of the European Union are listed in Annex I of the Directive.

The qualifying criteria for selecting SPAs involves identifying those areas within the UK which are regularly used by:

- 1% or more of the GB population of Annex I species in any season;
- 1% or more of the biogeographical population of a regularly occurring migratory species in any season; and
- 20,000 or more waterfowl or seabirds in any season.

Information on the sites which may qualify as SPAs in England comes from a range of sources. The Wetland Birds Survey (WeBS) wildfowl and wetland counts provides the main database from which sites are assessed.

In recognition that bird populations may change as a reflection of national or international trends or events, this advice on the bird interests of the European marine site focuses on the condition of the marine habitats necessary to support the bird populations. As with SAC interest features, sub-features are identified which describe the key habitats within the European marine site necessary to support the birds that qualify within the SPA. Detailed information and targets for habitat condition are listed in the favourable condition table in Section 6. Bird usage of the site varies seasonally, with different areas being favoured over others at certain times of the year.

Some important habitats in the SPAs (mainly freshwater habitats and areas of sparsely vegetated or unvegetated sand and shingle above the highest water mark) lie outside but adjacent to the boundary of the European marine site. As such they are not specifically included in the conservation objectives for the SPA interest in this document. Conservation objectives for these habitats will be identified through the terrestrial habitat management procedures. However, relevant authorities should have regard to such adjacent European interests within the management scheme for the European marine site, as they may be affected by activities taking place within or adjacent to the site.

Bird communities are highly mobile and exhibit patterns of activity related to tidal water movements and many other factors. Different bird species exploit different parts of an intertidal area and different prey species. Changes in the habitat may therefore affect their prey availability. The important bird populations therefore require a functional embayment which is capable of supporting intertidal habitat for feeding and roosting. The most important factors related to this are:

- current extent, distribution and proximity of suitable feeding, roosting and nesting habitat (e.g. saltmarsh, mudflats);
- sufficient prey availability (e.g. small fish, crustaceans and worms);
- minimal levels of disturbance;
- water quality necessary to maintain intertidal plant and animal communities; and
- water quantity and salinity gradients necessary to maintain saltmarsh conditions suitable for bird feeding and roosting.

4.2 The Wash SPA

The Wash SPA is one of the most outstanding coastal wetlands in Europe. The site comprises a mix of open deep water, permanent shallow water, mudflats, sandflats and saltmarsh. The intertidal habitats and their associated invertebrate communities support a greater number of non-breeding waterfowl than any other wetland site in Great Britain.

The Wash SPA qualifies under Article 4.1 of the EU Birds Directive by supporting:

- internationally important populations of a regularly occurring Annex 1 species

It also qualifies under Article 4.2 of the EU Birds Directive in that it supports:

- an internationally important assemblage of waterfowl and seabirds; and
- internationally important populations of regularly occurring migratory species.

The qualifying species as given in The Wash SPA citation (1988) are listed in Table 2 (after Section 5) together with relevant population data. Current (1999) qualifying species and populations are given in Appendix VI.

4.2.1 Internationally important populations of regularly occurring Annex 1 species

The Wash is of importance for internationally important breeding populations of Common Tern (*Sterna hirundo*) and Little Tern (*Sterna albifrons*). Both these species nest in SPA habitats that are outside but adjacent to the European marine site boundary but depend upon habitats within the European marine site for food. The site is also important for Bewick swan, though this species only uses terrestrial habitats outside, but adjacent to, the European marine site boundary. The Common Tern and Little Tern feeding habitats are also of importance to internationally important breeding populations of Annex I species (Sandwich Tern and Common Tern) that nest within the adjacent North Norfolk Coast SPA.

4.2.1.1 Key sub-features

Coastal waters

The shallow waters within the Wash support large populations of small fish such as sandeels and sprats. These populations of small fish represent a vital food resource for the breeding tern populations and are necessary to ensure breeding success.

4.2.2 Internationally important assemblage of non-breeding waterfowl including regularly occurring migratory species

The assemblage is defined as comprising regularly occurring migratory species of waterfowl present in internationally important numbers together with any additional waterfowl species present in nationally important numbers. Qualifying species are given in Table 2.

The large areas of intertidal mud and sand in the Wash support high densities of marine invertebrates which in turn provide a food source for exceptional numbers of non-breeding waterfowl. In this context, the Wash is the most important wetland site in Great Britain.

4.2.2.1 Key sub-features

Coastal waters

The shallow waters within the Wash support large populations of small fish, crustaceans and invertebrates. These are an important food source for species such as Common Scoter (*Melanitta nigra*) and Goldeneye (*Bucephala clangula*).

Intertidal mud and sand

These intertidal habitats support high densities of invertebrates such as cockles (*Cerastoderma edule*) and mud snails (*Hydrobia ulvae*) and the very high biomass of a variety of such species enables the site to support large populations of wading birds and wildfowl throughout the year. In addition, the remote and undisturbed nature of these habitats provide a secure roost site for internationally important numbers of Pink-footed Geese (*Anser brachyrhynchus*).

Saltmarsh

The large areas of saltmarsh in the Wash provide important feeding, roosting and breeding habitat for many of the bird species for which the site is important. Vegetation height and the species composition of the sward combine to provide a rich feeding habitat for species such as dark-bellied Brent goose (*Branta bernicla*) and Wigeon (*Anas penelope*). Some wading birds, especially Redshank (*Tringa totanus*), feed extensively on saltmarsh invertebrates. Higher areas of saltmarsh provide important high tide roost sites.

Sand and shingle

In some areas, particularly along the eastern side of the Wash, shingle ridges and beaches are a feature of the littoral zone. On all but the highest tides, these provide important roost sites for wading birds such as Sanderling (*Calidris alba*) and Turnstone (*Arenaria interpres*).

4.3 The North Norfolk Coast Special Protection Area

The North Norfolk Coast SPA comprises one of the most diverse coastal systems in Great Britain and one of the largest expanses of undeveloped coastal habitat of its type in Europe. It is among the ten most important wetland sites in Britain for numbers of waterfowl and the most important for numbers of wildfowl. A complex barrier dune system protects remote, extensive and varied tracts of saltmarsh which, together with shallow seas and large areas of intertidal mud and sand, support a rich invertebrate fauna, which in turn supports internationally important bird assemblages throughout the year. At several locations there are interlocking complexes of grazing marsh, reedbed and lagoons that are also vital to these key bird assemblages.

The North Norfolk Coast SPA qualifies under Article 4.1 of the EU Birds Directive by supporting:

- internationally important populations of a regularly occurring Annex 1 species

It also qualifies under Article 4.2 of the EU Birds Directive in that it supports:

- an internationally important assemblage of waterfowl and seabirds; and
- internationally important populations of regularly occurring migratory species.

The qualifying species as given in the North Norfolk SPA citation (1989) are listed in Table 3 together with relevant population data. Current (1999) qualifying species and populations are given in Appendix VII.

4.3.1 Internationally important populations of the regularly occurring Annex 1 species

The North Norfolk Coast is of importance for internationally important breeding populations of Marsh Harrier *(Circus aeruginosus)*, Montagu_s Harrier *(Circus pygargus)*, Avocet *(Recurvirostra avosetta)*, Sandwich Tern *(Sterna sandvicensis)*, Common Tern *(Sterna hirundo)* and Little Tern *(Sterna albifrons)*.

4.3.1.1 Key Sub-features

Coastal waters

The shallow waters in and around the complex series of harbours and inlets of the North Norfolk Coast support large populations of small fish such as sandeels and sprats. These populations of small fish represent a vital food resource for the breeding tern populations and are necessary to ensure breeding success.

Intertidal mud and sand

These intertidal habitats support high densities of invertebrates and are an important feeding habitat for the internationally important population of breeding Avocet.

Saltmarsh

The large tracts of saltmarsh along the North Norfolk Coast are an important feeding habitat for the internationally important breeding population of Marsh Harriers that nest in adjacent freshwater reedbeds. Principal prey species are the breeding populations of Skylark and Meadow Pipit as well as large post-breeding flocks of juvenile Starlings.

Sand and shingle

The sparsely vegetated or unvegetated sand and shingle spits, bars and beaches are important nesting areas for all the breeding tern species. The most important locations are Scolt Head Island and Blakeney Point.

Tidal reedbed

During the period 1970-72 a pair of Montagu_s Harriers nested in this habitat at Titchwell.

4.3.2 Internationally important assemblage of non-breeding waterfowl including regularly occurring migratory species.

The assemblage is defined as comprising regularly occurring migratory species of waterfowl present in internationally important numbers together with any additional waterfowl species present in nationally important numbers. Qualifying species are given in Table 3.

The large areas of both intertidal mud and sand and saltmarsh on the North Norfolk Coast support high densities of marine invertebrates which in turn provide a food source for exceptional numbers of non-breeding waterfowl. Large waterfowl populations are particularly vulnerable to disturbance in both feeding and roosting areas. Excessive disturbance can result in reduced food intake and/or increased energy expenditure.

4.3.2.1 Key sub-features

Intertidal mud and sand

These intertidal habitats support high densities of invertebrates such as cockles *(Cerastoderma edule)* and mud snails (*Hydrobia ulvae)* and the very high biomass of a variety of such species enables the site to support high populations of wading birds and wildfowl throughout the year. In addition, the remote and undisturbed nature of these habitats provide secure roost sites for internationally important

numbers of Pink-footed Geese *(Anser brachyrhynchus)* and dark-bellied Brent geese *(Branta bernicula bernicla).*

Saltmarsh

The large areas of saltmarsh in the North Norfolk Coast SPA provide important feeding, roosting and breeding habitat for many of the bird species for which the site is important. Vegetation height and the species composition of the sward combine to provide a rich feeding habitat for species such as Bewick Goose *(Branta bernicla)* and Wigeon *(Anas penelope).* Some wading birds, especially Redshank *(Tringa totanus)*, feed extensively on saltmarsh invertebrates. Higher areas of saltmarsh provide important height tide roost sites.

Sand and shingle

Sand and shingle spits, bars and beaches occur at a variety of locations on the North Norfolk Coast. These provide vital high tide roost sites for important populations of wading birds including species such as Oystercatcher *(Haematopus ostralegus)* and Ringed Plover *(Charadrius hiaticula)*. Additionally, on the highest tides, a significant part of the internationally important wader populations from The Wash SPA use the sand and shingle habitats at Holme, Thornham and Titchwell as a high tide roost - the main species involved are Grey Plover *(Pluvialis squatarola)*, Knot *(Calidris canutus)* and Bar-tailed Godwit *(Limosa lapponica)*.

4.4 Gibraltar Point Special Protection Area

Gibraltar Point SPA forms the north-eastern extremity of and entrance to the Wash. It has been created by complex tidal and geomorphological processes. Most of the site comprises intertidal flats and saltmarsh backed by an extensive and actively accreting dune system. The site accommodates large numbers of migrant and wintering species.

Gibraltar Point SPA qualifies under Article 4.1 of the EU Birds Directive by supporting:

- internationally important populations of a regularly occurring Annex 1 species

It also qualifies under Article 4.2 of the EU Birds Directive in that it supports:

- internationally important populations of regularly occurring migratory species.

The qualifying species as given in the Gibraltar Point SPA citation (1992) are listed in Table 4 together with relevant population data.

4.4.1 Internationally important populations of the regularly occurring Annex 1 species

Gibraltar Point is of importance for internationally important breeding populations of Little Tern *(Sterna albifrons)*.

4.4.1.1 Key sub-features

Coastal waters

The shallow waters within and adjacent to Gibraltar Point SPA support large populations of small fish such as sandeels and sprats. These populations of small fish represent a vital food resource for the breeding tern population and are necessary to ensure breeding success.

Sand and shingle

Sparsely vegetated or unvegetated areas of sand and shingle are important as nesting areas for the breeding population of Little Tern. The breeding population of Little Tern is particularly vulnerable

to the effects of disturbance and predation, both of which can have a significant adverse effect on breeding success.

4.4.2 Internationally important populations of regularly occurring migratory species.

The Gibraltar Point SPA supports internationally important non-breeding populations of Grey Plover *(Pluvialis squatarola)*, Sanderling *(Calidris alba)* and Bar-tailed Godwit *(Limosa lapponica)*.

The large areas of intertidal mud and sand support high densities of marine invertebrates which in turn provide a food source for the internationally important populations of wading birds. The availability of secure high tide roost sites is also important. Large waterfowl populations are particularly vulnerable to disturbance in both feeding and roosting areas. Excessive disturbance can result in reduced food intake and/or increased energy expenditure.

4.4.2.1 Key sub-features

Intertidal mud and sand

These intertidal habitats support high densities of invertebrates such as cockles *(Cerastoderma edule)* and mud snails (*Hydrobia ulvae)* and the very high biomass of a variety of such species enables the site to support high populations of wading birds throughout the year.

Saltmarsh

The areas of saltmarsh provide important feeding and roosting habitat for the bird species for which the site is important.

Sand and shingle

Sand and shingle habitats are also important as secure high tide roost sites.

5. Conservation objectives for all interest features

Under Regulation 33(2)(a) of The Conservation (Natural Habitats &c.) Regulations 1994, English Nature has a duty to advise other relevant authorities as to the conservation objectives for the European marine site. The conservation objectives for the Wash & North Norfolk Coast European marine site are provided below and should be read in the context of other advice given in this package, particularly:

- the attached maps (maps 1-6) showing the extent of the various interest features and sub- features;
- summary information on the interest of each of the features; and
- the favourable condition table, providing information on how to recognise favourable condition for each of the features and which will act as a basis from which the monitoring programme will be developed.

5.1 The conservation objective for the Large shallow inlet and bay is:

Subject to natural change, maintain the **large shallow inlet and bay** in favourable condition[5], in particular:

- Subtidal sandbanks

[5] For a detailed definition of how to recognise favourable condition see attached table (Section 6)

- Intertidal mudflats and sandflats
- Subtidal boulder and cobble communities
- Subtidal mixed sediment communities (e.g. *Sabellaria spinulosa* reefs)
- Glasswort and other annuals colonising mud and sand
- Atlantic salt meadows
- Mediterranean saltmarsh scrubs

5.2 The conservation objective for Sandbanks which are slightly covered by seawater all the time is:

Subject to natural change, maintain the **sandbanks which are slightly covered by seawater all the time** in favourable condition[5], in particular:

- Gravel and sand communities
- Muddy sand communities

5.3 The conservation objective for the mudflats and sandflats not covered by seawater at low tide is:

Subject to natural change, maintain the **mudflats and sandflats not covered by seawater at low tide** in favourable condition[5], in particular:

- Sand and gravel communities
- Muddy sand communities
- Mud communities

5.4 The conservation objective for Glasswort and other annuals colonising mud and sand is:

Subject to natural change, maintain **Glasswort and other annuals colonising mud and sand** in favourable condition[5], in particular:

- Annual *Salicornia* saltmarsh community
- Annual seablite (*Suaeda maritima*) saltmarsh community
- Ephemeral saltmarsh vegetation with *Sagina maritima* saltmarsh community

5.5 The conservation objective for Atlantic salt meadows is:

Subject to natural change, maintain **Atlantic salt meadows** in favourable condition[5], in particular:

- Low marsh and low-mid marsh communities
- Mid and mid-upper marsh communities

5.6 The conservation objective for Mediterranean saltmarsh scrubs is:

Subject to natural change, maintain **Mediterranean saltmarsh scrubs** in favourable condition[5], in particular:

- shrubby seablite (*Suaeda vera*) saltmarsh community
- shrubby seablite (*Suaeda vera*) and *Limonium binervosum* saltmarsh community
- transitional communities

5.7 The conservation objective for Common seals is:

Subject to natural change, maintain in favourable condition[5] the habitats of **Common seals**, in particular:

- Intertidal mudflats and sandflats

5.8 The conservation objectives for the Wash SPA are:

Subject to natural change, to maintain in favourable condition the habitats of the **internationally important populations of regularly occurring Annex 1 bird species**, under the EU Birds Directive, with particular reference to:

- coastal waters

The conservation objectives for the Wash SPA

Subject to natural change, to maintain in favourable condition the habitats of the **internationally important assemblage of more than 20,000 waterfowl including the internationally important populations of regularly occurring migratory bird species**, under the EU Birds Directive, with particular reference to:

- coastal waters
- intertidal mud and sand
- saltmarsh
- sand and shingle

NOTE

1. Annual counts for qualifying species will be used by English Nature, in the context of five year means and five year peak means, together with available information on UK population and distribution trends and inform on habitat condition, to assess whether this SPA is continuing to make an appropriate contribution to the Favourable Conservation Status of the species across Europe.

5.9 The conservation objectives for the North Norfolk Coast SPA are:

Subject to natural change, to maintain in favourable condition the habitats of the **internationally important populations of regularly occurring Annex 1 bird species**, under the EU Birds Directive, with particular reference to:

- coastal waters
- intertidal mud and sand
- saltmarsh
- sand and shingle
- tidal reedbed

The conservation objectives for the North Norfolk Coast SPA (continued)

Subject to natural change, to maintain in favourable condition the habitats of the **internationally important assemblage of over 20,000 waterfowl including the internationally important populations of regularly occurring migratory bird species**, under the EU Birds Directive, with particular reference to :

- intertidal mud and sand
- saltmarsh
- sand and shingle

NOTE

2. Annual counts for qualifying species will be used by English Nature, in the context of five year means and five year peak means, together with available information on UK population and distribution trends, to assess whether this SPA is continuing to make an appropriate contribution to the Favourable Conservation Status of the species across Europe.

5.10 The conservation objectives for Gibraltar Point SPA are:

Subject to natural change, to maintain in favourable condition the habitats of the **internationally important populations of regularly occurring Annex 1 bird species**, under the EU Birds Directive, with particular reference to :

- sand and shingle
- coastal waters

The conservation objectives for the Gibraltar Point SPA

Subject to natural change, to maintain in favourable condition the habitats of the **internationally important populations of regularly occurring migratory bird species**, under the EU Birds Directive, with particular reference to :

- intertidal mud and sand
- saltmarsh
- sand and shingle

NOTE

3. Annual counts for qualifying species will be used by English Nature, in the context of five year means and five year peak means, together with available information on UK population and distribution trends, to assess whether this SPA is continuing to make an appropriate contribution to the Favourable Conservation Status of the species across Europe.

TABLE 2. Information on populations of nationally and internationally important species under the EU Birds Directive that regularly use that part of The Wash SPA lying within The Wash and North Norfolk Coast European Marine Site.

Internationally important populations of Annex 1 species

Common Tern	breeding	220 pairs	2.0% of British population
Little Tern	breeding	30 pairs	2.0% of British population

Internationally important populations of migratory species

Pink-footed Goose	wintering	7300	7.0%	of European population
Dark-bellied Brent Goose	wintering	17000	12.0%	of European population
Shelduck	wintering	16000	12.0%	of European population
Pintail	wintering	1700	2.0%	of European population
Oystercatcher	wintering	24000	3.0%	of European population
Grey Plover	wintering	5500	7.0%	of European population
Sanderling	wintering	500	3.0%	of European population
Knot	wintering	75000	21.0%	of European population
Dunlin	wintering	29000	1.0%	of European population
Bar-tailed Godwit	wintering	8200	1.0%	of European population
Curlew	wintering	3700	1.0%	of European population
Redshank	wintering	4000	2.0%	of European population
Turnstone	wintering	980	2.0%	of European population

Internationally important assemblage of over 20,000 non-breeding waterfowl

In addition to the internationally important populations of Annex 1 species and the internationally important populations of migratory species listed above, the following bird species occur at levels of national importance and form a part of the assemblage :

Wigeon	wintering	3900	2.0%	of British population
Gadwall	wintering	130	3.0%	of British population
Common Scoter	wintering	830	2.0%	of British population
Goldeneye	wintering	220	1.0%	of British population
Black-tailed Godwit	wintering	260	5.0%	of British population

Also - _probably several gull species_

The Wash SPA supports an average of : **163000** waders and **51000** wildfowl.

NOTES

1. The above table has been prepared using data from The Wash SPA citation (1988). This data does not reflect the current SPA interest of the site.

TABLE 3. Information on populations of nationally and internationally important species of birds under the EU Birds Directive that regularly use that part of the North Norfolk Coast SPA lying within The Wash and North Norfolk Coast European Marine Site

Internationally important populations of Annex 1 species

Marsh Harrier	breeding	?	c.30% of British population
Montagu_s Harrier	breeding	?	?
Avocet	breeding	?	c.30% of British population
Sandwich Tern	breeding	up to 4500 prs.	c.33% of British population
Common Tern	breeding	up to 1000 prs.	9.0% of British population
Little Tern	breeding	up to 400 prs.	9.0% of British population

Internationally important populations of migratory species

Pink-footed Goose	wintering	6000	6.0%	of International population
Dark-bellied Brent Goose	wintering	9000	7.0%	of International population
Wigeon	wintering	5000	1.0%	of International population
Knot	wintering	6000	2.0%	of International population

Internationally important assemblage of over 20,000 non-breeding waterfowl

In addition to the internationally important populations of Annex 1 species and the internationally important populations of migratory species listed above, the following bird species occur at levels of national importance and form a part of the non-breeding assemblage :-

White-fronted Goose	wintering	270	4.0%	of British population
Shelduck	wintering	2600	1.0%	of British population
Pintail	wintering	450	2.0%	of British population
Oystercatcher	wintering	5000	2.0%	of British population
Ringed Plover	wintering	400	2.0%	of British population
Grey Plover	wintering	500	2.0%	of British population
Redshank	wintering	800	1.0%	of British population

NOTE

1. This table has been prepared using data from the North Norfolk Coast SPA citation (1989). This data is now inaccurate and seriously fails to reflect the current SPA interest of the site.

TABLE 4 Information on the nationally and internationally important species of birds under the EU Birds Directive that regularly use that part of the Gibraltar Point SPA lying within The Wash and North Norfolk Coast European Marine Site.

Internationally important populations of Annex 1 species

Little Tern	breeding	40 pairs in 1992	1.7% of British population

Internationally important populations of migratory species

Grey Plover	wintering	3980	2.0%	of International population
Sanderling	wintering	1140	4.0%	of International population
Bar-tailed Godwit	wintering	8800	7.0%	of International population

NOTES

1. The above table was prepared using data from the Gibraltar Point SPA citation (1992).

2. The wintering population data are Wetland Bird Survey 5 year peak means for the period 1987-1991.

6. Favourable condition table

The favourable condition table is supplied as an integral part of English Nature_s Regulation 33 advice package. It is intended to supplement the conservation objectives only in relation to management of established and ongoing activities and future reporting requirements on monitoring the condition of the site and its features. The table **does not by itself** provide a comprehensive basis on which to assess plans and projects as required under Regulations 20 and 48-50, but it does provide a basis to inform the scope and nature of any _appropriate assessment_ that may be needed. It should be noted that appropriate assessments (carried out by a competent authority) are, by contrast, a separate activity to condition monitoring, requiring consideration of issues specific to individual plans or projects. English Nature will provide more detailed advice to competent and relevant authorities to assess the implications of any given plan or project under the Regulations, where appropriate, at the time a plan or project is being considered.

The favourable condition table is the principal source of information that English Nature will use to assess the condition of an interest feature and as such comprises indicators of condition. On many terrestrial European sites, we know sufficient about the preferred or target condition of qualifying habitats to be able to define measures and associated targets for all attributes to be assessed in condition monitoring. Assessments as to whether individual interest features are in favourable condition will be made against these targets. In European marine sites we know far less about habitat condition and find it difficult to predict what favourable condition may look like. Individual sites within a single marine habitat category are also all very different, further hampering the identification of generic indicators of condition. Accordingly, in the absence of such information, condition of interest features in European marine sites will be assessed against targets based on the existing conditions, which may need to be established through baseline surveys in many cases.

The assumption that existing interest features on European marine sites are in favourable condition will be tested in the 2000 - 2006 reporting period and the results subsequently fed back into our advice and site management. Where there is more than one year_s observations on the condition of marine habitats, all available information will need to be used to set the site within long-term trends in order to form a view on favourable condition. Where it may become clear that certain attributes are a cause

for concern, and if detailed studies prove this correct, restorative management actions will need to be taken to return the interest feature from unfavourable to favourable condition. It is the intention of English Nature to provide, where possible, quantification of targets in the favourable condition table during the 2000 - 2006 reporting period.

This advice also provides the basis for discussions with management and advisory groups, and as such the attributes and associated measures and targets may be modified over time. The aim is to produce a single agreed set of attributes that will then be monitored in order to report on the condition of features. Monitoring of the attributes may be of fairly coarse methodology, underpinned by more rigorous methods on specific areas within the site. To meet UK agreed common standards, English Nature will be committed to reporting on each of the attributes subsequently listed in the final version of the table, although the information to be used may be collected by other organisations through agreements.

The table will be an important, but not the only, driver of the site monitoring programme. Other data, such as results from compliance monitoring and appropriate assessments, will also have an important role in assessing condition. The monitoring programme will be developed as part of the management scheme process through discussion with the relevant authorities and other interested parties. English Nature will be responsible for collating the information required to assess condition and will form a judgement on the condition of each feature within the site, taking into account all available information and using the favourable condition table as a guide.

Box 1 Glossary of terms used in the favourable condition table

Feature	The habitat or species for which the site has been selected.
Sub-feature	An ecologically important sub-division of the feature.
Attribute	Selected characteristic of an interest feature/sub-feature which provides

Table 5.1 Favourable Condition Table for the Wash and North Norfolk Coast Special Area of Conservation NB - Many of the attributes will be able to be monitored at the same time or during the same survey. The frequency of sampling for many attributes may need to be greater during the first reporting cycle in order to characterise the site and establish the baseline.

Feature	Sub-feature	Attribute	Measure	Target	Comments
Large shallow inlet and bay		Extent	Area (ha) of the large shallow inlet and bay, measured once during the reporting cycle.	No decrease in extent from an established baseline, subject to natural change.	Extent is an attribute on which reporting is required by the Habitats Directive. The extent of the large shallow inlet and bay will not change significantly over time unless due to some human activity but nevertheless needs to be measured periodically.
		Water density	Regular measurement of water temperature and salinity in the subtidal periodically throughout the reporting cycle.	Average temperature/ salinity should not deviate significantly from an established baseline, subject to natural change.	Temperature and salinity are characteristic of the overall hydrography of the area. Changes in temperature and salinity influences the presence and distribution of species (along with recruitment processes and spawning behaviour) including those at the edge of their geographical ranges and non-natives.
		Nutrient status	Average phytoplankton concentration in summer measured annually.	No significant increase in phytoplankton concentration from an established baseline, subject to natural change.	Nutrient enrichment stimulating excessive growth of phytoplankton is a common factor contributing to a reduction in water clarity. Single-species dominated phytoplankton blooms can also have harmful effects on shellfish and phytoplankton blooms have been recorded from the Wash.
	Subtidal sandbanks	Attributes and targets for this sub-feature are listed under the _Subtidal sandbanks_ interest feature covered in other sections of this table.			
	Intertidal mudflat and sandflat communities	Attributes and targets for this sub-feature are listed under the _Intertidal mudflats and sandflats_ interest feature covered in other sections of this table.			
	Glasswort and other annuals colonising mud and sand	Attributes and targets for this sub-feature are listed under the _Glasswort and other annuals colonising mud and sand_ interest feature covered in other sections of this table.			
Large shallow inlet and bay	Atlantic salt meadows	Attributes and targets for this sub-feature are listed under the _Atlantic Salt Meadows_ interest feature covered in other sections of this table.			
	Mediterranean saltmarsh scrubs	Attributes and targets for this sub-feature are listed under the _Mediterranean saltmarsh scrubs_ interest feature covered in other sections of this table.			
	Subtidal boulder and cobble communities	Extent and distribution of characteristic biotopes (listed in Appendix II)	Extent and distribution of biotopes, measured once during the reporting cycle.	Extent and distribution of biotopes should not deviate significantly from an established baseline, subject to natural change.	The extent and distribution of the biotopes listed under this sub-feature in Appendix II, is an important structural aspect of the site. Changes in extent and distribution may indicate long term changes in the physical conditions at the site.

	Subtidal mixed sediment communities	Extent and distribution of characteristic biotopes (listed in Appendix II)	Extent and distribution of biotopes, measured once during the reporting cycle.	Extent and distribution of biotopes should not deviate significantly from an established baseline, subject to natural change.	The extent and distribution of the biotopes listed under this sub-feature in Appendix II, is an important structural aspect of the site. Changes in extent and distribution may indicate long term changes in the physical conditions at the site.
		Species composition of characteristic biotopes CMX.SspiMx; CMX.ModMx.	Presence and abundance of composite species of each biotope, measured in summer, once during the reporting cycle.	Presence and abundance of composite species of each biotope should not deviate significantly from an established baseline, subject to natural change.	The presence and abundance of characterising species gives an indication of the quality of S*abellaria spinulosa* reefs and gravels and the *Modiolus* beds. Change in composition may indicate cyclic change/trend in the subtidal mixed sediment communities. Change in composition may also indicate changes in hydrography, salinity and or siltation.
Subtidal sandbanks		Extent	Area (ha) of the subtidal sandbanks measured periodically (frequency to be determined).	No decrease in extent from an established baseline, subject to natural change.	Extent of the feature is a reporting requirement of the Habitats Directive. Monitoring will need to take account of the dynamic nature of the feature but reduction in extent may indicate long term changes in the physical conditions influencing the feature.
Subtidal sandbanks		Sediment character	Particle size analysis (PSA). Parameters include percentage sand/silt/gravel, mean and median grain size, and sorting coefficient, used to characterise sediment type. Sediment character to be measured during summer once during reporting cycle.	Average PSA parameters should not deviate significantly from an established baseline, subject to natural change.	Sediment character defined by PSA is key to the structure of the feature, and reflects all of the physical processes acting on it. Particle size composition varies across the feature and can be used to indicate spatial distribution of sediment types, thus reflecting the stability of the feature and the processes supporting it.
		Topography	Depth distribution of sandbanks from selected sites, measured periodically (frequency to be determined).	Depth should not deviate significantly from an established baseline, subject to natural change.	Depth and distribution of the sandbanks reflects the energy conditions and stability of the sediment, which is key to the structure of the feature. Depth of the feature is a major influence on the distribution of communities throughout.
	Gravel and sand communities	Distribution and extent of characteristic range of biotopes (listed in Appendix II)	Distribution and extent of biotopes, measured by extent, once during the reporting cycle.	Distribution and extent of characteristic biotopes should not deviate significantly from an established baseline, subject to natural change.	The distribution and extent of the biotopes listed under this sub-feature in Appendix II, is an important structural aspect of the site. Changes in extent and distribution may indicate long term changes in the physical conditions at the site.
	Muddy sand	Distribution and	Distribution and extent	Distribution and extent of	The distribution of the biotopes listed under this

	communities	extent of characteristic biotopes (listed in Appendix II)	of characteristic biotopes, measured once during the reporting cycle.	characteristic biotopes should not deviate significantly from an established baseline, subject to natural change.	sub-feature in Appendix II, is an important structural aspect of the site. Changes in extent and distribution may indicate long term changes in the physical conditions at the site.
Subtidal sandbanks	Muddy sand communities	Species composition of characteristic biotopes IMS.EcorEns; CMS.AbrNuc Cor	Presence and abundance of composite species of each biotope measured once during the reporting cycle.	Presence and abundance of composite species should not deviate significantly from an established baseline, subject to natural change.	Species composition is an important contributor to the structure of the biotopes within the sub-feature. The presence and abundance of characterising species gives an indication of the quality of the biotopes and change in composition may indicate cyclic change or trends in subtidal sandbank communities.
Intertidal mudflats and sandflats		Extent	Area (ha) measured once during the reporting cycle.	No decrease in extent of intertidal mud and sandflats from an established baseline, subject to natural change.	Extent is an attribute on which reporting is required by the Habitats Directive. Loss of intertidal mud communities is likely to be detrimental to the structure of the feature, e.g. associated with a change in sediment budget or geomorphological regime, and may indicate long term changes in the physical conditions of the feature.
		Sediment character	1. Particle size analysis (PSA). Parameters include percentage sand/silt/gravel, mean and median grain size, and sorting coefficient, used to characterise sediment type. Measured in summer once during reporting cycle.	Average PSA parameters should not deviate significantly from the baseline, subject to natural change.	Sediment character defined by particle size analysis is key to the structure of the feature, and reflects all of the physical processes acting on it. Particle size composition varies across the feature and can be used to indicate spatial distribution of sediment types thus reflecting the stability of the feature and the processes supporting it.
Intertidal mudflats and sandflats		Sediment character (cont'd)	2. Sediment penetrability - degree of sinking.	Average measure should not deviate significantly from an established baseline, subject to natural change.	Penetrability is an indicator of sediment stability, degree of compaction indicates the shear strength of the sediment and thus the susceptibility of that sediment type to erosion. Compaction of the sediment influences the biological community within the sediment. Penetrability of sediments is determined by a combination of grain size and water content, which may provide a surrogate index of the penetrability of the sediments.
			3. Organic content	Average organic carbon	Organic content critically influences the infaunal

			% organic carbon from sediment sample measured periodically (frequency to be determined).	content should not deviate significantly from an established baseline, subject to natural change.	community and can cause deoxygenation of the feature which can be detrimental to the biota. However, a balance needs to be struck as organic content provides a measure of the material available to detritivores. A reduction in organic content could lead to a reduction in detritivores, with subsequent knock-on effects through the food chain.
			4. Oxidation - reduction potential. Depth of black anoxic layer. Measured periodically (frequency to be determined).	Average black layer depth should not deviate significantly from an established baseline, subject to natural change.	Degree of oxidation / reduction, reflecting oxygen availability within the sediment, critically influences the infaunal community and the mobility of chemical compounds. It is an indicator of the structure of the feature.
		Topography	Tidal elevation and shore slope, measured periodically (frequency to be determined).	Shore profile measurements should not deviate significantly from an established baseline, subject to natural change.	In the intertidal, topography reflects the energy conditions and stability of the sediment, which is key to the structure of the feature. Topography is a major influence on the distribution of communities throughout the feature. Measuring topography may also indicate the position of channels through the feature, which is another important indicator of the processes influencing the feature.
Intertidal mudflats and sandflats		Nutrient enrichment - macroalgal mats	Extent and seasonal abundance of macroalgal mats, measured periodically (frequency to be determined).	Average extent of macroalgae mats should not increase from an established baseline, subject to natural change.	Nutrient status is a key functional factor that influences biota associated with sediments including infauna as well as plants/algae at the surface. Green algae provide an indication of elevated nutrient levels since they respond by increasing extent or abundance. Further, mats of green algae, where they increase, both directly and indirectly affect sediment structure and function, primarily through smothering and associated deoxygenation.
	Sand and gravel communities	Distribution and extent of characteristic biotopes (listed in Appendix II)	Distribution and extent of characteristic biotopes, measured in the autumn, once during the reporting cycle.	Distribution and extent of characteristic biotopes should not deviate significantly from an established baseline, subject to natural change.	The distribution of the biotopes listed under this sub-feature in Appendix II is an important structural aspect of the site. Changes in extent and distribution may indicate long term changes in the physical conditions at the site.
		Characterising species - mussels *Mytilus edulis*	Abundance and age/size class profile of mussels. Measured periodically,	Abundance and age/size class profile of mussels should not deviate	Mussels are a key structuring component of the intertidal sand and gravel communities and they play an important role in the functioning of the

			frequency to be determined.	significantly from an established baseline, subject to natural change.	Wash ecosystem. A range of age classes is an important indicator of mussel recruitment and growth, which supports birds and other wildlife which feed selectively on different sizes of mussels.
	Muddy sand communities	Distribution and extent of characteristic biotopes (listed in Appendix II)	Distribution and extent of characteristic biotopes, measured in the autumn, once during the reporting cycle.	Distribution and extent of characteristic biotopes should not deviate significantly from an established baseline, subject to natural change.	The distribution of the biotopes listed under this sub-feature in Appendix II is an important structural aspect of the site. Changes in extent and distribution may indicate long term changes in the physical conditions at the site.
Intertidal mudflats and sandflats	Muddy sand communities	Species composition of characteristic biotopes LMS.PCer; LMS.MacAre	Presence and abundance of composite species measured in the autumn, once during the reporting cycle.	Presence and abundance of composite species should not deviate significantly from an established baseline, subject to natural change.	Species composition is an important contributor to the structure of the biotopes within the sub-feature. The presence and relative abundance of characterising species gives an indication of the quality of the biotopes and change in composition may indicate cyclic change / trends in the intertidal sediment communities.
		Extent of *Zostera* beds	Extent (m^2) of the *Zostera* beds measured during the peak growth period (May - -Aug) every three years during the reporting cycle.	No decrease in extent from an established baseline, subject to natural change.	The extent of the *Zostera* (eelgrass) beds is a key structural component of the sediments and provides a long term integrated measure of environmental conditions across the feature, and is also particularly important in being an internationally scarce and declining habitat. The eelgrass beds provide a rich food source for wintering waterfowl and provide important nursery and feeding areas for fish.
	Mud communities	Distribution and extent of characteristic biotopes (listed in Appendix II)	Distribution and extent of characteristic biotopes, measured in the autumn, once during the reporting cycle.	Distribution and extent of characteristic biotopes should not deviate significantly from an established baseline, subject to natural change.	The distribution of the biotopes listed under this sub-feature in Appendix II is an important structural aspect of the site. Changes in extent and distribution may indicate long term changes in the physical conditions at the site.
***Salicornia* and other annuals colonising mud and sand**		Extent	Area (hectares) measured once during the reporting cycle.	No decrease in extent from an established baseline subject to natural change. No increase at the expense of low- mid-saltmarsh communities.	Subject to periodic and seasonal variation- may need to be assessed over a period of time.
***Salicornia* and other annuals**		Topography	Surface elevation of saltmarsh and foreshore	No change in surface elevation of saltmarsh	Topography is an important physical factor which influences colonisation of mud and sand by

colonising mud and sand			measured periodically (frequency to be determined).	sediments and foreshore, subject to natural change.	saltmarsh plants - this will only occur if adequate sediment is accreting - this is influenced by extent of fronting mudflat which can dissipate wave energy and affect availability of suspended sediment. Sediment is deposited on the saltmarsh surface with each tide, with transport along creeks an important element of this, allowing the surface to build.
		Creek patterns	Creek density and morphology measured periodically during reporting cycle (frequency to be determined).	No alteration of creek patterns from an established baseline, subject to natural change.	Creeks absorb tidal energy and assist with the delivery of sediment into saltmarshes. The efficiency of this process depends on creek pattern. Creek density is influenced by vegetation cover, suspended sediment load and tidal influence. Creeks allow pioneer vegetation to be established along their banks higher into the saltmarsh system. Headward lengthening and deepening of creeks can indicate changes are occurring in the saltmarsh system.
		Nutrient enrichment - algal mat cover	Area and thickness of algal mat, measured during summer periodically (frequency to be determined).	Area and thickness of algal mats should not deviate significantly from an established baseline, subject to natural change.	Algal mats are often associated with the pioneer saltmarsh communities, and are important primary producers, but can be affected by changes to water quality - eutrophication may lead to expansion and smothering of vegetation, or pollution can cause a decline which can lead to destabilisation of sediment surfaces and initiate erosion. An increase in algal cover can also indicate a decline in grazing invertebrates.
***Salicornia* and other annuals colonising mud and sand**		Characteristic communities (listed in appendices IV & V)	Presence and abundance of characteristic communities or sub-communities measured periodically (frequency to be determined)	Presence and abundance of characteristic communities should not deviate significantly from an established baseline, subject to natural change.	These communities are important precursors to more stable vegetation of low to mid marsh. Communities may be dynamic in their distribution and are linked with the physical processes operating on the site e.g., topography., creek patterns, sea-level rise etc.
		Species composition of characteristic communities (listed in Appendices IV & V)	Frequency and abundance of constant species, measured periodically (frequency to be determined)	Frequency and abundance of constant species should not deviate significantly from an established baseline subject to natural change.	
Atlantic Salt		Extent	Area (hectares)	No decrease in extent of	Monitoring will need to take account of the

Meadows			measured once during reporting cycle	saltmarsh plant communities from the established baseline subject to natural change.	dynamic nature of some of these habitats. Coastal squeeze may result in replacement of Atlantic salt meadows by pioneer saltmarsh. A reduction in extent could be further indicated by ground survey to assess for signs of erosion such as toppled vegetated blocks; cliffing; stepping of saltmarsh edge; signs of roots in intertidal mud; signs of stress/damage to plants. Extent needs to be measured at low tide.
		Creek patterns	Creek density and morphology measured periodically (frequency to be determined)	No significant alteration of creek patterns from an established baseline, subject to natural change.	Creeks absorb tidal energy and assist with the delivery of sediment into saltmarshes. The efficiency of this process depends on creek pattern. Creek density is influenced by vegetation cover, suspended sediment load and tidal influence. Creeks allow pioneer vegetation to be established along their banks higher into the saltmarsh system
Atlantic Salt Meadows		Range of NVC saltmarsh communities	Presence and abundance of characteristic communities or sub-communities and transitions to other habitats measured periodically (frequency to be determined)	No decrease in extent of saltmarsh plant communities from an established baseline, subject to natural change.	A range of community types from low, mid, to upper saltmarsh should be present.
		Species composition of characteristic communities (listed in appendix V)	Frequency and abundance of constant species of characteristic communities measured periodically (frequency to be determined)	Frequency and abundance of constant species should not deviate significantly from an established baseline, subject to natural change.	The baseline will need to be established by habitat surveys using the National Vegetation Classification (NVC)
		Vegetation structure	Range and distribution of varying vegetation heights, measured periodically (frequency to be determined)	Vegetation structure should not deviate significantly from the established baseline, subject to natural change	Vegetation structure is largely affected by the impact of grazing (of wild or domestic herbivores) interacting with different vegetation communities.
	Low Marsh and Low-Mid Marsh communities	Species composition of characteristic communities or sub-communities (listed in	Frequency and abundance of constant species, measured once during the reporting cycle	Frequency and abundance of constant species should not deviate significantly from an established baseline, subject to natural change.	Low marsh and low-mid marsh communities can be relatively simple communities or more complex associations of species, and species composition will vary depending on geographical location and other physical factors.

		appendices IV & V)			
Atlantic Salt Meadows	Mid and Mid-Upper marsh	Species composition of characteristic communities and sub-communities (listed in appendices IV & V)	Frequency and abundance of constant species of each community, measured once during the reporting cycle	Frequency and abundance of constant species should not deviate significantly from an established baseline, subject to natural change.	Mid-marsh and mid-upper marsh communities are generally more complex than those of the lower marsh.
	Upper Marsh	Species composition of characteristic communities and sub-communities (listed in appendices IV & V)	Frequency and abundance of constant species, measured once during the reporting cycle	Frequency and abundance of constant species should not deviate significantly from an established baseline, subject to natural change	Upper marsh communities experience lass frequent tidal inundation and contain a broader range of species than lower marsh communities.
	Transitional communities	Range of transitional communities from saltmeadow to other communities	Extent of transitional communities measured once during the reporting cycle	No decrease in extent of transitional communities from an established baseline, subject to natural change.	Sites with a complete sequence of habitats from saltmeadow to coastal, terrestrial or freshwater/brackish habitats are the most valuable for nature conservation. Such habitats can include sand dunes, shingle, reedbeds, and woodland.
Mediterranean and thermo-Atlantic halophilus scrubs		Extent	Length/area of scrub along drift line measured once during the reporting cycle.	No decrease in linear extent/area from established baseline, subject to natural change	Community is generally rather open. Characteristic of interfaces between saltmarsh and other coastal and transitional habitats. Tidal inundation infrequent
		Absence of landward constraints	Percent of linear extent not immediately constrained by artificial structures, measured periodically (frequency to be determined).	No increase in linear extent constrained by artificial structures from established baseline.	Sea level rise may squeeze the habitat against sea walls. The extent of this habitat which can migrate inland as sea levels rise are likely to be especially valuable
		Range of NVC saltmarsh communities (listed in appendices IV &	Frequency and abundance of constant species for each community or sub-community measured	Frequency and abundance of constant species should not deviate significantly from an established baseline, subject to natural	This community is often associated with the upper saltmarsh community. It is limited in its distribution to south-east England and is unlikely to be found outside existing SACs.

		V)	periodically (frequency to be determined).	change.	
Common seals		Disturbance	Reduction or displacement of common seals measured using average count information measured periodically (frequency to be determined).	No significant reduction in numbers or displacement of common seals from an established baseline, subject to natural change.	Excessive disturbance can result in injury to pups, increased risk of infection (Drescher, 1978, cited in Bonner 1989) and/or increased energy expenditure.
	Intertidal mudflats and sandflats	Extent	Area (ha). Measured once during reporting cycle.	No decrease in extent of intertidal mudflats and sandflats from an established baseline, subject to natural change.	Important moulting, haul-out and breeding sites.

Table 5.2 Favourable Condition Table for the Wash Special Protection Area

Feature	Sub-feature	Attribute	Measure	Target	Comments
Internationally important Annex 1 bird populations Common Tern *(Sterna hirundo)* Little Tern *(Sterna albifrons)*	Shallow coastal waters	Presence and abundance of prey species.	Presence and abundance of fish, crustaceans, molluscs and worms. Measured periodically (frequency to be determined).	Presence and abundance of prey species should not deviate significantly from an established baseline, subject to natural change.	Availability of prey species including sandeels and sprats, especially in the size range 5- 8 cm., is important during the breeding period (April - August) for the common and little tern.
Internationally important	Shallow coastal waters	Presence and abundance of	Presence and abundance of molluscs, gastropods	Presence and abundance of prey species should not deviate	Prey species are marine invertebrates (e.g. *Mytilus* <40mm and

assemblage of non-breeding waterfowl including regularly occurring migratory species.		prey species.	and crustaceans. Measured periodically (frequency to be determined).	significantly from an established baseline, subject to natural change.	*Cerastoderma* <40mm) for common scoter & benthic invertebrates such as *Cardium, Littorina, Hydrobia* and *Carcinus* for Goldeneye.
	Intertidal mudflats and sandflats	Extent	Area (ha.) Measured once during reporting cycle.	No decrease in extent of intertidal mud and sand from established baseline, subject to natural change.	Important feeding and roosting areas
		Presence and abundance of prey species.	Presence and abundance of molluscs, crustaceans, fish, worms and insects. Measured periodically (frequency to be determined).	Presence and abundance of prey species should not deviate significantly from an established baseline, subject to natural change.	Prey species include molluscs (eg *Macoma, Mytilus, Cerastoderma*), marine worms (eg *Arenicola, Nereis, Nephtys, Lanice, Tubificiodes*) and crustaceans (eg *Carcinus, Bathyporeia, Gammarus, Corophium, Crangon*).
Internationally important assemblage of non-breeding waterfowl including regularly occurring migratory species.	Intertidal mudflats and sandflats	Presence and abundance of food species.	Presence and abundance of eelgrass and/or green algae. Measured periodically (frequency to be determined).	Presence and abundance of food species should not deviate significantly from an established baseline, subject to natural change.	*Zostera and Enteromorpha* are an important food source for grazing birds. Baseline conditions have yet to be established
	Saltmarsh	Extent	Area (ha.) Measured once during reporting cycle.	No decrease in extent of saltmarsh from established baseline, subject to natural change.	Important roosting and feeding areas
		Presence and abundance of food species	Presence and abundance of soft-leaved grasses & herbs. Measured periodically (frequency to be determined).	Presence and abundance of characteristic food species should not deviate significantly from an established baseline, subject to natural change.	Important food source for wildfowl. Characteristic food species include *Agrostis stolonifera, Puccinellia maritima, Trifolium repens, Triglochin maritimum, Salicornia spp.*
		Presence and abundance of prey species.	Presence and abundance of invertebrates. Measured periodically (frequency to be determined).	Presence and abundance of prey species should not deviate significantly from an established baseline, subject to natural change.	Important food source for waders. Prey species include mollusc (*e.g. Hydrobia*).
Internationally important assemblage of non-breeding waterfowl	Saltmarsh	Vegetation structure	Range of vegetation heights, measured periodically (frequency to be determined).	Range of vegetation heights should not deviate significantly from an established baseline, subject to natural change.	Vegetation of <10cm is required throughout areas for feeding roosting.

including regularly occurring migratory species.					
	Sand and shingle	Extent	Area (ha.) Measured once during reporting cycle.	No decrease in extent of sand and shingle from established baseline, subject to natural change.	Important roosting areas.
	Shallow coastal waters; intertidal mudflats and sandflats; saltmarsh; sand and shingle	Disturbance in feeding and roosting areas	Reduction in numbers or displacement of birds attributable to human disturbance. Measured annually using 5 year peak mean data on bird populations	No significant reduction in numbers of or displacement of birds attributable to human disturbance from an established baseline, subject to natural change.	Excessive disturbance can result in reduced food intake and/or increased energy expenditure.
		Absence of obstructions to view lines	Openness of terrain unrestricted by obstructions	No increase in obstructions to existing view lines.	Waterfowl require unrestricted views to allow early detection of predators when feeding and roosting.

Table 5.3 Favourable Condition Table for the North Norfolk Coast Special Protection Area Area

Feature	Sub-feature	Attribute	Measure	Target	Comments
Internationally important Annex 1 bird population Marsh Harrier (*Circus aeruginosus*)	Saltmarsh	Extent	Area (ha.) Measured once during reporting cycle.	No decrease in extent of saltmarsh from established baseline, subject to natural change.	Important feeding habitat.
		Presence and abundance of prey species	Presence and abundance of small - medium sized birds and mammals. Measured periodically (frequently to be determined).	Presence and abundance of prey species should not deviate significantly from an established baseline, subject to natural change.	Prey species include Skylark (*Alauda arvensis*), Meadow Pipit (*Anthus pratensis*) and Starling (*Sturnus vulgaris*).
Montagu_s Harrier (*Circus pygargus*)	Tidal reedbed	Extent	Area (ha.) Measured once during reporting cycle.	No decrease in extent of tidal reedbed from established baseline, subject to natural change.	Nesting habitat.
		Disturbance in nesting area.	Reduction in breeding success attributable to human disturbance. Measured annually.	No significant reduction in breeding success from established baseline, subject to natural change.	Montagu_s Harriers are very sensitive to human disturbance at or near the nest site.
Avocet *(Recurvirostra avosetta*)	Intertidal mudflats and sandflats.	Extent	Area (ha.) Measured once during reporting cycle.	No decrease in extent of intertidal mud and sand from an established baseline, subject to natural change.	Important feeding area.
		Presence and abundance of prey species.	Presence and abundance of insects, crustaceans, molluscs, small fish or worms. Measured periodically (frequency to be determined).	Presence and abundance of prey species should not deviate significantly from and established baseline, subject to natural change.	Important food source. Prey species include e.g. *Gammarus*, *Corophium* , flies, beetles, bugs, *Nereis*, *Hydrobia*, *Cardium*, gobies.
Internationally important Annex 1 bird populations Avocet *(Recurvirostra avosetta*) Sandwich tern	Shallow coastal waters.	Presence and abundance of prey species.	Presence and abundance of fish, crustaceans, molluscs and worms. Measured periodically (frequency to be determined).	Presence and abundance of prey species should not deviate significantly from an established baseline, subject to natural change.	Availability of prey species including sand eels and sprats is important during the breeding period (April-August)for all species.

(Sterna sandvicensis) Common Tern (*Sterna hirundo*) Little Tern (*Sterna albifrons*)					
	Sand and shingle.	Extent.	Area (ha.) Measured once during reporting cycle.	No decrease in extent of open, largely bare, sand and shingle from and established baseline, subject to natural change.	Important nesting habitat.
Avocet *(Recurvirostra avosetta*)		Vegetation cover/density.	Ratio of open ground with sparse vegetation and bare areas. Measured periodically (frequency to be determined).	Ratio of open ground with sparse vegetation and bare areas should not deviate significantly from an established baseline, subject to natural change.	Open, largely bare areas of sand and shingle comprise unrestricted views >200m with vegetation cover <10% and the remainder bare during the breeding period for Avocet (April-August).
Sandwich tern *(Sterna sandvicensis)* Common Tern (*Sterna hirundo*) Little Tern (*Sterna albifrons*)		Vegetation cover/density.	Mosaic of areas of bare ground and short vegetation amongst or close to longer vegetation. Measured periodically (frequency to be determined).	Mosaic of areas of bare ground and short vegetation amongst or close to longer vegetation should not deviate significantly from an established baseline, subject to natural change.	During the breeding period for terns (April-August) the vegetation/bare ground mosaic, with short vegetation <3cm, is important as nesting habitat. Slightly longer vegetation is important for cover of chicks.
All species	Saltmarsh; tidal reedbed; intertidal mudflats and sandflats; shallow coastal waters; sand and shingle.	Predation and disturbance in nesting areas.	Reduction in breeding success attributable to human disturbance or predation. Measured annually.	No significant reduction in breeding success attributable to human disturbance or predation.	The breeding success of all species is particularly vulnerable to disturbance and predation.
Internationally important assemblage of non-breeding waterfowl including regularly occurring migratory species.	Intertidal mudflats and sandflats.	Extent.	Area (ha.) Measured once during reporting cycle.	No decrease in extent of intertidal mud and sand from established baseline, subject to natural change.	Important feeding and roosting areas.
		Presence and abundance of prey species.	Presence and abundance of intertidal molluscs, crustaceans, fish and worms. Measured periodically (frequency to be determined).	Presence and abundance of prey species should not deviate significantly from an established baseline, subject to natural change.	Prey species include molluscs (eg *Macoma, Mytilus, Cerastoderma*), marine worms (eg *Arenicola, Nereis, Lanice, Nephtys, Tubificoides*), crustaceans (eg *Carcinus, Crangon,, Gammarus, Corophium*) and dipteran

					flies.
		Presence and abundance of food species.	Presence and abundance of eelgrass and green algae. Measured periodically (frequency to be determined).	Presence and abundance of food species should not deviate significantly from an established baseline, subject to natural change.	*Zostera* and *Enteromorpha* are an important food source of grazing birds.
	Saltmarsh.	Extent.	Area (ha.) Measured once during reporting cycle.	No decrease in extent of saltmarsh from established baseline, subject to natural change.	Important roosting and feeding areas.
		Presence and abundance of food species.	Presence and abundance of soft-leaved grasses & herbs. Measured periodically (frequency to be determined).	Presence and abundance of characteristic food species should not deviate significantly from an established baseline, subject to natural change.	Important food source for wildfowl. Characteristic food species include *Agrostis stolonifera, Puccinellia maritima, Trifolium repens, Spergularia marina, Triglochin maritima, Aster tripolium, Plantago spp., Salicornia spp.*
Internationally important assemblage of non-breeding waterfowl including regularly occurring migratory species.	Saltmarsh.	Presence and abundance of prey species.	Presence and abundance of invertebrates. Measured periodically (frequency to be determined).	Presence and abundance of prey species should not deviate significantly from and established baseline, subject to natural change.	Important food source for waders. Prey species include molluscs (eg *Hydrobia*).
		Vegetation characteristics	Range of vegetation heights, measured periodically (frequency to be determined).	Range of vegetation heights should not deviate significantly from an established baseline, subject to natural change.	Vegetation of <10cm is required throughout areas for roosting and feeding.
	Sand and shingle.	Extent.	Area (ha.) Measured once during reporting cycle.	No decrease in extent of sand and shingle from established baseline, subject to natural change.	Important roosting areas.
	Saltmarsh; intertidal mudflats and sandflats; sand and shingle.	Disturbance in feeding and roosting areas.	Reduction in numbers or displacement of birds attributable to human disturbance. Measured annually using 5 year peak mean data on bird populations.	No significant reduction in numbers of or displacement of birds attributable to human disturbance from an established baseline, subject to natural change.	Excessive disturbance can result in reduced food intake and/or increased energy expenditure.
		Absence of obstructions to	Openness of terrain unrestricted by	No increase in obstructions to existing view lines.	Waterfowl require unrestricted views to allow early detection of predators when

		view lines	obstructions		feeding and roosting.

Table 5.4 Favourable Condition Table for the Gibraltar Point Special Protection Area

Feature	Sub-feature	Attribute	Measure	Target	Comments
Internationally important Annex 1 bird population Little Tern *(Sterna albifrons)*	Shallow coastal waters	Presence and abundance of prey species	Presence and abundance of small fish, crustaceans, molluscs and worms. Measured periodically (frequency to be determined).	Presence and abundance of prey species should not deviate significantly from an established baseline, subject to natural change.	Availability of prey species e.g. crustaceans, sandeels and sprats is important during the breeding period (April-August). Baseline conditions yet to be established.
	Sand and shingle	Extent	Area (ha.) measured once during reporting cycle.	No decrease in extent of sand and shingle from established baseline, subject to natural change.	Important nesting habitat.
		Vegetation cover/density	Ratio of open ground with sparse vegetation and bare surfaces. Measured periodically (frequency to be determined),	Ratio of open ground with sparse vegetation and bare surfaces should not deviate significantly from an established baseline, subject to natural change.	Open areas of largely bare sand and shingle should comprise unrestricted views over > 200m with vegetation cover < 10% and the remainder bare during the breeding period (April-August)..
		Predation and disturbance in nesting areas	Reduction in breeding success attributable to human disturbance or predation. Measured annually.	No significant reduction in breeding success attributable to human disturbance or predation.	The breeding success of Little Terns is particularly vulnerable to disturbance and predation.
Internationally important non-breeding populations of regularly	Intertidal mudflats and sandflats	Extent	Area (ha.) measured once during reporting cycle.	No decrease in extent of intertidal mud and sand from established baseline, subject to natural change.	Important feeding and roosting areas.
		Presence and abundance of prey species.	Presence and abundance of intertidal molluscs, crustaceans, and worms. Measured periodically (frequency to be	Presence and abundance of prey species should not deviate significantly from an established baseline, subject to natural change.	Prey species include molluscs (eg *Macoma*, *Mytilus*), marine worms (eg *Arenicola*, *Nereis*), and crustaceans (eg *Bathyporeia*, *Crangon*).

			determined).		
	Saltmarsh	Extent	Area (ha.) measured once during reporting cycle.	No decrease in extent of saltmarsh from established baseline, subject to natural change.	Important roosting habitat.
		Vegetation characteristics	Range of vegetation heights, measured periodically (frequency to be determined).	Range of vegetation heights should not deviate significantly from an established baseline, subject to natural change.	Vegetation of <10cm is required throughout areas for roosting and feeding.
	Sand and shingle	Extent	Area (ha.) measured once during reporting cycle.	No decrease in extent of sand and shingle from established baseline, subject to natural change.	Important roosting habitat
Internationally important non-breeding populations of regularly	Intertidal mudflats and sandflats; saltmarsh; sand and shingle	Disturbance in feeding and roosting areas	Reduction in numbers or displacement of birds attributable to human disturbance. Measured annually using 5 year peak mean data on bird populations.	No significant reduction in numbers of or displacement of birds attributable to human disturbance from an established baseline, subject to natural change.	Excessive disturbance can result in reduced food intake and/or increased energy expenditure.
	Intertidal mudflats and sandflats; saltmarsh; sand and shingle	Absence of obstructions to view lines	Openness of terrain unrestricted by obstructions	No increase in obstructions to existing view lines.	Waterfowl require unrestricted views to allow early detection of predators when feeding and roosting.

7. Advice on operations

English Nature has a duty under Regulation 33(2)(b) of The Conservation (Natural Habitats &c.) Regulations 1994 to advise other relevant authorities as to 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. Information on how English Nature has developed this advice is given in Section 7.2, and on how it may be reviewed and updated in the future, in Section 7.4.

The advice is provided in summary form in Tables 6 and 7 and Section 7.5 to 7.8 and with more detail in Tables 8 and 10 and section 7.9, including advice in relation to specific interest features and their sub-features.

7.1 Purpose of advice

The aim of this advice is to enable relevant authorities to direct and prioritise their work on the management of activities that pose the greatest potential threat to the favourable condition of interest features on the Wash and North Norfolk Coast European marine site. The advice is linked to the conservation objectives for interest features and will help provide the basis for detailed discussion within the management group to formulate and agree a management scheme to agreed time scales for the site. The Directive requires only consideration of activities that could lead to a deterioration of the natural habitats and habitats of species or significant disturbance of species in terms of meeting the site's conservation objectives. The advice given here will inform on, but is without prejudice to, any advice to be given subsequently under Regulation 48 or Regulation 50 on operations that qualify as plans or projects within the meaning of Article 6 of the Habitats Directive.

7.2 Methods for assessment

To develop this advice on operations English Nature has used a three step process involving:

- an assessment of the **sensitivity** of the interest features or their component sub-features to operations;

- an assessment of the **exposure** of each interest feature or their component sub-features to operations; and

- a final assessment of current **vulnerability** of interest features or their component sub-features to operations.

This three step process builds up a level of information necessary to manage activities in and around the European marine site in an effective manner. Through a consistent approach, this process enables English Nature to both explain the reasoning behind our advice and identify to competent and relevant authorities those operations which pose the most current threats to the favourable condition of the interest features on the European marine site.

All the scores of relative sensitivity, exposure and vulnerability are derived using best available scientific information and informed scientific interpretation and judgement. The process uses sufficiently coarse categorisation to minimise uncertainty in information, reflecting the current state of our knowledge and understanding of the marine environment. Information has been gathered from a range of sources such as ABP (1999), Gubbay & Knapman (1999) and Cole *et al.*, (1999).

7.2.1 Sensitivity assessment

The sensitivity assessment used is an assessment of the relative sensitivity of the interest features or the component sub-features of the Wash and North Norfolk Coast European marine site to the effects of broad categories of human activities. In relation to this assessment, sensitivity has been defined as the intolerance of a habitat, community or individual (or individual colony) of a species to damage, or death, from an external factor (Hiscock, 1996). As an example, seagrass beds are highly sensitive to increases in turbidity of the surrounding water. This reduces the light penetration which in turn, prevents adequate photosynthesis.

The sensitivity assessments of the interest features or their component sub-features of the Wash and North Norfolk Coast European marine site are based primarily upon a series of UK Marine SACs *Life* Project Task Reports _An overview of dynamic and sensitivity characteristics for conservation and management of marine SACs_ (see references).

The sensitivity assessments are based on current information but may develop with improvements in scientific knowledge and understanding. In particular, English Nature and Scottish Natural Heritage have commissioned the Marine Biological Association of the UK, through its Marine Life Information Network (MarLIN) to provide detailed sensitivity information to underpin this advice, over the next three years, to be made available to all over the World Wide Web (www.marlin.ac.uk).

7.2.2 Exposure assessment

This has been undertaken for the Wash and North Norfolk Coast European marine site by assessing the relative exposure of the interest features or their component sub-features on the site to the effects of broad categories of human activities currently occurring on the site as at February 2000 (Tables 9 and 11). For example, the exposure of interest features within the site to changes in the thermal regime as a result of human activities is negligible but exposure of some of the interest features to nutrient enrichment is high.

7.2.3 Vulnerability assessment

The third step in the process is to determine the vulnerability of interest features or their component sub- features to operations. This is an integration of sensitivity and exposure. Only if a feature is both sensitive and exposed to a human activity will it be considered vulnerable. In this context therefore, _vulnerability_ has been defined as the exposure of a habitat, community or individual (or individual colony) of a species to an external factor to which it is sensitive (Hiscock, 1996). For example, *Sabellaria* reefs are highly sensitive to physical loss, through aggregate extraction, which would result in the complete removal of the habitat. However, the *Sabellaria* communities in the Wash are not currently considered vulnerable to such activities, as aggregate extraction does not occur within the Wash. However, in Aggregate Area 107, just offshore from the Wash where the best UK example of a *Sabellaria* reef exists, aggregate extraction exclusion zones have been put in place to protect the sensitive reef. The process of deriving and scoring relative vulnerability is provided in Appendix III.

7.3 Format of advice

The advice is provided within six broad categories of operations which may cause deterioration of natural habitats or the habitats of species, or disturbance of species. This approach therefore:

- enables links to be made between human activities and the ecological requirements of the habitats or species, as required under Article 6 of the Habitats Directive;

- provides a consistent framework to enable relevant authorities in England to assess the effect of activities and identify priorities for management within their areas of responsibility; and

- is appropriately robust to take into account the development of novel activities or operations which may cause deterioration or disturbance to the interest features of the site and should have sufficient stability to need only infrequent review and updating by English Nature.

These broad categories provide a clear framework against which relevant authorities can assess activities under their responsibility. The more detailed information in Tables 8 and 10 provides relevant authorities with a context against which to consider an assessment of _significant effect_ of any plans or projects which may affect the site and a basis to inform on the scope and nature of appropriate assessments required in relation to plans and projects. It is important to note that this advice is only a starting point for assessing impacts. It does not remove the need for the relevant authorities to formally consult English Nature over individual plans and projects where required to do so under the Regulations.

7.4 Update and review of advice

Information as to the operations which may cause deterioration of natural habitats or the habitats of species, or disturbance of species, for which the site has been designated, is provided in light of what English Nature knows about current activities and patterns of usage at the Wash and North Norfolk Coast European marine site. English Nature expects that the information on current activities and patterns of usage (which was used to derive Table 9 and 11) will be supplemented as part of the process of developing the management scheme through further discussion with the relevant authorities and advisory groups. As such, it is important that future consideration of this advice by relevant authorities and others takes account of changes in the usage patterns that have occurred at the site, over the intervening period, since the advice was issued. In contrast, the information provided in this advice on the sensitivity of interest features or sub-features (Tables 8 and 10) is relatively stable and will only change as a result of an improvement in our scientific knowledge, which will be a relatively long term process. Advice for sites will be kept under review and may be periodically updated through discussions with relevant authorities and others to reflect significant changes in our understanding of sensitivity together with the potential effects of plans and projects on the marine environment.

7.5 Summary of advice on operations for the Wash & North Norfolk Coast SAC

7.5.1 Large shallow inlets and bays

In pursuit of the conservation objective for the large shallow inlet and bay (Section 5.1), the relevant and competent authorities for the Wash and North Norfolk Coast European marine site are advised to manage human activities within their remit such that they do not result in deterioration or disturbance through any of the following:

- Physical loss by removal and/or by smothering
- Physical damage resulting from abrasion and/or selective extraction
- Increased synthetic and/or non-synthetic toxic contamination
- Changes in nutrient and/or organic enrichment and/or in salinity
- Biological disturbance through the introduction of non-native species and/or the selective extraction of species

7.5.2 Sandbanks which are slightly covered by seawater all the time

In pursuit of the conservation objective for the sandbanks which are slightly covered by seawater all the time (Section 5.2), the relevant and competent authorities for the Wash and North Norfolk Coast European marine site are advised to manage human activities within their remit such that they do not result in deterioration or disturbance through any of the following:

- Removal of subtidal sandbank habitats
- Physical damage resulting from abrasion and/or selective extraction
- Increased synthetic and/or non-synthetic toxic contamination
- Changes in organic enrichment
- Biological disturbance through the selective extraction of species

7.5.3 Mudflats and sandflats not covered by seawater at low tide

In pursuit of the conservation objective for the mudflats and sandflats not covered by seawater at low tide (Section 5.3), the relevant and competent authorities for the Wash and North Norfolk Coast European marine site are advised to manage human activities within their remit such that they do not result in deterioration or disturbance through any of the following:

- Removal and/or smothering of intertidal sediment habitats
- Physical damage resulting from abrasion and/or selective extraction
- Increased synthetic and/or non-synthetic toxic contamination
- Changes in Nutrient and/or organic enrichment and/or in salinity levels
- Biological disturbance through the introduction of non-native species and/or the selective extraction of species

7.5.4 Glasswort and other annuals colonising mud and sand

In pursuit of the conservation objective for glasswort and other annuals colonising mud and sand (Section 5.4), the relevant and competent authorities for the Wash and North Norfolk Coast European marine site are advised to manage human activities within their remit such that they do not result in deterioration or disturbance through any of the following:

- Physical loss by removal
- Physical damage resulting from abrasion and/or selective extraction
- Biological disturbance through the selective extraction of species

7.5.5 Atlantic salt meadows

In pursuit of the conservation objective for the Atlantic salt meadows (Section 5.5), the relevant and competent authorities for the Wash and North Norfolk Coast European marine site are advised to manage human activities within their remit such that they do not result in deterioration or disturbance through any of the following:

- Physical loss by removal
- Physical damage resulting from abrasion and/or selective extraction
- Changes in salinity levels
- Biological disturbance through the selective extraction of species

7.5.6 Mediterranean saltmarsh scrubs

In pursuit of the conservation objective for Mediterranean saltmarsh scrubs (Section 5.6), the relevant and competent authorities for the Wash and North Norfolk Coast European marine site are advised to manage human activities within their remit such that they do not result in deterioration or disturbance through any of the following:

- Physical loss by removal
- Physical damage resulting from abrasion and/or selective extraction

7.5.7 Common seals

In pursuit of the conservation objective for Common seals (Section 5.7), the relevant and competent authorities for the Wash and North Norfolk Coast European marine site are advised to manage human activities within their remit such that they do not result in deterioration or disturbance through any of the following:

- Physical loss by removal
- Non-physical disturbance through noise and/or visual presence
- Toxic contamination through the introduction of synthetic and/or non-synthetic compounds
- Biological disturbance through the introduction of microbial pathogens

7.6 Summary of advice on operations for the Wash SPA

In pursuit of the conservation objective for habitats supporting internationally important populations of regularly occurring species listed on Annex 1of the EU Birds Directive (Section 5.8), the relevant and competent authorities for The Wash and North Norfolk Coast European marine site are advised to manage human activities within their remit such that they do not result in deterioration or disturbance through any of the following :

- Physical loss through removal of habitat.
- Increased non-toxic contamination through changes in turbidity.

In pursuit of the conservation objective for habitats supporting the internationally important assemblage of waterfowl including the internationally important populations of regularly occurring migratory species (Section 5.8), the relevant and competent authorities for The Wash and North Norfolk Coast European marine site are advised to manage human activities within their remit such that they do not result in deterioration or disturbance through any of the following :

- Physical loss through removal or smothering of habitats.
- Physical damage from abrasion and/or selective extraction.
- Disturbance from noise and/or visual activities.
- Increased non-toxic contamination through nutrient enrichment and/or organic enrichment.
- Biological disturbance through selective extraction of species.

7.7 Summary of advice on operations for The North Norfolk Coast SPA

In pursuit of the conservation objective for habitats supporting internationally important populations of regularly occurring species listed on Annex 1of the EU Birds Directive (Section 5.9), the relevant and competent authorities for The Wash and North Norfolk Coast European marine site are advised to manage human activities within their remit such that they do not result in deterioration or disturbance through any of the following :

- Physical loss through removal of habitats.
- Physical damage from abrasion and /or selective extraction.
- Disturbance from noise and/or visual activities.
- Increased non-toxic contamination through nutrient enrichment and/or organic enrichment and/or changes in turbidity.
- Biological disturbance through selective extraction of species.

In pursuit of the conservation objective for habitats supporting the internationally important assemblage of waterfowl including the internationally important populations of regularly occurring migratory species (Section 5.9), the relevant and competent authorities for The Wash and North

Norfolk Coast European marine site are advised to manage human activities within their remit such that they do not result in deterioration or disturbance through any of the following :

- Physical loss through removal of habitats.
- Physical damage from abrasion and selective extraction.
- Disturbance from noise and/or visual activities.
- Increased non-toxic contamination through nutrient enrichment and/or organic enrichment and/or changes in salinity.
- Biological disturbance through selective extraction of species.

7.8 Summary of advice on operations for Gibraltar Point SPA

In pursuit of the conservation objective for habitats supporting internationally important populations of regularly occurring species listed on Annex 1 of the EU Birds Directive (Section, 5.10), the relevant and competent authorities for The Wash and North Norfolk Coast European marine site are advised to manage human activities within their remit such that they do not result in deterioration or disturbance through any of the following :

- Physical loss through removal of habitats.
- Physical damage from abrasion and /or selective extraction.
- Disturbance from noise and/or visual activities.

In pursuit of the conservation objective for habitats supporting the internationally important populations of regularly occurring migratory species (Section 5.10), the relevant and competent authorities for The Wash and North Norfolk Coast European marine site are advised to manage human activities within their remit such that they do not result in deterioration or disturbance through any of the following :

- Physical loss through removal of habitats.
- Physical damage from abrasion and/or selective extraction.
- Disturbance from noise and/or visual activities.
- Increased non-toxic contamination through nutrient enrichment and/or organic enrichment.
- Biological disturbance through selective extraction of species.

Table 6 showing operations which may cause deterioration or disturbance to the Wash and North Norfolk Coast European marine site interest features at current levels of use[6]
[6]

The advice below is not a list of prohibitions but rather a checklist for operations which may need to be subject to some form of management measures(s) or further measures where actions are already in force. Examples of activities under relevant authority jurisdiction are also provided. Operations marked with a _ indicate those features (or some component of them) that are considered to be highly or moderately vulnerable to the effects of the operations.

Standard list of categories of operations which may cause deterioration or disturbance	Large shallow inlets and bays	Subtidal sandbanks	Intertidal mudflats and sandflats	Glasswort & other annuals	Atlantic salt meadows	Mediterranean saltmarsh scrub	Common Seals
Physical Loss							
Removal (e.g. harvesting, land claim, coastal development)	_	_	_	_	_	_	_
Smothering (e.g. disposal of dredge spoil)	_		_				
Physical Damage							
Siltation (e.g. dredging, outfalls)							
Abrasion (e.g. mobile benthic fishing, anchoring)	_	_	_	_	_	_	
Selective extraction (e.g. aggregate dredging, entanglement)	_	_	_	_	_		_
Non-physical disturbance							
Noise (e.g. boat activity)							_
Visual presence (e.g. recreational activity)							_
Toxic contamination							
Introduction of synthetic compounds (e.g. TBT, PCBs)	_	_	_				_
Introduction of non-synthetic compounds (e.g. heavy metals, hydrocarbons)	_	_	_				_
Introduction of radionuclides							
Non-toxic contamination							
Nutrient enrichment (e.g. agricultural run-off, outfalls)	_		_				
Organic enrichment (e.g. mariculture, outfalls)	_	_	_				
Changes in thermal regime (e.g. power stations)							
Changes in turbidity (e.g. dredging)							
Changes in salinity (e.g. water abstraction, outfalls)	_		_		_		

Biological disturbance							
Introduction of microbial pathogens							–
Introduction of non-native species and translocation	–		–				
Selective extraction of species (e.g. commercial & recreational fishing)	–	–	–	–	–		

[6]This advice has been developed using best available scientific information and informed scientific interpretation and judgement (as at February 2000). This process has used a coarse grading of relative sensitivity, exposure and vulnerability of each interest feature to different categories of operation based on the current state of our knowledge and understanding of the marine environment. This is shown in the sensitivity and vulnerability matrices at Table 7. The advice is indicative only, and is given to guide relevant authorities and others on particular operations which may cause deterioration of natural habitats or the habitats of species, or disturbance of species for which the site has been designated. The advice, therefore, is not a list of prohibitions but rather a check list for operations which may need to be subject to some form of management measure(s) or further measures where actions are already in force.

The precise impact of any category of operation occurring on the site will be dependent upon the nature, scale, location and timing of events. More detailed advice is available from English Nature to assist relevant authorities in assessing actual impacts and cumulative effects. Assessment of this information should be undertaken in the development of the management scheme by the management group and through wider consultation.

In accordance with Government policy guidance, the advice on operations is feature and site specific, and provided in the light of current activities and patterns of usage at the site (as at February 2000). As such, it is important that future consideration of this advice by relevant authorities, and others, takes account of changes in usage patterns that have occurred at the site over the intervening period. Advice for sites will be kept under review and may be periodically updated through discussions with relevant authorities, and others, to reflect significant changes in our understanding of sensitivity together with the potential effects of plans or projects on the marine environment. The provision of the statutory advice given here, on operations which may cause deterioration of natural habitats or the habitats of species, or disturbance of species, for which the site has been designated, under Regulation 33(2), is provided without prejudice to specific advice given under Regulation 48 (3) or Regulation 50 on individual operations that qualify as plans or projects within the meaning of Article 6 of the Habitats Directive.

Table 7 Showing operations which may cause deterioration or damage to the SPA interest features of The Wash and North Norfolk Coast marine site at current levels of use

The advice below is not a list of prohibitions but rather a checklist for operations which may need to be subject to some form of management measure(s) or further measures where actions are already in force. Examples of activities under relevant authority jurisdiction are also provided. Operations marked with a _ indicate those features (or some component of them) that are considered to be highly or moderately vulnerable to the effects of the operations.

(a) THE WASH SPA

Standard list of categories of operations which may cause deterioration or disturbance	**Internationally important Annex 1 birds** (Common Tern & Little Tern)	**Internationally important assemblage of waterfowl including Internationally important populations of migratory species**
Physical Loss		
Removal (eg. harvesting, land claim, coastal development)	_	_
Smothering (eg. disposal of dredge spoil)		_
Physical Damage		
Siltation (eg. dredging, outfalls)		
Abrasion (eg. mobile benthic fishing, anchoring)		_
Selective extraction (eg. aggregate dredging, entanglement)		_
Non-physical Disturbance		
Noise (eg. boat activity)		_
Visual presence (eg. recreational activity)		_
Toxic Contamination		
Introduction of synthetic compounds (eg. TBT, PCBs)		_
Introduction of non-synthetic compounds (eg. heavy metals, hydrocarbons)		_
Introduction of radionuclides		
Non-toxic Contamination		
Nutrient enrichment (eg. agricultural runoff, outfalls)		_
Organic enrichment (eg. mariculture, outfalls)		_
Changes in thermal regime (eg. power stations)		
Changes in turbidity (eg. dredging)	_	
Changes in salinity (eg. water abstraction, outfalls)		
Biological Disturbance		
Introduction of microbial pathogens		
Introduction of non-native species and translocation		_
Selective extraction of species (eg. commercial and recreational fishing		_

(b) NORTH NORFOLK COAST SPA

Standard list of categories of operations which may cause deterioration or disturbance	**Internationally important Annex 1 birds** (Montagu's Harrier, Marsh Harrier, Avocet, Sandwich Tern, Common Tern, Little Tern)	**Internationally important assemblage of waterfowl including internationally important populations of migratory species**
Physical Loss Removal (eg. harvesting, land claim, coastal development) Smothering (eg. disposal of dredge spoil)	_	_
Physical Damage Siltation (eg. dredging, outfalls) Abrasion (eg. mobile benthic fishing, anchoring) Selective extraction (eg. aggregate dredging, entanglement)	_ _	_ _
Non-physical Disturbance Noise (eg. boat activity) Visual presence (eg. recreational activity)	_ _	_ _
Toxic Contamination Introduction of synthetic compounds (eg. TBT, PCBs) Introduction of non-synthetic compounds (eg. heavy metals, hydrocarbons) Introduction of radionuclides		
Non-toxic Contamination Nutrient enrichment (eg. agricultural runoff, outfalls) Organic enrichment (eg. mariculture, outfalls) Changes in thermal regime (eg. power stations) Changes in turbidity (eg. dredging) Changes in salinity (eg. water abstraction, outfalls)	_ _ _	_ _ _
Biological Disturbance Introduction of microbial pathogens Introduction of non-native species and translocation Selective extraction of species (eg. commercial and recreational fishing		_ _

(c) GIBRALTAR POINT SPA

Standard list of categories of operations which may cause deterioration or disturbance	**Internationally important Annex 1 birds** (Little Tern)	**Internationally important populations of migratory species**
Physical Loss Removal (eg. harvesting, land claim, coastal development) Smothering (eg. disposal of dredge spoil)	_	_
Physical Damage Siltation (eg. dredging, outfalls) Abrasion (eg. mobile benthic fishing, anchoring) Selective extraction (eg. aggregate dredging, entanglement)	_ _	_ _
Non-physical Disturbance Noise (eg. boat activity) Visual presence (eg. recreational activity)	_ _	_ _
Toxic Contamination Introduction of synthetic compounds (eg. TBT, PCBs) Introduction of non-synthetic compounds (eg. heavy metals, hydrocarbons) Introduction of radionuclides		
Non-toxic Contamination Nutrient enrichment (eg. agricultural runoff, outfalls) Organic enrichment (eg. mariculture, outfalls) Changes in thermal regime (eg. power stations) Changes in turbidity (eg. dredging) Changes in salinity (eg. water abstraction, outfalls)		
Biological Disturbance Introduction of microbial pathogens Introduction of non-native species and translocation Selective extraction of species (eg. commercial and recreational fishing		

7.9 Detailed advice on operations for The Wash & North Norfolk Coast SAC

This section of the advice relates to the vulnerability of the interest features and sub-features of the Wash and North Norfolk Coast European marine site to current levels of human usage as set out in Table 7 and summarised in Table 6. Further explanation of the sensitivity of the interest features or sub-features follows with examples of their exposure and therefore their vulnerability to damage or disturbance from the listed categories of operations. This enables links to be made between the categories of operation and the ecological requirements of the European marine site_s interest features, as set out in Sections 3 and 4.

7.9.1 Large shallow inlets and bays

The Wash is the largest bay in England and supports a wide diversity of habitats and species as well as important habitats for wintering and migrant waterfowl which rely on the structure and function of these habitats. Although this feature includes all the other features found within the Wash the comments below refer only to the two sub-features which are confined to it i.e. subtidal boulder and cobble communities and subtidal mixed sediment communities. For the other features found within the Wash see 7.9.2, 7.9.3, 7.9.4, 7.9.5, 7.9.6 and 7.9.7. Note, these will also have to be taken into account when considering any management measures within the Wash.

i) Physical loss

- All the sub-features of the embayment are sensitive to loss resulting from removal or smothering of the habitats because such losses would be permanent and could lead to changes in the coastal processes within the embayment which could result in the migration of river channels or changes in sediment type. Such changes would have consequences for other interest features in bay and their species composition within the bay. Either of these processes can be the result of one-off events or the cumulative effect of continuous activities. Many communities are also interdependent upon the ecological functioning of others and this link must be not be overlooked when the potential impact of smothering or removal is considered.

- Both subtidal boulder and cobble communities and subtidal mixed sediment communities are considered to be moderately vulnerable to removal of the habitats by virtue of their high sensitivity. Loss of these habitats and communities can occur as a result of benthic fishing activity which can lead to removal of the hard substrata, particularly if the activity is regularly occurring or continuous, though the exposure is currently considered to be low. Projects resulting in physical loss of habitat will need careful assessment and where necessary measures put in place to mitigate against the impacts. Activities that may lead to loss of these habitats may, however, also lead to physical damage to the communities - see below.

ii) Physical damage

- Both subtidal hard substrata sub-features are considered moderately vulnerable to damage caused by abrasion. Of particular concern is physical damage to the fragile communities within the bay such as the S*abellaria spinulosa* reef, which is reported to be damaged by benthic fishing gear (Berhahn and Vorberg 1993). Whilst *S. spinulosa* is fast growing, large well-developed reefs such as those found in the Wash are considered to be several years old (Holt *et al.*, 1998) and would take some time to recover following damage to their structure. There is also evidence from the Wadden Sea that sustained fishing activity in areas that used to contain *S. spinulosa* reef has resulted in permanent loss of the reef with replacement by mussel communities (Reise & Schubert, 1987). Projects which may result in physical damage to any of these communities will need careful assessment and where necessary measures put in place to mitigate against the impact physical damage.

iii) Toxic contamination

- Both subtidal hard substrata sub-features are considered to be moderately vulnerable to toxic contamination resulting from the introduction of synthetic compounds. These features are particularly sensitive to synthetic compounds (such as polychlorinated biphenols (PCBs) because they are known to have toxic effects even in low concentrations (particularly to invertebrate larvae) and to be capable of high levels of bioaccumulation within the food chain. Whilst the effects of individual synthetic compounds on the many invertebrate species found in these communities is poorly understood, there is evidence of high levels of toxicity to some groups of species such as crustaceans (see Cole *et al.,* 1999). Despite the presence of potential sources and the large catchment of the Wash, this feature is considered to have a low exposure to toxic contamination at present

iv) Biological disturbance

- The communities found on both sub-features are considered to be moderately vulnerable to biological disturbance caused by selective extraction of species. Whilst the precise role played by individual species within a community is poorly understood, removal of individual components of the food chain (such as crabs, lobsters, mussel spat and shrimp) may adversely affect the community structure as well as the species richness, hence their moderate sensitivity. Other species may also be removed as by-catch. For example, the collection of mussel spat from the subtidal areas within the Wash results in the removal of other species of bryozoan and hydroid turfs on which the mussels often settle.

7.9.2 Sandbanks which are slightly covered by seawater at all times

i) Physical loss

- The Wash and North Norfolk Coast supports a wide range of subtidal sediment communities, many of which are sensitive to physical loss. The gravel and sand communities and the muddy sand communities in particular, are highly sensitive to physical loss through removal and moderately sensitive to physical loss through smothering. Although subtidal sandbanks are relatively high energy environments, often with a good ability to recover from physical disturbance, loss of any one or more of its biotopes through removal of sediment habitat may result in a decrease of the diversity of the interest feature and could have direct or indirect impacts on the structure or functioning of adjacent habitats. Due to current levels of exposure, subtidal sandbanks are currently considered to have moderate vulnerability to removal.

ii) Physical damage

- Subtidal sandbanks are moderately sensitive to physical damage through siltation or abrasion, and are highly sensitive to physical damage through the selective extraction of part of that habitat. Abrasion of subtidal sediments or extraction of parts of the sandbanks may place a greater stress on those specialist communities inhabiting them, which may lead to changes in their community structures. For example, benthic communities can be affected by mobile benthic fishing gear such as beam trawls as the surface is abraded and certain elements of the habitat selectively removed. Subtidal sandbanks within the Wash and North Norfolk Coast have a high exposure to activities which may cause physical damage though abrasion and selective extraction and as a consequence, are given a high vulnerability score. The potential effects of physical damage to *Ensis* spp. beds and its associated communities are currently being

investigated through an appropriate assessment, following concerns about the commercial extraction of *Ensis* species.

iv) Toxic contamination

- All the sub-features of the subtidal sandbanks are considered to be moderately sensitive to toxic contamination through the introduction of synthetic or non-synthetic compounds. Many synthetic compounds, such as polychlorinated biphenols (PCBs), are known to have toxic effects even in low concentrations and to be capable of high levels of bioaccumulation within many benthic organisms, such as polychaete worms. Toxic compounds can have lethal or sub-lethal effects on marine species, potentially altering the composition of their communities. The potential effects of these pollutants varies according to the state and availability of the compound and the characteristics and organisms of the receiving system. Where effects are lethal, removal of individual species may result in a dominance of pollution tolerant organisms. Sub-lethal effects however, may affect the healthy functioning of organisms such as its reproduction, physiology or genetics, which may ultimately reduce the organism's fitness for survival. Some sediment species display a tolerance of contaminants such as heavy metals, although the larval and juvenile stages can be very sensitive (Davidson & Hughes, 1998).

- Despite the presence of potential sources of toxic contaminants and the large catchment area, particularly into the Wash, Environment Agency monitoring programmes suggest that subtidal sandbanks have a low exposure to toxic contamination at present. However, other studies such as the recent work by Plymouth Marine Laboratory, suggest there are higher levels of toxic contamination exposure which could affect this interest feature. In view of this uncertainty a precautionary approach has been adopted and a moderate exposure score given to the sub-features of subtidal sandbanks until this uncertainty can be resolved. This exposure score consequently produces a moderate vulnerability rating to the introduction of synthetic and non-synthetic toxic compounds. Monitoring and periodic review is necessary to further understand the degree of exposure and the likely effects.

- In general, subtidal sandbanks tend to be less vulnerable to the risk of oil spills than intertidal sediment environments, unless the oil is dispersed during clean-up operations, or if wave action allows sediment mobility and the incorporation of oil into the sediments.

v) Non-toxic contamination

- Increases in organic material can result in a reduction in species diversity and an increase in those opportunistic species which can tolerate such stressed conditions. Certain polychaete worms in particular, thrive in organically enriched sediments at the expense of other invertebrates. A high organic loading can ultimately lead to anoxic conditions within the sediments. Within the Wash and North Norfolk Coast European marine site, subtidal sandbanks are considered to have a moderate exposure to non-toxic contamination by organic enrichment, mainly from the large riverine input. As a result of this sensitivity and its current exposure, at present subtidal sandbanks are moderately vulnerable.

vi) Biological disturbance

- Subtidal sandbank communities are currently highly vulnerable to biological extraction through the selective extraction of species. Removal of specific elements of benthic communities may have consequences on the structure and functioning of the habitat. Certain species such as flatfish, play key predator roles, whereas others such as shrimps are important prey items for other species and the loss of one of more of

these species can alter the crucial balance of the system. There are several species associated with the subtidal benthic communities of the Wash and North Norfolk Coast which are currently selectively removed including crabs, lobsters, flatfish, shrimps and mussels. Other species such as *Ensis* spp., *Tapes* and *Spisula* may also be potentially subject to selective removal. As mentioned earlier, the potential effects of physical damage to *Ensis* spp. beds and its associated communities are currently being investigated through an appropriate assessment, following concerns about the commercial extraction of *Ensis* species.

7.9.3 Mudflats and sandflats not covered by seawater at low tide

i) Physical loss

- The intertidal sediments of the Wash and North Norfolk Coast are currently highly vulnerable to physical loss through removal, and moderately vulnerable to the effects of smothering. Many of these sediments support a high diversity of invertebrate species such as shellfish and marine worms, which in turn support a large number and range of predators such as fish and birds. Mudflats also play a crucial role in the supply of sediment to saltmarshes, of which three distinct internationally important types occur in the Wash and North Norfolk Coast European marine site. Loss of these intertidal habitats is likely to not only affect the favourable condition of the mudflats and sandflats interest feature, but also its ability to effectively support associated habitats and species. Intertidal sediments are also sensitive to smothering by substances such as oil. This can prevent oxygen transport to the substratum and can lead to anoxic conditions, resulting in the death of infaunal species. Tidal action will also serve to push oil into intertidal sands. Such physiochemical changes will favour the development of opportunistic communities (Elliott *et al.,* 1998)**.**

- Within the Wash, recent land claim and construction of training walls have led to the rapid, continuing expansion of saltmarsh at the expense of intertidal mudflats and sandflats. This, together with sea level rise, results in coastal squeeze which may lead to loss of important intertidal habitats, which themselves are natural sea defences and which contribute significantly to the reduction of tidal and wave energy. Land development may also lead to a change in the physical processes within the coastal system which may exacerbate any direct loss. Such processes, together with activities such as intertidal dredging, result in a medium exposure score for intertidal mudflats and sandflats to physical loss.

ii) Physical damage

- The mud communities and muddy sand communities sub-features of the intertidal mudflats and sandflats are sensitive to physical damage through siltation, abrasion and selective extraction. These habitats, dominated by bivalve molluscs and polychaete worms, are generally less dynamic than the coarser gravel and sand communities and are consequently less tolerant to physical disturbance. Physical damage to such soft sediment communities can alter the habitat structure which may lead to a change in its species composition. Excessive damage may ultimately result in the destabilisation of the sediment and an increase in its erosion.

- The site is exposed to a number of activities which may cause physical damage to this feature. Bait collection on the intertidal flats locally disturbs the sediment through digging and as a result of trampling. In relation to the intertidal mudflats and sandflats interest feature, this activity is seen as sustainable where traditional methods are employed, and should not be an issue for the management scheme. However, a distinction needs to be made between traditional sustainable activities and commercial exploitation of the resource. The latter may have an adverse effect on favourable condition and will need to be kept under regular review.

Dredging for shellfish in the intertidal also occurs and this may also lead to deterioration or disturbance of the interest feature. Exposure to physical damage through selective extraction and abrasion, primarily through these activities is therefore moderate. As a consequence, muddy sand communities are moderately vulnerable to these two processes.

iii) Toxic contamination

- All the sub-features of the intertidal mudflats and sandflats are considered to be highly sensitive to toxic contamination by both synthetic compounds such as PCBs and non-synthetic compounds such as hydrocarbons. Some toxic substances have an affinity for sediments, particularly those with a smaller grain size and a higher organic content such as mud and muddy sand. Many marine invertebrates such as polychaete worms and bivalve molluscs, which are often abundant within these sediments, are poor at regulating the uptake of contaminants and may, therefore, bioaccumulate these compounds.

- Despite the presence of potential sources of toxic contaminants and the large catchment area, particularly into the Wash, Environment Agency monitoring programmes suggest that subtidal sandbanks have a low exposure to toxic contamination at present. However, other studies such as the recent work by Plymouth Marine Laboratory, suggest there are higher levels of toxic contamination exposure which could affect this interest feature. In view of this uncertainty a precautionary approach has been adopted and a moderate exposure score given to the sub-features of subtidal sandbanks until this uncertainty can be resolved. This exposure score consequently produces a moderate vulnerability rating to the introduction of synthetic and non-synthetic toxic compounds. Monitoring and periodic review is necessary to further understand the degree of exposure and the likely effects.

- Historically there have been low exposures of this interest feature to oil. However, its high sensitivity to the potential effects of oil pollution should be noted and procedures to respond to oil incidents need to be kept under review.

iv) Non-toxic contamination

- Intertidal mudflats and sandflats are sensitive to nutrient and organic enrichment. An increase in nutrient loading in waters overlying the flats as a result for example of riverine input, can result in an elevated growth of opportunistic ephemeral algae such as *Enteromorpha* spp. in the form of algal mats. This can have smothering effects with an associated rise in anoxic conditions to the detriment of many invertebrate communities. Sediment communities can also act as nutrient sinks, trapping nutrients within the sediments and if they are subsequently disturbed these nutrients can then be released back into the system again. The mudflats and sandflats interest feature is considered to have a moderate exposure to non-toxic contamination at present through nutrient enrichment due to the large agricultural catchment of the Wash in particular. As such, the interest feature is currently moderately vulnerable to this process.

- Increased levels of organic material in the water column can also lead to depleted oxygen levels due to the increased activity of anaerobic bacteria which break down the organic material. A good supply of oxygen in the water column and within the sediment is vital for most marine species and elevated levels of organic material can alter this natural balance, potentially causing changes to the species composition and distribution on the interest feature. With exposure currently moderate, the vulnerability of this interest feature to organic enrichment is also currently moderate.

- Changes in salinity through a reduction in freshwater inputs may also affect the intertidal mudflats and sandflats interest feature by altering the biological structure of the communities, particularly where salinity sensitive species and communities occur. Changes in salinity can happen through a variety of ways including water abstraction within the river catchment. Reductions in river flows potentially leading to changes in salinity are an issue on the Norfolk coast. This feature is therefore currently moderately vulnerable to changes in salinity.

v) Biological Disturbance

- Intertidal mudflats and sandflats within the Wash and North Norfolk Coast are sensitive to biological disturbance, through the introduction, translocation or spread of non-native species. Introduced species may thrive at the expense of native species, resulting in a change in the biological composition and potentially, the healthy functioning of the feature and its associated communities.

- It is difficult to predict whether or when a non-native species may be introduced into the local marine system, although there are a number of activities occurring within or in the vicinity of the site that may pose a risk of non-native introduction such as mariculture. Indeed, non-native oysters which are currently cultivated in the Wash have now been found free-living on the intertidal flats. The occurrence of non-natives and methods for their possible introduction should be kept under surveillance.

- Intertidal mudflats and sandflats are exposed to a number of activities which may result in the deterioration of the habitat through the selective extraction of species such as bait digging and shellfish extraction. Though widespread, bait digging which can result in the local loss or reduction of particular infaunal species such as polychaete worms, is currently thought to be sustainable at historic levels of exposure. The moderate vulnerability of sand and gravel communities and muddy sand communities to selective extraction of species reflects their moderate sensitivity and medium exposure to a number of activities which may lead to this form of biological disturbance.

- These activities are seen as sustainable where traditional methods are employed, and should not be an issue for the management scheme. However, a distinction needs to be made between traditional sustainable activities and commercial exploitation of the resource. The latter may have an adverse effect on favourable condition and will need to be kept under regular review.

7.9.4 Samphire (glasswort) and other annuals colonising mud and sand

i) Physical loss

- Samphire (glasswort) and other annuals colonising mud and sand are highly sensitive to physical loss through removal, which can occur as a result of activities such as direct land claim and coastal construction. Coastal development may also create a barrier to the inland expansion of saltmarsh as a response to sea level rise. Changes to coastal processes can also alter the tidal regime which can affect the suitability of a habitat for saltmarsh plants.

- This feature is considered to be highly vulnerable to physical loss through removal, because seawalls over large areas of the site constrain the natural responses of the saltmarsh communities to sea level rise and local coastal process changes.

ii) Physical damage

- Samphire (glasswort) and other annuals colonising mud and sand are sensitive to abrasion. This may occur as a result of recreational activities such as off-road driving, or grazing livestock walking across the saltmarsh, which can damage plants directly and can compact the mudflat substrate. This can lead to highly localised loss of habitat with a subsequent potential impact on the saltmarsh_s physical and ecological structure.

- The interest feature is also exposed to a number of activities which may be termed traditional longshore activities such as the collection of samphire (glasswort) which is widespread throughout the site, (in places also subject to common rights), and could potentially result in localised loss and damage through selective extraction of the samphire and by trampling of the plants. These activities are seen as sustainable where traditional methods are employed, and should not be an issue for the management scheme. However, a distinction needs to be made between traditional sustainable activities and commercial exploitation of the resource. The latter may have an adverse effect on favourable condition and will need to be kept under regular review.

- The very local nature of recreational activities around most of the site means that trampling effects are highly localised. However grazing is widespread around the Wash with animals trampling and selectively eating plants. The extent of grazing around the Wash results in an overall moderate exposure and moderate vulnerability. Grazing around the Wash is implementing an English Nature initiative and is subject to monitoring to ensure significant adverse impacts are avoided.

iii) Biological disturbance

- Samphire (glasswort) communities are sensitive to biological disturbance through the introduction of invasive species such as common cord-grass *Spartina anglica*. This species is a robust and aggressive plant which out competes samphire (glasswort) communities for suitable substrate. However there is no evidence to suggest that this is happening within the site at present.

- The site is exposed to a number of activities which are widespread. The collection of samphire (glasswort) can potentially lead to localised loss of species through collection and trampling. These activities are seen as sustainable where traditional methods are employed, and should not be an issue for the management scheme. However, a distinction needs to be made between traditional sustainable activities and commercial exploitation of the resource. The latter may have an adverse effect on favourable condition and will need to be kept under regular review.

- Grazing is widespread around the Wash with animals selectively eating saltmarsh plants. The extent of grazing around the Wash results in an overall moderate exposure and moderate vulnerability. Grazing levels around the Wash are managed through an English Nature initiative and are subject to monitoring to ensure significant adverse impacts are avoided.

7.9.5 Atlantic salt meadows

i) Physical loss

- Saltmarshes are highly sensitive to physical loss through direct land reclamation and construction. Sea level rise may squeeze this habitat against sea walls and may result in the replacement of mid-marsh by pioneer saltmarsh. Changes to coastal processes can also alter the tidal regime which can affect the suitability of a habitat to saltmarsh plants.

- As with pioneer saltmarsh, this feature is considered to be highly vulnerable to removal, largely because over large areas of the site(especially the Wash) seawalls constrain the natural responses of the saltmarsh communities to sea level rise and local coastal process changes which produces moderate exposure levels.

ii) Physical damage

- Atlantic salt meadow communities are sensitive to abrasion and selective extraction. This may occur as a result of recreational activities such as off-road driving, or grazing livestock walking across the saltmarsh, which can damage plants directly and can compact the mudflat substrate. This can lead to highly localised loss of habitat with a subsequent potential impact on the saltmarsh_s physical and ecological structure.

- The interest feature is exposed to a number of activities which have the potential to cause physical damage. These may be termed traditional longshore activities such as the collection of samphire (glasswort) and bait digging which are both widespread throughout the site, (in places also subject to common rights), and could potentially result in localised loss and damage through trampling. However, these activities are seen as sustainable where traditional methods are employed, and should not be an issue for the management scheme. However, a distinction needs to be made between traditional sustainable activities and commercial exploitation of the resource. The latter may have an adverse effect on favourable condition and will need to be kept under regular review. There are instances where off-road vehicles have caused very localised but moderate damage at the upper end of the Atlantic salt meadow.

- In the Wash about 50% of the saltmarsh including Atlantic salt meadow is grazed for the Wash and is therefore exposed at moderate levels to trampling and other abrasive affects as a result. The high sensitivity of this feature produces a high vulnerability for abrasion, but moderate vulnerability to selective extraction. Grazing around the Wash is implementing an English Nature Trans-management initiative and is subject to monitoring to ensure significant adverse impacts are avoided.

iii) Toxic contamination

- Atlantic salt meadows are considered to have a moderate sensitivity to toxic contamination by synthetic and non-synthetic contaminants, and a low sensitivity to radionuclides. Although saltmarsh plants may be reasonably tolerant of heavy metals, they can bioaccumulate toxic compounds and act as sinks for them (Holt *et al*, 1995). This can have implications for the organisms, such as waterfowl, which depend upon a healthy functioning saltmarsh.

- Atlantic salt meadows are sensitive to oil, even at relatively low levels (Holt *et al*, 1995). This is mainly by virtue of their ability to trap sediments. Acute events such as oil spills can be particularly damaging to saltmarsh plants.

iv) Non-toxic contamination

- The transitional communities notably the tidal reed swamps are sensitive to changes in salinity as they are dependent on freshwater flows. On the North Norfolk coast water abstraction may be affecting freshwater flows across the saltmarshes and hence the salinities. The exposure to changes in salinity has therefore been scored as medium for this community and produces a moderate vulnerability.

v) Biological disturbance

- Atlantic salt meadow communities are sensitive to biological disturbance through the introduction of non-native species and activities which may affect its biological structure.

- In the Wash about 50% of the saltmarsh including Atlantic saltmeadow is grazed to implement an English Nature conservation strategy for the Wash and can affect the sward composition and structure. The extent of grazing around the Wash results in an overall moderate exposure and moderate vulnerability score. Grazing around the Wash is implementing an English Nature initiative and is subject to monitoring to ensure significant adverse impacts are avoided.

  - Cord-grass, *Spartina anglica* is not considered invasive in this community though it is present within the feature. The site is exposed to a number of activities as part of the longshore economy which occurs throughout the area. The collection of samphire (glasswort) can potentially lead to localised loss of species through collection. However, these activities are seen as sustainable where traditional methods are employed, and should not be an issue for the management scheme. However, a distinction needs to be made between traditional sustainable activities and commercial exploitation of the resource. The latter may have an adverse effect on favourable condition and will need to be kept under regular review.

7.9.6 Mediterranean saltmarsh scrubs

i) Physical loss

- Saltmarshes are sensitive to physical loss through direct land reclamation and construction. Sea level rise may squeeze this habitat against sea walls and may result in the replacement of mid-marsh by pioneer saltmarsh. Changes to coastal processes can also alter the tidal regime which can affect the suitability of a habitat to saltmarsh plants.

- This feature is seen as being highly vulnerable to physical loss, largely because over large areas of the site, seawalls constrain the natural responses of the salt marsh communities to sea-level rise and local coastal process changes.

ii) Physical damage

- Mediterranean saltmarsh scrub communities are sensitive to abrasion and selective extraction which may occur as a result of recreational activities such as off-road driving, which can damage plants directly. It is also exposed to activities such as sea defence maintenance and construction which may cause physical damage and localised loss. Damage to any one or more of the components of the community may affect the overall community structure of the interest feature.

- This community is found in the higher marsh areas which are more subject to traffic from walkers, vehicles and from construction work on seawalls. This has resulted in the moderate exposure and vulnerability scores.

7.9.7 Common seals

i) Physical loss

- Intertidal mudflats and sandflats form a crucial element of the habitat for common seals within the European marine site. Loss by removal of habitats or part of them may affect its suitability to support the common seal population.

ii) Physical damage

- Selective extraction of fish by netting may sometimes result in release of nets into the environment. Common seals are moderately sensitive to entanglement in large pieces of netting, which can cause a seal to drown directly, and smaller pieces may severely restrict normal swimming activity, and hence food-gathering ability (Bonner, 1989). Entanglement may also increase drag and therefore increase energy expenditure (Feldcamp, 1985). Common seals are also sensitive to other forms of plastic debris, such as small fragments which may be ingested, or plastic packing bands which are occasionally seen caught around the necks of seals; if this occurs when the seals are still growing they could eventually die (Thompson, 1989) Whilst there have been reports of seals with injuries caused by plastic packing bands from the Wash (RSPCA, pers. comm.) the exposure is considered to be low and therefore the seals are not considered vulnerable at present.

iii) Non-physical disturbance

- Common seals are sensitive to disturbance through both noise and visual presence. Although there is evidence that they become habituated to human presence, they are disturbed by unfamiliar noises and/or visual cues. Disturbance to haul-out sites can lead to increased energy expenditure as they are important for a variety of reasons including rest and sleep, and skin maintenance and moult (Brasseur *et al*, 1996). This is of particular significance for females during the moulting season, as their body mass is depleted following pregnancy and lactation (Thompson, 1989).

- Disturbance of common seal haul-out sites may lead to an increased risk of infection. Common seals have been observed with large open ulcers on their bellies. It has been suggested that these may arise from umbilical infections in pups. Healing followed by fresh infection could result in lesions persisting for several years. Undisturbed seals on haul-out sites will remain until the sea rises and they float off, but if seals are scared into the water, a pup with an unhealed navel following an adult with an unhealed ulcer might pick up an infection (Drescher, 1978, cited in Bonner, 1989).

- Common seals spend a large proportion of their time in the water within the site. Regard should therefore be given to the sensitivity of common seals whilst they are in the water and the potential disturbance from noise and visual activities (Cole *et al* 1999).

- Rest is especially important for pups. For up to two months after birth, mixed blood is used in the muscles and pups soon become exhausted and may not be able to follow the mother. Disturbance of nursing pups can result in poor condition and low weaning weights (Reijnders, 1981).

- The habitats used by the seal populations in both the Wash and North Norfolk are subjected to non-physical disturbance from both noise and visual presence. The evidence is that whilst regular commercial boat traffic and controlled seal watching is not a problem, irregular disturbance for example through uncontrolled approaches from walkers with and without dogs, or recreational boat traffic, may result in some of the effects described above. Common seals are therefore considered moderately exposed to noise and visual presence and combined with a high sensitivity they are considered highly vulnerable to non-physical disturbance.

iv) Toxic contamination

- Common seals have been found to contain high levels of pollutants, especially fat-soluble organochlorine compounds such as DDT and industrial polychlorinated biphenyls (PCBs) which accumulate in the blubber primarily through their food.

There is evidence that high PCB levels can lead to lowered reproductive capacity (Reijnders, 1986), and may suppress the immune system (de Swarl *et al*, 1994).

- Despite the presence of potential sources and the large catchment, particularly into the Wash, Environment Agency monitoring programmes suggest the feature has a low exposure to toxic contamination at present. However other studies by Plymouth Marine Laboratory on this site suggest there are higher levels of exposure to contamination. In view of this uncertainty a precautionary approach has been adopted and a moderate exposure score given until this uncertainty can be resolved. Given the high sensitivity of seals to toxic contamination, the moderate exposure produces a moderate vulnerability score. This situation needs monitoring and reviewing at intervals because it has the potential to have serious impacts not on this feature.

v) Biological disturbance

- Grey seals are also frequently re-introduced into the wild within the site after rehabilitation. Whilst a native species it is not known whether this has any affects on the common seal population.

- Common seals were subject in 1988 to an outbreak of the phocine distemper virus which is thought to have reduced the common seal population within the site by about two-thirds and numbers have not fully recovered unlike populations in other areas. Although exposure to this virus, and potentially others, is low, the high sensitivity of the seals to infections results in a moderately vulnerable score.

7.10 Detailed advice on operations for The Wash SPA

7.10.1 Internationally important populations of Annex 1 birds

i) Physical loss

- The Wash provides important breeding and feeding habitats for internationally important populations of Common Tern and Little Tern. The nesting habitats of these species are SPA habitats that lie outside but adjacent to the boundary of the European marine site but both species feed within the European marine site. In addition, The Wash SPA provides important feeding habitat for internationally important populations of Sandwich Tern and Common Tern that nest in the adjacent North Norfolk Coast SPA. Any loss of shallow coastal waters can reduce the food supply upon which these birds depend.

- Removal of feeding habitat may also lead to changes in coastal processes, for example increased wave exposure, that can exacerbate habitat loss and can change the nature of existing sediments.

ii) Non toxic contamination

- Changes in turbidity of the waters in which the terns feed may reduce suitable habitat for prey species, or result in prey species being less visible to feeding terns.

7.10.2 Internationally important assemblage of waterfowl including the internationally important populations of regularly occurring migratory species

i) Physical loss

- The Wash provides feeding and roosting habitats for an internationally important assemblage of waterfowl including internationally important populations of several regularly occurring migratory species. Loss by removal or smothering of any of the habitats on which they depend could result in loss of roost sites and/or reduction in food resource and would be detrimental to the favourable condition of the feature.

- Removal of feeding and roosting habitat may also lead to changes in coastal processes, for example increased wave exposure, that can exacerbate habitat loss and can change the nature of existing sediments.

- In the Wash for example, physical losses has been caused by the construction of training walls on intertidal and subtidal habitats leading to the direct loss of relatively small areas of habitat. However larger habitat losses are caused by increased siltation behind the training walls which leads to the expansion of saltmarsh into the intertidal flats which are lost as feeding areas.

- Although new construction works for training walls or embankments for land claim are not currently an issue in the site, the effects of earlier construction works are continuing and result in the medium exposure of intertidal mud and sand, and produces a high vulnerability when combined with the high sensitivity score.

- Saltmarsh is seen as being highly vulnerable to physical loss, largely because over large areas of the site (especially the Wash) seawalls constrain the natural responses of the saltmarsh communities to sea-level rise and local coastal process changes which produces moderate exposure levels.

ii) Physical damage

- Habitats within the Wash that support waterfowl are also sensitive to physical damage from abrasion and/or selective abstraction.

- Sand and shingle habitats have high exposures as in the Wash shingle areas are popular public access areas subject to high levels of trampling. Physical damage resulting from trampling may reduce the suitability of the habitats as roosting or feeding areas. The high sensitivity of this feature results in a high vulnerability score. However these areas are currently monitored and managed as part of a nature reserve.

- for reasons explained in the saltmarsh sections above saltmarsh has a medium exposure to abrasion and selective extraction in the Wash from grazing.

- The Wash has a medium exposure to selective extraction on intertidal mud and sandflats due to the shellfisheries which principally use this habitat for cockling. Suction dredging can damage this habitat by changing the type of sediment and invertebrate species found in old dredge paths. These effects may change the availability and abundance of prey species for feeding waterfowl. The combined exposure and sensitivity score for intertidal mud and sandflats produces a moderate vulnerability score.

iii) Non-physical disturbance

- Birds can be disturbed by human activities which cause noise or visual disturbance when they are feeding or roosting. They are particularly sensitive to

disturbance in the winter months when there are only short daylight hours for feeding and temperatures may be low. Moving from disturbed areas results in loss of feeding time and wasteful energy expenditure. During the winter of 1990-1 a period of severe weather resulted in 2,500 wader deaths from starvation and cold (Clarke 1993).

- During high spring tides, birds are pushed higher up the shore and have fewer roost sites available. The birds are more easily disturbed in these conditions and if forced to fly off, may waste limited energy reserves.

- Disturbance can also exclude birds from areas of otherwise suitable feeding habitat that they would otherwise use. Having to feed on other, possibly less optimal, areas may result in a greater expenditure of energy to find a smaller amount of food.

- The Wash is subjected to apparently high exposure levels of noise principally from fast jet aircraft mainly flying over the saltmarsh and intertidal flats to military ranges. Whilst these are noisy activities the waterfowl populations are apparently tolerant of it under normal conditions. However during periods of severe weather in winter when feeding time is short and energy reserves low, waterfowl can be very sensitive to any noisy activity which could make them move unnecessarily or prevent them from feeding. Given the widespread nature of noise around the Wash and the potential for high mortality during period of severe weather, exposure in the Wash is judged as medium overall. The high sensitivity combined with moderate exposure results in high vulnerability scores for intertidal mud and sand, saltmarsh and shingle.

- Recreational activity occurs around most of the Wash at most times of the year, however this is mainly confined to areas around a limited number of access points, and at relatively low intensity. Hence the low exposure scores for the saltmarsh and intertidal flats which are the habitats used by waterfowl and might be affected by the visual presence of people around most of the Wash. The high sensitivity score combined with a low exposure results in a moderate vulnerability.

- As explained previously the shingle habitats in the Wash are in high public use areas and hence have a high exposure and vulnerability scores. However much of this habitat is found within a nature reserve which is managed to provide undisturbed roosting areas for waterfowl.

iv) Toxic contamination

- Industrial and domestic effluent discharges contain contaminants which build up in the food chain and may have toxic effects on birds and the prey of birds. These contaminants are include heavy metals such as copper, zinc, mercury, cadmium, radionuclides, and synthetic organic compounds (e.g. dieldrin, TBT, PCBs - polychlorinated biphenyls). These may have lethal and sub-lethal effects on marine invertebrates predated by birds. This may allow pollution-tolerant species to dominate. Specialist feeders could be affected by the loss of a prey species, while generalist feeders could benefit from an abundance of opportunistic prey species. This may however, result in a reduced diversity of species in the bird assemblage and may affect internationally important populations. Sub-lethal effects on food sources reduce the fitness of individual prey species by affecting reproduction, genetics, physiology and general health, though, initially this may result in an abundance of food as invertebrate prey behaviour may be altered making them more available to feeding populations. Ultimately the prey populations would start to reduce in number. Birds feeding on contaminated food sources are directly at risk from those containing substances with the potential to accumulate in the food chain.

- Toxic contamination of intertidal sand and mud has been discussed earlier as an issue and results in the medium exposure and vulnerability scores for this habitat.

iv) Non-toxic contamination

• Nutrient and organic enrichment can effect birds' feeding habitats either positively by increasing food availability or negatively by altering species composition to less favourable prey species, reducing food availability through increased growth of algal mats or by reducing water clarity and thus prey availability.

- Non-toxic contamination of intertidal sand and mud has been discussed earlier as an issue and results in the medium exposure and vulnerability scores for this habitat.

v) Biological disturbance

• Selective extraction of elements of the habitats necessary to waterfowl may reduce the suitability of the habitat for feeding. Examples of selective extraction include bait digging and samphire picking. These are traditional local activities with long histories on this site. At historic levels of exposure, where traditional methods are employed, these activities are at sustainable levels and should not currently be an issue for the management scheme. However within the Wash intensive commercial collection of bait has occurred in the past and the levels of such activities should be kept under regular review.

- The effects of commercial shellfisheries on the intertidal mud and sandflats and hence the prey species of waterfowl have been described above. Bird populations may be affected if they are in competition with humans in exploiting a food species. Over exploitation of shellfish stocks could have a serious impact on birds such as knot and oystercatcher. The combined exposure and sensitivity score for intertidal mud and sandflats produces a moderate vulnerability score.

• Wildfowling involves the selective extraction of a component part of the interest feature. This activity occurs principally on the Wash saltmarshes. Although the assemblage is sensitive to selective extraction, current levels of exposure to this traditional activity within the Wash SPA are low. This activity is seen as sustainable at current levels and should not be an issue for the management scheme.

- The moderate exposure arises from the effects of saltmarsh grazing on this habitat. The Wash saltmarshes are grazed as part of a English Nature conservation strategy to maintain the diversity of plant communities and structure around the site. The grazing affects about 50% of the saltmarsh in the Wash which should maintain the characteristics for feeding and roosting required by the waterfowl assemblages. The effects of the grazing strategy are being monitored and reviewed. The medium exposure of saltmarsh combined with the high sensitivity score produces the moderate vulnerability for saltmarsh.

7.11 Detailed operations advice for The North Norfolk Coast SPA

7.11.1 Internationally important populations of Annex 1 birds

i) Physical loss

- The North Norfolk Coast provides important breeding and feeding habitats for internationally important populations of Sandwich Tern, Common Tern and Little Tern. Any loss of shallow coastal waters can reduce the food supply upon which these birds depend. Any loss of the sand and shingle habitats on which the terns nest can reduce the overall area within the site for their breeding.

- Removal of breeding and/or feeding habitat may also lead to changes in coastal processes, for example increased wave exposure, that can exacerbate habitat loss and can change the nature of existing sediments.

- The North Norfolk Coast supports a internationally important population of breeding Marsh Harriers for which the saltmarsh is an important feeding habitat. Any loss of this habitat through removal could result in a reduction in the food resource.

- The tidal reedbeds on the North Norfolk Coast provide nesting habitat for Montagu's Harrier. Any loss of this habitat through removal should be avoided.

- The internationally important breeding population of Avocet on the North Norfolk Coast use intertidal mud and sand habitats for feeding. Any loss of this habitat through removal could result in a reduction in food resource.

ii) Physical damage

- Habitats within the North Norfolk Coast SPA that support Sandwich, Common and Little Terns are also sensitive to physical damage, particularly abrasion and selective extraction. Physical disturbance to the sand and shingle can reduce its suitability for nesting terns. Some sand and shingle habitats are currently exposed to activities which may cause physical damage, such as recreation, and are considered highly vulnerable.

- The tidal reedbeds that support breeding Montagu's Harriers are highly sensitive to damage by trampling but current exposure levels are very low.

- The intertidal mud and sand that supports the breeding Avocet population is also sensitive to physical damage, particularly selective extraction. Although bait digging may be seen as causing this type of physical damage, historically this activity is carried out at relatively low levels and in a traditionally sustainable manner and not an issue for the management scheme at current levels.

iii) Non-physical disturbance

- All three species of breeding terns are particularly sensitive to human activities which cause noise or visual disturbance. Both noise and visual disturbance can cause to terns to leave their nests resulting in eggs and/or young being exposed to risks of predation and physical damage. In extreme cases, persistent noise and/or visual disturbance may lead to desertion of the breeding site.

- Hunting Marsh Harriers and their prey are also sensitive to noise and visual disturbance.

- Breeding Montagu's Harriers are particularly sensitive to visual disturbance in the vicinity of the nest site.

- Feeding Avocets are also sensitive to noise and visual disturbance.

- All intertidal habitats apart from tidal reedbed have medium to high exposure to noise or visual disturbance, which combined with high sensitivities results in the high vulnerability scores.

iv) Non toxic contamination

• The tidal reedbeds supporting breeding Montagu's Harrier are particularly sensitive to increases in salinity. Excessive water abstraction may decrease freshwater inflows which could result in deterioration of the habitat. Additional research to increase understanding of these processes is required. These reedbeds may also be important in reducing nutrient and organic enrichment to the benefit of other marine SAC habitats.

• Nutrient and organic enrichment may alter the prey species composition of the intertidal mud and sand habitats used by feeding Avocets.

v) Biological disturbance

• Selective extraction of, for example, invertebrates and fish which are food for terns, may reduce the suitability of the habitat for feeding terns. Currently, the North Norfolk Coast does not support a sandeel/sprat fishery of any significance and current levels of selective extraction do not present a threat at this site.

7.11.2 The internationally important populations of regularly occurring migratory species

i) Physical loss

• The North Norfolk Coast provides feeding and roosting habitats for an internationally important assemblage of waterfowl including internationally important populations of several regularly occurring migratory species. Loss by removal or smothering of any of the habitats on which they depend could result in loss of roost sites and/or reduction in food resource and would be detrimental to the favourable condition of the feature.

• Removal of feeding and roosting habitat may also lead to changes in coastal processes , for example increased wave exposure, that can exacerbate habitat loss and can change the nature of existing sediments.

ii) Physical damage

• Habitats within the North Norfolk Coast that support waterfowl are also sensitive to physical damage from abrasion and/or selective abstraction. Physical damage resulting from such operations may reduce the suitability of the habitats as roosting or feeding areas and any operations that adversely affect these habitats should be avoided. Trampling resulting from recreational activities is locally high on saltmarshes and sand/shingle.

• Waterfowl may also potentially become entangled in litter or fishing gear but at current levels of use there is no evidence to suggest that this represents a threat at this site.

iii) Non-physical disturbance

• Birds can be disturbed by human activities which cause noise or visual disturbance when they are feeding or roosting. They are particularly sensitive to disturbance in the winter months when there are only short daylight hours for feeding

and temperatures may be low. Moving from disturbed areas results in loss of feeding time and wasteful energy expenditure. Low-flying aircraft are a regular cause of non-physical disturbance.

- During high spring tides, birds are pushed higher up the shore and have fewer roost sites available. The birds are more easily disturbed in these conditions and if forced to fly off, may waste limited energy reserves.

- Disturbance can also exclude birds from areas of suitable feeding habitat that they would otherwise use. Having to feed on other, possibly less optimal, areas may result in a greater expenditure of energy to find a smaller amount of food.

- All terrestrial habitats have medium to high exposure to noise or visual disturbance, which combined with high sensitivities results in the high vulnerability scores.

iv) Non-toxic contamination

- Nutrient and organic enrichment can effect birds' feeding habitats either positively by increasing food availability or negatively by altering species composition to less favourable prey species, reducing food availability through increased growth of algal mats or by reducing water clarity and thus prey availability.

- Changes in salinity through a reduction in freshwater inputs may also affect the intertidal mudflats and sandflats interest feature by altering the biological structure of the communities, particularly where salinity sensitive species and communities occur. Changes in salinity can happen through a variety of ways including water abstraction within the river catchment. Water abstraction may produce changes in salinity affecting the intertidal mud and sand and saltmarsh habitats. This may be an issue on the Norfolk coast where these habitats are important for supporting waterfowl and Annex 1 species. This feature is therefore currently moderately vulnerable to changes in salinity.

v) Biological disturbance

- Selective extraction of elements of the habitats necessary to waterfowl may reduce the suitability of the habitat for feeding. Examples of selective extraction include bait digging, samphire picking. These are traditional local activities with long histories of sustainable use. These activities are seen as sustainable where traditional methods are employed, and should not be an issue for the management scheme. However, a distinction needs to be made between traditional sustainable activities and commercial exploitation of the resource. The latter may have an adverse effect on favourable condition and will need to be kept under regular review.

- Wildfowling may involve the selective extraction of a component part of the interest feature. Current levels of this traditional activity within that part of the SPA within the European marine site are seen as sustainable and not an issue for the management scheme. There is no evidence to suggest that it poses a threat at this site.

- Reed harvesting in the tidal reedbeds is carried out during the winter months when Montagu's Harriers are absent. Reed cutting is carried out as a Common Right in accordance with the principles under Common Law of the sufficiency of the common. It is also an essential part of the management of the habitat and the methods used have been agreed with English Nature. It is thus seen as not being an issue for the management scheme.

7.12 Detailed operations advice for the Gibraltar Point SPA

7.12.1 Internationally important populations of Annex 1 birds

i) Physical loss

- Gibraltar Point provides important breeding and feeding habitats for internationally important populations of Little Tern. Any loss of shallow coastal waters can reduce the food supply upon which these birds depend. Any loss of the sand and shingle habitats on which the terns nest can reduce the overall area within the site for their breeding.

- Removal of feeding and/or breeding habitat may also lead to changes in coastal processes, for example increased wave exposure, that can exacerbate habitat loss and can change the nature of existing sediments.

ii) Physical damage

- Habitats within the Gibraltar Point SPA that support Little Terns are also sensitive to physical damage, particularly abrasion and selective extraction. Physical disturbance to the sand and shingle can reduce its suitability for nesting terns.

iii) Non-physical disturbance

- Breeding Little Terns are particularly sensitive to human activities which cause noise or visual disturbance. Both noise and visual disturbance can cause the terns to leave their nests resulting in eggs and/or young being exposed to risks of predation and physical damage. In extreme cases, persistent noise and/or visual disturbance may lead to desertion of the breeding site.

iv) Biological disturbance

- Selective extraction of elements of the habitat necessary to the terns, for example removal of invertebrates and fish, may reduce the suitability of the habitat for feeding terns. Currently, the waters around the Gibraltar Point SPA do not support a sandeel/sprat fishery of any significance and current levels of selective extraction do not present a threat at this site.

7.12.2 Internationally important populations of regularly occurring migratory species

i) Physical loss

- Gibraltar Point provides feeding and roosting habitats for an internationally important assemblage of waterfowl including internationally important populations of several regularly occurring migratory species. Loss by removal or smothering of any of the habitats on which they depend could result in loss of roost sites and/or reduction in food resource and would be detrimental to the favourable condition of the feature.

- Removal of feeding and roosting habitat may also lead to changes in coastal processes , for example increased wave exposure, that can exacerbate habitat loss and can change the nature of existing sediments.

ii) Physical damage

- Habitats at Gibraltar Point that support waterfowl are also sensitive to physical damage from abrasion and/or selective abstraction. Physical damage resulting from such operations may reduce the suitability of the habitats as roosting or feeding areas and any operations that adversely affect these habitats should be avoided.

- Waterfowl may also potentially become entangled in litter or fishing gear but at current levels of use there is no evidence to suggest that this represents a threat at this site.

iii) Non-physical disturbance

- Birds can be disturbed by human activities which cause noise or visual disturbance when they are feeding or roosting. They are particularly sensitive to disturbance in the winter months when there are only short daylight hours for feeding and temperatures may be low. Moving from disturbed areas results in loss of feeding time and wasteful energy expenditure .

- During high spring tides, birds are pushed higher up the shore and have fewer roost sites available. The birds are more easily disturbed in these conditions and if forced to fly off, may waste limited energy reserves.

- Disturbance can also exclude birds from areas of suitable feeding habitat that they would otherwise use. Having to feed on other, possibly less optimal, areas may result in a greater expenditure of energy to find a smaller amount of food.

iv) Non-toxic contamination

- Nutrient and organic enrichment can effect birds' feeding habitats either positively by increasing food availability or negatively by altering species composition to less favourable prey species, reducing food availability through increased growth of algal mats or by reducing water clarity and thus prey availability.

v) Biological disturbance

- Selective extraction of elements of the habitats necessary to waterfowl may reduce the suitability of the habitat for feeding. Examples of selective extraction include bait digging and samphire picking. These are traditional local activities with long histories of sustainable use. At current levels, where traditional methods are employed, these activities are seen as sustainable and should not be an issue for the management scheme. However, a distinction needs to be made between traditional sustainable activities and commercial exploitation of the resource. The latter may have an adverse effect on favourable condition and will need to be kept under regular review.

- Wildfowling may involve the selective extraction of a component part of the interest feature. Current levels of this traditional activity around the Gibraltar Point SPA are seen as sustainable and not an issue for the management scheme. There is no evidence to suggest that it poses a threat at this site.

7.13 Plans and Projects

Under Regulation 48(1), an appropriate assessment needs to be undertaken in respect of any plan or project which:

a. either alone or in combination with other plans or projects would be likely to have a ***significant effect*** on a European Site; and

b. is not directly connected with the management of the site for nature conservation.

An appropriate assessment is required by law for all European Sites (Regulation 48). A European Site is any classified SPA and any SAC from the point where the Commission and the Government agree the site as a Site of Community Importance. Appropriate assessment is also required, as a matter of Government policy, for potential SPAs, candidate SACs and listed Ramsar Sites for the purpose of considering development proposals affecting them. (PPG 9 paras 13 and C7).

Tables 6 and 7 provide relevant authorities with a guide against which to initiate an assessment of the _significance_ of any plans or projects (and ongoing operations or activities) proposed for the site although this will only be the starting point for assessing impacts and does not remove the need for relevant authorities to formally consult English Nature over individual plans and projects where required under the Regulations.

7.14 Review of consents by competent authorities

Many of the competent authorities issue consents as part of the statutory roles. Regulation 50 of The Conservation (Natural Habitats, &c.) Regulations 1994 requires competent authorities to undertake a review of all existing consents and permissions affecting cSAC and SPAs, as soon as possible after the site officially becomes a Site of Community Importance. This will have implications for discharge and other consents, which will need to be reviewed in light of the conservation objectives contained within this package and may mean that lower targets for e.g. background levels of contaminants will need to be set.

Table 8. Assessment of the relative vulnerability of interest features and sub-features of the Wash and North Norfolk Coast European marine site to different categories of operations. Categories of operations to which the features or sub-features of the site are highly or moderately vulnerable are indicated by shading. This table also incorporates relative sensitivity scores used in part to derive vulnerability.

Key

	High vulnerability	••••	High sensitivity
	Moderate vulnerability	•••	Moderate sensitivity
		••	Low sensitivity
		•	No detectable sensitivity

Categories of operations which may cause deterioration or disturbance	**Large shallow inlet and bay**		
	Subtidal boulder and cobble communities	**Subtidal mixed sediment communities**	**Annex I Interest Features**
Physical Loss			For sensitivity and vulnerability information on the Annex I Interest Features existing within the Wash embayment see the sections of this table which relate to the following interest features:- *Subtidal sandbanks; intertidal mudflats and sandflats; Glasswort and other annuals; Atlantic salt meadows; Mediterranean saltmarsh scrub.*
Removal (e.g. harvesting, land claim, coastal development)	••••	••••	
Smothering (e.g. by artificial structures, disposal of dredge spoil)	••••	•••	
Physical damage			
Siltation (e.g. run-off, channel dredging, outfalls)	•••	••	
Abrasion (e.g. mobile benthic fishing gear, anchoring, trampling)	•••	•••	
Selective extraction (e.g. aggregate dredging, entanglement)	•••	•	
Non-physical disturbance			
Noise (e.g. boat activity)	•	•	
Visual presence (e.g. recreational activity)	•	•	
Toxic contamination			
Introduction of synthetic compounds (e.g. pesticides, TBT, PCBs)	••••	••••	
Introduction of non-synthetic compounds (e.g. heavy metals, hydrocarbons)	•••	•••	
Introduction of radionuclides	••	••	
Non-toxic contamination			For sensitivity and vulnerability

			information on the Annex I Interest Features existing within the Wash embayment see the sections of this table which relate to the following interest features:- *Subtidal sandbanks; intertidal mudflats and sandflats; Glasswort and other annuals; Atlantic salt meadows; Mediterranean saltmarsh scrub.*
Nutrient enrichment (e.g. agricultural run-off, outfalls)	•••	•••	
Organic enrichment (e.g. outfalls)	•••	•••	
Changes in thermal regime (e.g. power station outfalls)	••	••	
Changes in turbidity (e.g. run-off, dredging)	••	••	
Changes in salinity (e.g. water abstraction, outfalls)	•••	•••	
Biological disturbance			
Introduction of microbial pathogens (e.g. Sewage effluent)	•	•	
Introduction of non-native species and translocation (e.g. ship_s ballast water)	•••	•••	
Selective extraction of species (e.g. commercial fishing)	•••	•••	

Categories of operations which may cause deterioration or disturbance	**Subtidal sandbanks**		**Intertidal mudflats and sandflats**		
	Gravel and sand communities	**Muddy sand communities**	**Sand and gravel communities**	**Muddy sand communities**	**Mud communities**
Physical Loss					
Removal (e.g. harvesting, land claim, coastal development)	••••	••••	••••	••••	••••
Smothering (e.g. by artificial structures, disposal of dredge spoil)	•••	•••	•••	•••	•••
Physical damage					
Siltation (e.g. run-off, channel dredging, outfalls)	•••	•••	•••	•••	•••
Abrasion (e.g. mobile benthic fishing gear, anchoring, trampling)	•••	•••	••	•••	•••
Selective extraction (e.g. aggregate dredging, entanglement)	••••	••••	••	•••	•••
Non-physical disturbance					
Noise (e.g. boat activity)	•	•	•	•	•
Visual presence (e.g. recreational activity)	•	•	•	•	•
Toxic contamination					

Introduction of synthetic compounds (e.g. pesticides, TBT, PCBs)	•••	•••	••••	••••	••••
Introduction of non-synthetic compounds (e.g. heavy metals, hydrocarbons)	•••	•••	••••	••••	••••
Introduction of radionuclides	••	••	••	••	••
Non-toxic contamination					
Nutrient enrichment (e.g. agricultural run-off, outfalls)	••	••	•••	•••	•••
Organic enrichment (e.g. outfalls)	•••	•••	•••	•••	•••
Changes in thermal regime (e.g. power station outfalls)	•••	•••	••	••	••
Changes in turbidity (e.g. run-off, dredging)	••	••	••	••	••
Changes in salinity (e.g. water abstraction, outfalls)	•••	•••	•••	•••	•••
Biological disturbance					
Introduction of microbial pathogens (e.g. Sewage effluent)	••	••	••	••	••
Introduction of non-native species and --translocation (e.g. ship_s ballast water)	•••	•••	•••	•••	•••
Selective extraction of species (e.g. bait digging, commercial fishing)	•••	•••	•••	•••	••

Categories of operations which may cause deterioration or disturbance	**Saltmarsh interest feature**		
	Glasswort and other annuals	**Atlantic salt meadows**	**Mediterranean saltmarsh scrub**
Physical Loss			
Removal (e.g. land claim, coastal development)	••••	••••	••••
Smothering (e.g. by artificial structures, disposal of dredge spoil)	•••	•••	•••
Physical damage			
Siltation (e.g. run-off, channel dredging, outfalls)	••	••	••
Abrasion (e.g. anchoring, trampling, vehicles)	•••	••••	•••
Selective extraction (e.g. harvesting, grazing)	•••	•••	•••
Non-physical disturbance			
Noise (e.g. boat activity)	•	•	•
Visual presence (e.g. recreational activity)	•	•	•
Toxic contamination			
Introduction of synthetic compounds (e.g. pesticides, TBT, PCBs)	•••	•••	•••
Introduction of non-synthetic compounds (e.g. heavy metals, hydrocarbons)	•••	•••	•••
Introduction of radionuclides	•••	•••	•••
Non-toxic contamination			
Nutrient enrichment (e.g. agricultural run-off, outfalls)	•••	•••	•••
Organic enrichment (e.g. outfalls)	•••	•••	•••
Changes in thermal regime (e.g. power station outfalls)	•••	•••	•••
Changes in turbidity (e.g. run-off, dredging)	••	••	••
Changes in salinity (e.g. water abstraction,	•••	•••	•••

outfalls)			
Biological disturbance			
Introduction of microbial pathogens (e.g. Sewage effluent)	•	•	•
Introduction of non-native species and translocation (e.g. ship_s ballast water)	•••	•••	•••
Selective extraction of species (e.g. harvesting. grazing)	•••	•••	•••

Categories of operations which may cause deterioration or disturbance	**Annex II species** **Common seals**
	Intertidal mudflats and sandflats
Physical Loss	
Removal (e.g. harvesting, land claim, coastal development)	••••
Smothering (e.g. by artificial structures, disposal of dredge spoil)	••
Physical damage	
Siltation (e.g. run-off, channel dredging, outfalls)	•
Abrasion (e.g. mobile benthic fishing gear, anchoring, trampling)	•
Selective extraction (e.g. aggregate dredging, entanglement)	•••
Non-physical disturbance	
Noise (e.g. boat activity)	••••
Visual presence (e.g. recreational activity)	••••
Toxic contamination	
Introduction of synthetic compounds (e.g. pesticides, TBT, PCBs)	••••
Introduction of non-synthetic compounds (e.g. heavy metals, hydrocarbons)	••••
Introduction of radionuclides	••
Non-toxic contamination	
Nutrient enrichment (e.g. agricultural run-off, outfalls)	•
Organic enrichment (e.g. outfalls)	•
Changes in thermal regime (e.g. power station outfalls)	•
Changes in turbidity (e.g. run-off, dredging)	•
Changes in salinity (e.g. water abstraction, outfalls)	•
Biological disturbance	
Introduction of microbial pathogens (e.g. Sewage effluent)	••••
Introduction of non-native species and translocation (e.g. ship_s ballast water)	•
Selective extraction of species (e.g. bait digging, commercial fishing)	••

Table 9. Assessment of the relative exposure of interest features and sub-features of the Wash and North Norfolk Coast European Marine Site to different categories of operations (as at February 2000)

High = 3, Medium = 2, Low = 1 and None = 0

Categories of operations which may cause deterioration or disturbance	Large shallow inlet and bay		
	Subtidal boulder and cobble communities	**Subtidal mixed sediment communities**	**Annex I Interest Features**
Physical Loss			For information on the Annex I Interest Features existing within the Wash embayment see the sections of this table which relate to the following interest features:- *Subtidal sandbanks; intertidal mudflats and sandflats; Glasswort and other annuals; Atlantic salt meadows; Mediterranean saltmarsh scrub.*
Removal (e.g. harvesting, land claim, coastal development)	**Low**	**Low**	
Smothering (e.g. by artificial structures, disposal of dredge spoil)	**Low**	**Low**	
Physical damage			
Siltation (e.g. run-off, channel dredging, outfalls)	**Low**	**Low**	
Abrasion (e.g. mobile benthic fishing gear, anchoring, trampling)	**Medium**	**Medium**	
Selective extraction (e.g. aggregate dredging, entanglement)	**Low**	**Low**	
Non-physical disturbance			
Noise (e.g. boat activity)	**None**	**None**	
Visual presence (e.g. recreational activity)	**None**	**None**	
Toxic contamination			
Introduction of synthetic compounds (e.g. pesticides, TBT, PCBs)	**Low**	**Low**	
Introduction of non-synthetic compounds (e.g. heavy metals, hydrocarbons)	**Low**	**Low**	
Introduction of radionuclides	**None**	**None**	
Non-toxic contamination			
Nutrient enrichment (e.g. agricultural run-off, outfalls)	**Low**	**Low**	
Organic enrichment (e.g. outfalls)	**Low**	**Low**	
Changes in thermal regime (e.g. power station outfalls)	**None**	**None**	
Changes in turbidity (e.g. run-off, dredging)	**None**	**None**	
Changes in salinity (e.g. water abstraction, outfalls)	**Low**	**Low**	
Biological disturbance			
Introduction of microbial pathogens (e.g. Sewage effluent)	**None**	**None**	

Introduction of non-native species and translocation (e.g. ballast water)	**None**	**None**	
Selective extraction of species (e.g. commercial fishing)	**Medium**	**Medium**	

Categories of operations which may cause deterioration or disturbance	**Subtidal sandbanks**		**Intertidal mudflats and sandflats**		
	Gravel and sand communities	**Muddy sand communities**	**Sand and gravel communities**	**Muddy sand communities**	**Mud communities**
Physical Loss					
Removal (e.g. harvesting, land claim, coastal development)	**Low**	**Low**	**Medium**	**Medium**	**Medium**
Smothering (e.g. by artificial structures, disposal of dredge spoil)	**None**	**None**	**Medium**	**Medium**	**Medium**
Physical damage					
Siltation (e.g. run-off, channel dredging, outfalls)	**Low**	**Low**	**Low**	**Low**	**Low**
Abrasion (e.g. mobile benthic fishing gear, anchoring, trampling)	**High**	**High**	**Medium**	**Medium**	**Low**
Selective extraction (e.g. aggregate dredging, entanglement)	**High**	**High**	**Medium**	**Medium**	**Low**
Non-physical disturbance					
Noise (e.g. boat activity)	**None**	**None**	**None**	**None**	**None**
Visual presence (e.g. recreational activity)	**None**	**None**	**None**	**None**	**None**
Toxic contamination					
Introduction of synthetic compounds (e.g. pesticides, TBT, PCBs)	**Medium**	**Medium**	**Medium**	**Medium**	**Medium**
Introduction of non-synthetic compounds (e.g. heavy metals, hydrocarbons)	**Medium**	**Medium**	**Medium**	**Medium**	**Medium**
Introduction of radionuclides	**None**	**None**	**None**	**None**	**None**
Non-toxic contamination					
Nutrient enrichment (e.g. agricultural run-off, outfalls)	**Medium**	**Medium**	**Medium**	**Medium**	**Medium**
Organic enrichment (e.g. outfalls)	**Medium**	**Medium**	**Medium**	**Medium**	**Medium**
Changes in thermal regime (e.g. power station outfalls)	**None**	**None**	**None**	**None**	**None**
Changes in turbidity (e.g. run-off, dredging)	**None**	**None**	**None**	**None**	**None**
Changes in salinity (e.g. water abstraction, outfalls)	**Low**	**Low**	**Medium**	**Medium**	**Medium**
Biological disturbance					
Introduction of microbial pathogens (e.g. Sewage effluent)	**None**	**None**	**None**	**None**	**None**
Introduction of non-native species and --translocation (e.g.ballast water)	**Low**	**Low**	**Medium**	**Medium**	**Low**
Selective extraction of species (e.g. bait digging, commercial fishing)	**High**	**High**	**Medium**	**Medium**	**Medium**

Categories of operations which may cause deterioration or disturbance	Saltmarsh interest features		
	Glasswort and other annuals	**Atlantic salt meadows**	**Mediterranean saltmarsh scrub**
Physical Loss			
Removal (e.g. land claim, coastal development)	**Medium**	**Medium**	**Medium**
Smothering (e.g. by artificial structures, disposal of dredge spoil)	**Low**	**Low**	**Low**
Physical damage			
Siltation (e.g. run-off, channel dredging, outfalls)	**Low**	**Low**	**Low**
Abrasion (e.g. anchoring, trampling, vehicles)	**Medium**	**Medium**	**Medium**
Selective extraction (e.g. harvesting, grazing)	**Medium**	**Medium**	**Low**
Non-physical disturbance			
Noise (e.g. boat activity)	**None**	**None**	**None**
Visual presence (e.g. recreational activity)	**None**	**None**	**None**
Toxic contamination			
Introduction of synthetic compounds (e.g. pesticides, TBT, PCBs)	**Low**	**Low**	**Low**
Introduction of non-synthetic compounds (e.g. heavy metals, hydrocarbons)	**Low**	**Low**	**Low**
Introduction of radionuclides	**None**	**None**	**None**
Non-toxic contamination			
Nutrient enrichment (e.g. agricultural run-off, outfalls)	**Low**	**Low**	**Low**
Organic enrichment (e.g. outfalls)	**Low**	**Low**	**Low**
Changes in thermal regime (e.g. power station outfalls)	**None**	**None**	**None**
Changes in turbidity (e.g. run-off, dredging)	**Low**	**Low**	**Low**
Changes in salinity (e.g. water abstraction, outfalls)	**Low**	**Medium**	**Low**
Biological disturbance			
Introduction of microbial pathogens (e.g. Sewage effluent)	**None**	**None**	**None**
Introduction of non-native species and translocation (e.g. ship_s ballast water)	**Low**	**Low**	**Low**
Selective extraction of species (e.g. harvesting. grazing)	**Medium**	**Medium**	**Low**

Categories of operations which may cause deterioration or disturbance	**Annex II species** Common seals **Intertidal Mud and sandflats**
Physical Loss	
Removal (e.g. harvesting, land claim, coastal development)	**Medium**
Smothering (e.g. by artificial structures, disposal of dredge spoil)	**Medium**
Physical damage	
Siltation (e.g. run-off, channel dredging, outfalls)	**Low**
Abrasion (e.g. mobile benthic fishing gear, anchoring, trampling)	**Medium**
Selective extraction (e.g. aggregate dredging, entanglement)	**Medium**
Non-physical disturbance	
Noise (e.g. boat activity)	**Medium**
Visual presence (e.g. recreational activity)	**Medium**
Toxic contamination	
Introduction of synthetic compounds (e.g. pesticides, TBT, PCBs)	**Medium**
Introduction of non-synthetic compounds (e.g. heavy metals, hydrocarbons)	**Medium**
Introduction of radionuclides	**None**
Non-toxic contamination	
Nutrient enrichment (e.g. agricultural run-off, outfalls)	**Medium**

Organic enrichment (e.g. outfalls)	**Medium**
Changes in thermal regime (e.g. power station outfalls)	**None**
Changes in turbidity (e.g. run-off, dredging)	**None**
Changes in salinity (e.g. water abstraction, outfalls)	**Medium**
Biological disturbance	
Introduction of microbial pathogens (e.g. Sewage effluent)	**Low**
Introduction of non-native species and translocation (e.g. ship_s ballast water)	**Low**
Selective extraction of species (e.g. bait digging, commercial fishing)	**Medium**

Table 10 Assessment or relative vulnerability of SPA interest features and sub-features os The Wash and North Norfolk Coast marine site to different categories of operations. Categories of operations to which the features or sub-features of the site are highly or moderately vulnerable are indicated by shading. This table also incorporates relative sensitivity scores used in part to derive vulnerability.
ghly or moderately vulnerable are indicated by shading. This table also incorporates relative sensitivity scores used in part to derive vulnerability.

Key •••• High sensitivity ••Low sensitivity High vulnerability
••• Moderate sensitivity • No detectable sensitivity Moderate vulnerability

THE WASH SPA

Categories of operations which may cause deterioration or disturbance	**Annex 1 species**	**Internationally important assemblage**			
	Coastal Waters	*Coastal Waters*	*Intertidal mud and sand*	*Saltmarsh*	*Sand and shingle*
Physical Loss					
Removal (e.g. harvesting, land claim, coastal development)	••••	••••	••••	••••	••••
Smothering (e.g. by artificial structures, disposal of dredge spoil)	••	••	•••	•••	•••
Physical Damage					
Siltation (e.g. run-off, channel dredging, outfalls**)**	••	••	••	••	•
Abrasion (e.g. mobile benthic fishing gear, anchoring, trampling)	••	••	•••	•••	••••
Selective extraction (e.g. aggregate dredging, entanglement)	••	••	••	•••	••••
Non-physical Disturbance					
Noise (e.g. boat activity)	••	••	••••	••••	••••
Visual presence (e.g. recreational activity	••	••	••••	••••	••••
Toxic Contamination					
Introduction of synthetic compounds (e.g. pesticides, TBT, PCBs)	•••	•••	•••	•••	•
Introduction of non-synthetic compounds (e.g. heavy metals, hydrocarbons)	•••	•••	•••	•••	•
Introduction of radionuclides	••	••	••	•	•
Non-toxic Contamination					
Nutrient enrichment (e.g. agricultural run-off, outfalls)	••	••	•••	•••	•
Organic enrichment (e.g. outfalls)	••	••	•••	•••	•
Changes in thermal regime (e.g. power station outfalls)	•	•	•	•	•
Changes in turbidity (e.g. run-off, dredging)	•••	•••	•	•	•
Changes in salinity (e.g. water abstraction, outfalls)	••	••	•••	•••	•

Biological Disturbance					
Introduction of microbial pathogens (e.g. sewage effluent)	••	••	••	••	•
Introduction of non-native species and translocation (e.g. ships' ballast water)	••	••	•••	•••	•
Selective extraction of species (e.g. bait digging, commercial fishing)	•••	•••	•••	•••	•

THE NORTH NORFOLK COAST SPA

Categories of operations which may cause deterioration or disturbance	Annex 1 species					Internationally important assemblage		
	Coastal waters	*Intertidal mud and sand*	*Saltmarsh*	*Tidal reed-bed*	*Sand and shingle*	*Intertidal mud and sand*	*Saltmarsh*	*Sand and shingle*
Physical Loss								
Removal (e.g. harvesting, land claim, coastal development)	••••	••••	••••	••••	••••	••••	••••	••••
Smothering (e.g. by artificial structures, disposal of dredge spoil)	••	•••	•••	•••	•••	•••	•••	•••
Physical Damage								
Siltation (e.g. run-off, channel dredging, outfalls)	••	••	••	••	•	••	••	•
Abrasion (e.g. mobile benthic fishing gear, anchoring, trampling)	••	••	•••	••••	••••	••	•••	••••
Selective extraction (e.g. aggregate dredging, entanglement)	••	•••	•••	••	••••	•••	••	••••
Non-physical Disturbance								
Noise (e.g. boat activity)	••	••••	••••	•••	••••	••••	••••	••••
Visual presence (e.g. recreational activity)	••	••••	••••	••••	••••	••••	••••	••••

Categories of operations which may cause deterioration or disturbance	Annex 1 species					Internationally important assemblage		
	Coastal Waters	*Intertidal mud and sand*	*Saltmarsh*	*Tidal reed-bed*	*Sand and shingle*	*Intertidal mud and sand*	*Saltmarsh*	*Sand and shingle*
Toxic Contamination								
Introduction of synthetic compounds (e.g. pesticides, TBT, PCBs)	•••	•••	•••	•••	•	•••	•••	•
Introduction of non-synthetic compounds (e.g. heavy metals, hydrocarbons)	•••	•••	•••	•••	•	•••	•••	•
Introduction of radionuclides	••	••	••	••	•	••	••	•
Non toxic Contamination								
Nutrient enrichment (e.g. agricultural run-off, outfalls)	••	•••	•••	•••	•	•••	•••	•
Organic enrichment (e.g. outfalls)	••	•••	•••	•••	•	•••	•••	•
Changes in thermal regime (e.g. power station outfalls)	•	••	•	•	•	••	•	•
Changes in turbidity (e.g. run-off, dredging)	•••	••	•	•	•	••	•	•
Changes in salinity (e.g. water abstraction, outfalls)	••	•••	•••	••••	•	•••	•••	•
Biological Disturbance								

Introduction of microbial pathogens (e.g. sewage effluent)	••	••	••	••	•	••	••	•
Introduction of non-native species and translocation (e.g. ships' ballast water)	••	•••	•••	••	•	•••	•••	•
Selective extraction of species (e.g. bait digging, commercial fishing)	•••	•••	•••	•••	•	•••	•••	•

GIBRALTAR POINT SPA

Categories of operations which may cause deterioration or disturbance	**Annex 1 species**		**Internationally important assemblage**		
	Coastal Waters	*Sand and shingle*	*Intertidal mud and sand*	*Saltmarsh*	*Sand and shingle*
Physical Loss					
Removal (e.g. harvesting, land claim, coastal development)	••••	••••	••••	••••	••••
Smothering (e.g. by artificial structures, disposal of dredge spoil)	••	•••	•••	•••	•••
Physical Damage					
Siltation (e.g. run-off, channel dredging, outfalls)	••	•	••	••	•
Abrasion (e.g. mobile benthic fishing gear, anchoring, trampling)	••	••••	•••	•••	••••
Selective extraction (e.g. aggregate dredging, entanglement)	••	••••	••	••	••••
Non-physical Disturbance					
Noise (e.g. boat activity)	••	••••	••••	••••	••••
Visual presence (e.g. recreational activity)	••	••••	••••	••••	••••
Toxic Contamination					
Introduction of synthetic compounds (e.g. pesticides, TBT, PCBs)	•••	•	•••	•••	•
Introduction of non-synthetic compounds (e.g. heavy metals, hydrocarbons)	•••	•	•••	•••	•
Introduction of radionuclides	••	•	••	••	•
Non-toxic Contamination					
Nutrient enrichment (e.g. agricultural run-off, outfalls)	••	•	•••	•••	•
Organic enrichment (e.g. outfalls)	••	•	•••	•••	•
Changes in thermal regime (e.g. power station outfalls)	•	•	•	•	•
Changes in turbidity (e.g. run off, dredging)	•••	•	•	•	•
Changes in salinity (e.g. water abstraction, outfalls)	•	•	•••	•••	•
Biological disturbance					
Introduction of microbial pathogens (e.g. sewage effluent)	••	•	••	••	•
Introduction of non-native species and translocation (e.g. ships' ballast water)	••	•	•••	•••	•
Selective extraction of species (e.g. bait digging, commercial fishing)	•••	•	•••	•••	•

Table 11 Assessment of the relative exposure of SPA interest features and sub-features of The Wash and North Norfolk Coast marine site to different categories of operations based on current levels of activities.

Key High = High exposure (3) Med = Medium exposure (2) Low = Low exposure (1)

THE WASH SPA

Categories of operations which may cause deterioration or disturbance	**Annex 1 species**	**Internationally important assemblage**			
	Coastal Waters	***Coastal Waters***	***Intertidal mud and sand***	***Saltmarsh***	***Sand and shingle***
Physical Loss					
Removal (e.g. harvesting, land claim, coastal development)	Low	Low	Medium	Medium	Medium
Smothering (e.g. by artificial structures, disposal of dredge spoil)	None	None	Medium	Low	Low
Physical Damage					
Siltation (e.g. run-off, channel dredging, outfalls**)**	Low	Low	Low	Low	Low
Abrasion (e.g. mobile benthic fishing gear, anchoring, trampling)	None	None	Medium	Medium	High
Selective extraction (e.g. aggregate dredging, entanglement)	None	None	Medium	Medium	Low
Non-physical Disturbance					
Noise (e.g. boat activity)	Medium	Medium	Medium	Medium	Medium
Visual presence (e.g. recreational activity	Medium	Medium	Low	Low	High
Toxic Contamination					
Introduction of synthetic compounds (e.g. pesticides, TBT, PCBs)	Low	Low	Medium	Low	Low
Introduction of non-synthetic compounds (e.g. heavy metals, hydrocarbons)	Low	Low	Medium	Low	Low
Introduction of radionuclides	None	None	None	None	None
Non-toxic Contamination					
Nutrient enrichment (e.g. agricultural run-off, outfalls)	Medium	Medium	Medium	Low	Low
Organic enrichment (e.g. outfalls)	Medium	Medium	Medium	Low	Low
Changes in thermal regime (e.g. power station outfalls)	None	None	None	None	None
Changes in turbidity (e.g. run-off, dredging)	Medium	Medium	None	None	None
Changes in salinity (e.g. water abstraction, outfalls)	Low	Low	Low	Low	Low
Biological Disturbance					
Introduction of microbial pathogens (e.g. sewage effluent)	None	None	None	None	None
Introduction of non-native species and translocation (e.g. ships' ballast water)	Low	Low	Medium	Low	Low
Selective extraction of species (e.g. bait digging, commercial fishing)	Low	Low	Medium	Medium	Low

THE NORTH NORFOLK COAST SPA

Categories of operations which may cause deterioration or disturbance	**Annex 1 species**					**Internationally important assemblage**		
	Coastal waters	***Intertidal mud and sand***	***Saltmarsh***	***Tidal reed-bed***	***Sand and shingle***	***Intertidal mud and sand***	***Saltmarsh***	***Sand and shingle***
Physical Loss								
Removal (e.g. harvesting, land claim, coastal development)	Low	Medium	Medium	Medium	Medium	Medium	Medium	Medium
Smothering (e.g. by artificial structures, disposal of dredge spoil)	None	Low	Low	None	Low	Low	Low	Low
Physical Damage								
Siltation (e.g. run-off, channel dredging, outfalls)	Low	Low	Low	Low	Low	Low	Low	Low
Abrasion (e.g. mobile benthic fishing gear, anchoring, trampling)	None	Low	Low	Low	Medium	Low	Medium	Medium
Selective extraction (e.g. aggregate dredging, entanglement)	None	Medium	Low	Low	Low	Medium	Low	Low
Non-physical Disturbance								
Noise (e.g. boat activity)	Medium	High	Medium	Low	High	High	Medium	High
Visual presence (e.g. recreational activity)	Medium	High	High	Low	High	High	High	High
Toxic Contamination								
Introduction of synthetic compounds (e.g. pesticides, TBT, PCBs)	Low	Low	Low	Low	Low	Low	Low	Low
Introduction of non-synthetic compounds (e.g. heavy metals, hydrocarbons)	Low	Low	Low	Low	Low	Low	Low	Low
Introduction of radionuclides	Low	Low	Low	Low	Low	Low	Low	Low
Non toxic Contamination								
Nutrient enrichment (e.g. agricultural run-off, outfalls)	Medium	Medium	Low	Medium	Low	Medium	Medium	Low
Organic enrichment (e.g. outfalls)	Medium	Medium	Low	Medium	Low	Medium	Medium	Low
Changes in thermal regime (e.g. power station outfalls)	Low	None	None	None	None	None	None	None
Changes in turbidity (e.g. run-off, dredging)	Low	None	None	Low	None	None	None	None
Changes in salinity (e.g. water abstraction, outfalls)	Low	Medium	Medium	Medium	Low	Medium	Medium	Low
Biological Disturbance								
Introduction of microbial pathogens (e.g. sewage effluent)	Medium	Low	Low	Low	Low	Low	Low	Low
Introduction of non-native species and translocation (e.g. ships' ballast water)	Low	Low	Low	Low	Low	Medium	Medium	Low
Selective extraction of species (e.g. bait digging, commercial fishing)	Low	Low	Low	Low	Low	Medium	Medium	Low

GIBRALTAR POINT SPA

Categories of operations which may cause deterioration or disturbance	Annex 1 species		Internationally important assemblage		
	Coastal Waters	*Sand and shingle*	*Intertidal mud and sand*	*Saltmarsh*	*Sand and shingle*
Physical Loss					
Removal (e.g. harvesting, land claim, coastal development)	Low	Medium	Medium	Medium	Medium
Smothering (e.g. by artificial structures, disposal of dredge spoil)	None	Low	Low	Low	Low
Physical Damage					
Siltation (e.g. run-off, channel dredging, outfalls)	Low	Low	Low	Low	Low
Abrasion (e.g. mobile benthic fishing gear, anchoring, trampling)	Low	Medium	Low	Medium	Medium
Selective extraction (e.g. aggregate dredging, entanglement)	Low	Low	Medium	Low	Low
Non-physical Disturbance					
Noise (e.g. boat activity)	High	Medium	High	Medium	High
Visual presence (e.g. recreational activity)	Medium	High	High	High	High
Toxic Contamination					
Introduction of synthetic compounds (e.g. pesticides, TBT, PCBs)	Low	Low	Low	Low	Low
Introduction of non-synthetic compounds (e.g. heavy metals, hydrocarbons)	Low	Low	Low	Low	Low
Introduction of radionuclides	None	None	None	None	None
Non-toxic Contamination					
Nutrient enrichment (e.g. agricultural run-off, outfalls)	Low	Low	Low	Low	Low
Organic enrichment (e.g. outfalls)	Low	Low	Low	Low	Low
Changes in thermal regime (e.g. power station outfalls)	None	None	None	None	None
Changes in turbidity (e.g. run off, dredging)	Low	None	None	None	None
Changes in salinity (e.g. water abstraction, outfalls)	Low	Low	Low	Low	Low
Biological disturbance					
Introduction of microbial pathogens (e.g. sewage effluent)	Low	Low	Low	Low	Low
Introduction of non-native species and translocation (e.g. ships' ballast water)	Low	Low	Low	Low	Low
Selective extraction of species (e.g. bait digging, commercial fishing)	Low	Low	Low	Low	Low

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9. Glossary

Advisory Group The body of representatives from local interests, user groups and conservation groups, formed to advise the management group.

Annex I habitat type(s) A natural habitat(s) listed in Annex I of the Habitats Directive for which Special Areas of Conservation can be selected.

Annex II species A species listed in Annex II of the Habitats Directive for which Special Areas of Conservation can be selected.

Annex V The listing, in the Habitats Directive, of the animal and plant species whose taking in the wild and exploitation may be subject to management measures.

Anoxic Deficient in oxygen.

Ascidian Sea-squirt.

Assemblage A collection of plants and/or animals characteristically associated with a particular environment.

Attribute Characteristic of an interest feature/sub-feature which provides an indication of the condition of the feature or sub-feature to which it applies.

BAP Biodiversity Action Plan.

Benthos Those organisms attached to, or living on, in or near the sea bed, including that part which is exposed by the tides.

Biota The flora and fauna of a region.

Biotope The physical habitat with its biological community; a term which refers to the combination of physical environment and its distinctive assemblage of conspicuous species.

Biodiversity The total variety of life on earth. This includes diversity within species, between species and of ecosystems.

Bryozoans Small marine colonial animals which superficially resemble seaweeds. Sometimes known as moss animals, the individuals being called zooids and bearing a crown of ciliated tentacles.

Characteristic Special to or especially abundant in a particular situation or biotope. Characteristic species should be immediately conspicuous and easily identified.

Circalittoral Animal dominated deeper subtidal zone.

Coastal squeeze The process by which natural coastal features are drowned or eroded away as they become trapped between man-made sea defences or high ground and rising sea levels.

Compliance monitoring Monitoring against accepted standards to ensure that agreed or required measures are being followed.

Community A group of organisms occurring in a particular environment, presumably interacting with each other and with the environment, and identifiable by means of ecological survey from other groups.

Competent authority Any Minister, government department, public or statutory undertaker, public body or person holding a public office that exercises legislative powers.

Conservation objective A statement of the nature conservation aspirations for a site, expressed in terms of the favourable condition that we wish to see the species and/or habitats for which the site has been selected to attain. Conservation objectives for European marine sites relate to the aims of the Habitats Directive.

Echinoderms Marine animals that are bilaterally symmetrical as larvae but show five rayed symmetry as adults, and have a calcareous endoskeleton and a water vascular system.

Epifauna Animals living on the surface of the substratum.

Epiphytic Organisms living on the surfaces of plants.

Eulittoral The main part of the intertidal zone characterised by limpets, barnacles, mussels, fucoid algae and with red algae often abundant on the lower part.

European marine site A European site (SAC or SPA) which consists of, or in so far as it consists of, marine areas.

Favourable conservation status A range of conditions for a natural habitat or species at which the sum of the influences acting upon that habitat or species are not adversely affecting its distribution, abundance, structure or function throughout the EC in the long term. The condition in which the habitat or species is capable of sustaining itself on a long-term basis.

Favourable condition A range of conditions for a natural habitat or species at which the sum of the influences acting upon that habitat or species are not adversely affecting its distribution, abundance, structure or function within an individual Natura 2000 site in

the long term. The condition in which the habitat or species is capable of sustaining itself on a long-term basis.

Habitat The place in which a plant or animal lives.

Habitats Directive The abbreviated term for *Council Directive 92/43/EEC of 21 May 1992 on the Conservation of Natural Habitats and of Wild Fauna and Flora*. It is the aim of this Directive to promote the conservation of certain habitats and species within the European Union.

Hydroids Colonial animals forming tuft-like growths on seaweeds etc.

Infauna Benthic animals which live within the seabed.

Infralittoral The subtidal zone in which upward facing rocks are dominated by erect algae, typically kelps.

Interest feature A natural or semi-natural feature for which a European site has been selected. This includes any Habitats Directive Annex I habitat, or specific component of their fauna and flora, or any Annex II species and any population of a bird species for which and SPA has been designated under the Birds Directive. Any habitat of a species for which a site has been selected, or typical species of an Annex I habitat are also considered to be interest features.

Internationally scarce/rare For marine purposes, these are regarded as species of limited national occurrence.

Maintain The action required for an interest feature when it is considered to be in favourable condition.

Management group The body of relevant authorities formed to manage the European marine site

Management scheme The framework established by the relevant authorities at a European marine site under which their functions are exercised to secure, in relation to that site, compliance with the requirements of the Habitats Directive.

National Vegetation Classification (NVC) A methodology for classifying vegetation in communities. The standard work for saltmarshes is Rodwell (2000) (see Bibliography)

Natura 2000 The European network of protected sites established under the Birds Directive and the Habitats Directive

Notable species A species that is considered to be notable due to its importance as an indicator, and may also be of nature conservation importance, and which is unlikely to be a _characteristic species_ (*qv*)

Operations which may cause deterioration or disturbance Any activity or operation taking place within, adjacent to, or remote from a European marine site that has the potential to cause deterioration to the natural habitats for which the site was designated or disturbance to the species and its habitats for which the site was designated.

The Directive requires only consideration of activities that could lead to the deterioration of the natural habitats and habitats of species or

significant disturbance of the species in terms of meeting the site's objectives.

Plan or project Any proposed development that is within a relevant authority_s function to control, or over which a competent authority has a statutory function to decide on applications for consents, authorisations, licences or permissions.

Polychaetes A group of marine annelids including bristle worms, tube worms and fan worms, with numerous chaetae borne on projections of the body.

Relevant authority The specific competent authority which has powers or functions which have, or could have, an impact on the marine environment, or adjacent to, a European marine site.

Restore The action required for an interest feature when it is not considered to be in a favourable condition.

RoxAnn Ground discriminating system which uses a signal processor to sample the return echo from an echo sounder. Apart from depth, *RoxAnn* produces two pieces of information derived from the first and second echoes that can be interpreted as a measure of roughness and hardness of the sea floor.

Sensitivity The intolerance of a habitat, community or individual species to damage from an external force.

Sub-feature An ecologically important sub-division of an interest feature.

Vulnerability The exposure of a habitat, community or individual of a species to an external factor to which it is sensitive.

Waterfowl The Ramsar Convention functionally defines waterfowl (synonymous with waterbirds) as _birds ecologically dependent on wetlands_. This definition thus includes any wetland bird species. However, at the broad level of taxonomic order, it includes especially divers, grebes, cormorants, herons, bitterns, spoonbills, swans, geese, ducks, cranes, rails, waders, gulls and terns.

WeBS Wetland Bird Survey: a collaborative national surveillance scheme of the UK_s waterfowl based on counts undertaken once per month outside of the breeding season

Appendices

Appendix I List of relevant authorities for The Wash and North Norfolk coast European marine site

English Nature (Norfolk Team) Mr S Lane - Team Manager 60 Bracondale Norwich NR1 2BE	English Nature (East Midlands Team) Dr Rick Keymer / Dr Ian Paterson The Maltings Wharf Road Grantham Lincolnshire NG31 6BH
Environment Agency (Anglian Region) Wendy Brooks Kingfisher House Orton Goldhay Goldhay Way Peterborough PE2 5ZR	Fenland District Council Mr T Furnell Fenland Hall County Road March Cambridgeshire PE15 8NQ
Lincolnshire County Council Mr Steve Catney - Planning Department County Offices Newland Lincoln LN1 1YL	East Lindsey District Council Mr Bob Bowe Head of Policy, Forward Planning Section Tedder Hall Manby Louth Lincolnshire LN11 8UP
Boston Borough Council Mr Stuart Birkett - Planning Department Municipal Buildings Boston Lincolnshire PE21 8QR	South Holland District Council Mr Bob Scriven - Conservation Officer Council Offices Priory Road Spalding Lincolnshire PE11 2XE
Norfolk County Council Mr M Shaw - Director of Planning and Transportation County Hall Martineau Lane Norwich NR1 2DH	Kings Lynn and West Norfolk Borough Council Mr A Parker - Director of Planning Kings Court Chapel Street Kings Lynn Norfolk PE30 1EX
North Norfolk District Council Mr S Oxenham - Director of Planning PO Box 5 Council Offices Holt Road Cromer Norfolk NR27 9DZ	Eastern Sea Fisheries Joint Committee Mr S C Amos Clerk & Chief Unit 6 North Lynn Business Village Bergen Way North Lynn Norfolk PE30 2JU
Internal Drainage Boards c/o Mr John Elsey South Holland Internal Drainage Board Marsh Reeves Foxes Lowe Road Holbeach Spalding Lincolnshire PE12 7PA.	Wells Harbour Commissioners Ms Lorraine Marshall - Clerk to the Harbour Master Harbour Office The Old Lifeboat House West Quay Wells-next-the-Sea NR23 1AT
King's Lynn Conservancy Board Captain John Lorking Harbour Master Common Staithe King's Lynn	Port of Boston Captain A Johnson Harbour Master Dock Office Boston

Norfolk PE30 1LL	Lincolnshire PE21 6BN
Ministry of Defence Mr Peter Rushmer Defence Estate Organisation (Lands) Stirling House Denny End Road Waterbeach Cambridgeshire CB5 9QE	North Norfolk Common Right Holders c/o Mr Richard Sepping Secretary, Scolt Head and District Common Right Holders Association. 4 Pasture Close Burnham Deepdale King's Lynn Norfolk PE31 8DD

Appendix II

Summary of sub-features and associated biotopes and community descriptions - reference Favourable Condition Table

Interest Feature	Sub-feature	Biotope Code	Biotope Description	Equivalent Community Description
Large shallow inlet and bay	Subtidal boulder and cobble communities	MCR.ByH.Flu	*Flustra foliacea* and other hydroid/bryozoan turf species on slightly scoured circalittoral rock or mixed substrata	Rich faunal Turf dominated by both tall and short bryozoans and hydroids[1]
		ECR.EFaPomByC	*Pomatoceros triqueter*, *Balanus crenatus* and bryozoan crusts on mobile circalittoral cobbles and pebbles	Encrusting bryozoans and coralline algae mixed with short tufted bryozoans[1]
		MCR.ByH	Bryozoan/hydroid turfs (sand influenced)	Sparse to moderately rich bryozoan/hydroid turf epifauna on a silty gravelly sand substratum with a *Sabellaria* gravel/shell component[1]
	Subtidal mixed sediment communities	CMX.SspiMx	*Sabellaria spinulosa* and *Polydora* spp on stable circalittoral mixed sediments	a) *Sabellaria* reef with rich infauna[1] b) Low incrustations of *Sabellaria spinulosa* with rich faunal component with *Lanice* usually present[1]
		CMX.ModMx	*Modiolus modiolus* beds on circalittoral mixed sediment	*Modiolus* beds[1]
		IMX.MytX	*Mytilus edulis* beds on variable salinity infralittoral mixed sediment	Sub-littoral mussel beds.
Subtidal sandbanks	Gravel and sand communities	IGS.Fas.LCon	Dense *Lanice conchilega* and other polychaetes in tide-swept infralittoral sand	*Lanice conchilega* communities[1]
		IGS.Fas.NcirBat	*Nephtys cirrosa* and *Bathyporeia* spp in - infralittoral sand	*Nephtys*/*Bathyporeia* communities in medium fine sand[1]
		CGS.Ven.Bra	Venerid bivalves and *Branchiostoma lanceolatum* in circalittoral coarse sand with shell gravel	Dense beds of *Ophiura ophiura* with *Ophiura albida*[1]
		IGS.Fas.ScupHyd	*Sertularia cupressina* and *Hydrallmania falcata* on tide-swept sublittoral cobbles or pebbles in coarse sand	Colonies of the hydroid *Hydrallmania* trailing over current-swept cobble with a thin layer of mobile sand that forms distinct ripples[1]
	Muddy sand communities	CMS.Abr.Nuc.Cor	*Abra alba*, *Nucella nitida* and *Corbula gibba* in circalittoral muddy sand or slightly mixed sediment	a) *Sabellaria pavonina* community[1] b) *Lanice*/*Sabella discifera* with rich infauna[1] c) *Abra alba* community[1] d) Dense *Ophiura albida* beds[1]
		IMS.EcorEns	*Echinocardium cordatum* and *Ensis* spp in	*Ensis* beds[1]

			lower shore or shallow sublittoral fine sand	
		IMS.FaMS.SpiSpi	*Spio filicarnus* and *Spiophanes bambyx* in infralittoral clean or muddy sand	a) *Scoloplos*/*Spiophanes* community[1] b) *Nephtys*/*Scoloplos* community[1] c) Sparse polychaetes/nemertean[1]
Intertidal mudflats and sandflats	Sand and gravel communities	LGS.AEur[2]	Burrowing amphipods and *Eurydice pulchra* in well-drained clean sand shores	Burrowing amphipod and polychaete dominated biotopes. 40% cover of North Norfolk Coast intertidal zone
		LGS.AP[2]	Burrowing amphipods and polychaetes in clean sand shores	
		LGS.AP.P[2]	Burrowing amphipods and polychaetes (often _-*Arenicola marina*) in clean sand shores	
		LGS.AP.Pon[3]		
		LGS.BarSnd[2]	Barren coarse sand shores	Barren coarse sand, shingle and gravel biotopes. 30% cover of North Norfolk Coast intertidal zone
		LGS.BarSh[2]	Barren shingle or gravel shores	
		LGS.Lan	Dense *Lanice conchilega* in tide-swept lower shore sand	
		SLR.MytX	*Mytilus edulis* (mussel) beds on eulittoral mixed substrata of gravels and sands	
	Muddy sand communities	LMS.MacAre	*Macoma balthica* and *Arenicola marina* in muddy sand shores	
		LMS.MacAre.Ma re	*Macoma balthica, Arenicola marina* and *Mya arenaria* in muddy sand shores	
		LMS.Znol	*Zostera* beds in upper to mid shore muddy sand	
		LMS.Pcer[3]	Polychaetes and *Cerastoderma edule* in fine sand or muddy sand shores	Cockle beds
	Mud communities	HedMac[2]	*Hediste diversicolor* and *Macoma balthica* in sandy mud shores	Hediste diversicolor dominated biotopes. 20% cover of North Norfolk Coast intertidal zone.
		HedMac.Are[2]	*Hediste diversicolor, Macoma balthica* and *Arenicola marina* in muddy sand or sandy mud shores	
		HedMac.Pyg[2]	*Hediste diversicolor, Macoma balthica* and *Pygospio elegans* in sandy mud shores	
		HedOl[2]	*Hediste diversicolor* and oligochaetes in low salinity mud shores	
		HedScr[2]	*Hediste diversicolor* and *Scrobicularia*	

			plana in reduced salinity mud shores	
		HedMac.Mare[3]		

[1]Foster-Smith & Sotheran, 1999
[2]Perrins & Bunker, 1998
[3]ITE, 1986

Appendix III Matrix of relative vulnerability

The relative vulnerability of an interest feature or sub-feature is determined by multiplying the scores for relative sensitivity and exposure, and classifying that total into categories of relative vulnerability.

Relative sensitivity of the interest feature

		High (3)	**Medium (2)**	**Low (1)**	**None detectable (0)**
		9	**6**	**3**	**0**
	High (3)				
Relative exposure of the interest feature	**Medium (2)**	**6**	**4**	**2**	
					0
	Low (1)	**3**	**2**	**1**	**0**
	None (0)	**0**	**0**	**0**	**0**

	Categories of relative vulnerability	
	High	**6 - 9**
	Medium	**3 - 5**
	Low	**1 - 2**
	None detectable	**0**

Appendix IV

Saltmarsh NVC communities occurring within the Wash and North Norfolk Coast European marine site (according to The Saltmarsh Survey of Great Britain, Burd, 1989) - reference Favourable Condition Table

Interest feature	Sub- feature	NVC community	NCC (Burd 1989)	Saltmarsh plant species
Glasswort and other annuals covering mud and sand	Annual *Salicornia* saltmarsh community	**SM8**	2a *Salicornia*/*Suaeda*	Annual *Salicornia* sp.
	Annual seablite (*Suaeda maritima*) saltmarsh community	**SM9**	2a *Salicornia*/*Suaeda*	*Suaeda maritima*
	Ephemeral saltmarsh vegetation *Sagina maritima* saltmarsh community	**SM27**	Not included in mapping scheme	*Sagina maritima, Sagina nodosa* and *Plantago coronopus*
Atlantic salt meadows	Low marsh and low-mid marsh communities	**SM10**	**3a *Puccinellia***	*Puccinellia maritima*, annual *Salicornia* species and *Suaeda maritima.*
		SM11	2b *Aster*	*Aster tripolium var. discoides*
		SM12	2b *Aster*	Rayed *Aster tripolium*
		SM13	4a -- *Limonium*/*Armeria*	*Limonium vulgare Armeria maritima*
		SM14	3b *Atriplex portucaloides*	*Atriplex portulacoides*
	Transitional	**S4b**	4b *Phragmites*	*Phragmites Atriplex portulacoides Aster tripolium*
Atlantic salt meadows	Mid and mid-upper marsh communities	**SM16**	4b *Puccinellia*/ *Festuca*/*Plantago*	*Festuca rubra* with *Juncus gerardii*
		SM17	4b *Puccinellia*/ *Festuca*/*Plantago*	*Seriphidium maritima*
	Juncus maritimus - *Triglochin maritima* saltmarsh community	**SM15**	4d *Juncus maritimus*	*Juncus maritimus* with *Triglochin maritimum*
Mediterranean saltmarsh scrubs	Shrubby seablite (*Suaeda vera*) saltmarsh community	**SM25**	5b *Suaeda vera*	*Elymus pycnanthus*
	Shrubby seablite (*Suaeda vera*) and *Limonium binervosum* saltmarsh community	**SM21**	7i Dune transition	*Suaeda vera* and *Limonium binervosum*

Appendix V

Descriptions of saltmarsh communities found within the Wash and North Norfolk coast. Accounts follow Rodwell (2000). Nomenclature (Latin names) follows Stace, 1997.

Glassworts and other annuals colonising mud and sand

Annual *Salicornia* saltmarsh community: SM8

Several distinct taxa can be recognised among the British annual glassworts *Salicornias* but diagnosis below the level of the three groups *Salicornia europaea*, *S. procumbens* and *S. pusilla* is difficult. Therefore all annual taxa encountered are described as *Salicornia* agg. The community comprises ephemeral stands of annual *Salicornia* agg. sometimes with no other species. The vegetation is invariably somewhat open and though *Salicornia* agg. cover is always conspicuous, the density of plants is variable. Around the Wash, *Salicornia* agg. cover is high whereas at sites with sandier substrates the density can be very low. There is often an algal mat over the substrate surface but vascular plants are usually very few. Scattered plants of common saltmarsh-grass *Puccinellia maritima*, annual seablite *Suaeda maritima* and common cordgrass *Spartina anglica* occur frequently with occasional records of a variety of other lower marsh species e.g. bladderwrack, *Fucus vesiculosus* is abundant at Blakeney Point.

Annual *Salicornia*s germinate in May from seeds widely dispersed over the whole marsh surfaces. The lower limit of establishment appears to be set by the time necessary for the seedlings to become firmly anchored, eg. in the Dovey Estuary, two to three days exposure between tidal floodings was necessary for sufficient root growth to take place. *Salicornia* agg. is tolerant of frequent tidal submersion, enduring around 600 flooding tides per year at its lower limits where it forms the familiar pioneer stands. The community is also characteristic of other bare marsh habitats such as creek sides, saltpans, borrow pits and other disturbed areas in the upper marsh.

Annual *Salicornia* stands occur in both grazed and un-grazed marshes. All species are highly susceptible to oil and refinery effluent spills being killed by a single inundation.

Annual seablite (*Suaeda maritima*) saltmarsh community: SM9

This is a species-poor community, generally open, though always dominated by annual seablite *Suaeda maritima*, the density of which is normally high. There is sometimes a little annual *Salicornia*, common saltmarsh-grass *Puccinellia maritima*, cordgrass *Spartina anglica*, sea purslane *Atriplex portulacoides* and sea aster *Aster tripolium* var. *discoideus.* An algal mat is quite common.

Annual seablite *Suaeda maritima* is an annual and it is tolerant of a wide range of soil types subject to various submersion regimes. It is dominant on Norfolk marshes with between 290 - 430 submergences per year. Like the annual *Salicornia*s, its growth appears heavily dependent upon sediment nutrients, especially nitrogen, and it is particularly characteristic of open situations free of competition from established perennials. On the lower marsh it is especially distinctive of rather gravelly mud where it forms mosaics with stands of annual *Salicornia*s. The annual seablite *Suaeda maritima* saltmarsh community is also found along creek sides. Two further distinctive habitats where it is found are: those areas where drift litter accumulates at the foot of sea walls, where dense stands can exploit the release of nutrients upon decomposition of the litter; and brackish areas behind sea walls where prostrate forms of annual seablite *Suaeda maritima* are common.

Ephemeral saltmarsh vegetation with *Sagina maritima* saltmarsh community: SM27

Small stands of ephemeral vegetation with an often open cover of annuals and short-lived perennials occur patchily on British saltmarshes. Recurrent assemblages are rare and there seems to be a large element of chance in the floristic composition, early arrivals frequently pre-empting the niche. Such vegetation may include sea pearlwort *Sagina maritima,* knotted pearlwort *Sagina nodosa* and buck_s horn plantain *Plantago coronopus.* Breaks in the turf of mid-and upper marsh communities provide the most usual habitat for such species and they are especially characteristic of old turf-cuttings where they form part of the sequence of recolonising vegetation. Such ephemerals also occur in disturbed situations around reclamation banks.

Atlantic salt meadows

Low marsh and low-mid marsh communities

Transitional low-marsh vegetation with saltmarsh grass *Puccinellia maritima,* annual *Salicornia* species and annual seablite *Suaeda maritima* saltmarsh community: SM10

There are a number of vegetation types recognised of the low marsh in which common saltmarsh-grass *Puccinellia maritima* was co- dominant with annual *Salicornia* species and / or annual seablite *Suaeda maritima* during the growing season, but which during the winter took on the appearance of very open common saltmarsh-grass *Puccinellia maritima* swards. Stands of the community are invariably species-poor and always dominated by complementary proportions of the three constants (common saltmarsh-grass *Puccinellia maritima, Salicornia* species and annual seablite *Suaeda maritima*), which during the growing season form a fairly low sward of rather variable total cover. The rayed variety of sea aster *Aster tripolium* and the rayless form var. *discoideus* are quite frequent though never abundant. There is sometimes an algal mat which can cover up to 50% of the substrate surface.

At its lower limit the number of tides flooding the community is probably similar to that experienced by the lower part of the *Puccinellietum maritimae.* Soils vary from firm clays to coarse sands with a pH range of 7.0-8.0 and high levels of free calcium carbonate. The community is also widespread on the sides of large creeks where it occupies a distinct zone above the *Salicornia*s. The majority of such occurrences are on ungrazed or cattle-grazed marshes. On sheep-grazed marshes the community is confined to inaccessible creek sides. In the low marsh the community will be replaced by others as accretion progresses: in the south-east most probably by the *Puccinellietum maritimae* or the *Halimionetum portulacoides.* Creek side occurrences are part of what is probably a static zonation rather than a successional sequence. The *Puccinellietum maritimae* community is widespread, although stands are often small.

Sea aster (rayless) *Aster tripolium* var. *discoideus* saltmarsh community: SM11

The association is dominated by the rayless form of sea aster *Aster tripolium* var. *discoideus* which is especially distinctive in the late summer-early autumn flowering season when its stems may attain a height of about 1m; at other times the vegetation is 10-20cm tall. The stands are generally species-poor though there is usually some *Salicornia* agg. , common saltmarsh-grass *Puccinellia maritima* and annual seablite *Suaeda maritima.*

The substrate surface is frequently dissected by small drainage runnels threading between the sea aster *Aster tripolium* rootstocks, and locally may be carpeted by free-living brown seaweeds. Although there is a floristic graduation between low level stands with abundant *Salicornia* agg. and those at higher levels with abundant common saltmarsh-grass *Puccinellia maritima,* no sensible subdivisions can be made within the association.

The association occurs as an extensive zone in the low-marsh or on creek sides at varying levels in the marsh. At its lower limit the association seems able to tolerate upwards of 500 submergences / year, with a maximum development around 350 submergences per year. The sediments are predominantly

firm clays or silts low in organic matter but with a high proportion of fine shell fragments and a pH between 7.0 and 8.0. Most of the sites are ungrazed or only lightly cattle-grazed.

In the lower-marsh the association forms a distinct zone above the *Salicornia / Spartina* swards. Upwards it passes into the *Puccinellietum maritimae* or *Halimionetum portulacoides*. Landward boundaries are diffuse and patches of the association are frequently found in the lower part of the zone above. Although sea aster *Aster tripolium* can grow at lower levels on the shore than many saltmarsh species, it is not a successful primary coloniser. At Scolt Head, Norfolk, the association has been shown to take 25 years to develop from the pioneer *Salicornia* community. The association is predominantly south-eastern in its distribution, being frequent in The Wash, North Norfolk and Essex. Its general absence from the west may reflect climatic limitations, the scarcity of muddy marshes or the higher incidence of grazing there.

Sea aster (rayed form) *Aster tripolium* saltmarsh community: SM12

Stands dominated by rayed sea aster *Aster tripolium* have been encountered in situations with some freshwater influence, such as brackish ditches where common cord-grass *Spartina anglica* and common saltmarsh-grass *Puccinellia maritima* are frequent associates.

***Puccinellia maritima* saltmarsh community: SM13**

Although species from low and high marsh communities occur as associates, the *Puccenellietum maritimae* as a whole is differentiated from low marsh communities by the reduced frequency and cover-abundance of annual *Salicornia* species and common cord-grass *Spartina anglica*, and from the high marsh by low levels of red fescue *Festuca rubra*, creeping bent *Agrostis stolonifera* and saltmarsh rush *Juncus gerardii*. The most common associates throughout are sea arrowgrass *Triglochin maritima*, sea plantain *Plantago maritima* and thrift *Armeria maritima* and there is frequently an algal mat. It is often very varied floristically.

The *Puccinellietum maritimae* is the most widespread and extensive perennial community of the lower saltmarsh in Britain. It occurs both as a discontinuous pioneer zone and as a continuous sward in the zonation above the pioneer vegetation. It is also common on slumped creek-sides, in old pans and on disturbed sites in the upper marsh.

The association occurs on a wide range of substrates including various clays and silts, highly calcareous sands and soils of high organic content; more rarely it is found on gravel and shingle. Its importance as a colonising community is very much increased on sandier substrates. The pH is usually basic with most soils in the range 6.0-8.5. Soils are often intermittently water-logged and poorly aerated and share a moderate to high submergence rate and salinity.

Grazing is of undoubted importance in the maintenance of the association, though its effect is complex and there is evidence that the response of species varies between sites. Many marshes are heavily used for pasturing stock, most frequently sheep but also cattle, horses and wildfowl grazing may also be intensive. Grazing affects the species composition of the sward. *Puccinellia maritima* responds to grazing by the production of small, prostrate, short-leaved and rapidly tillering forms. With intensive grazing sea lavender *Limonium* spp. and sea purslane *Atriplex portulacoides* may be reduced in abundance. On silt and clay marshes heavy cattle trampling can lead to widespread poaching. Moderate grazing helps maintain a sward that can support considerable populations of wintering wildfowl. There is evidence of a preference for *Puccinellia maritima* as against rank swards, such as those of the *Juncetum gerardii*, in wigeon and dark- bellied Brent goose. For Brent goose, the *Puccinellietum maritimae* provides a valuable food source after *Zostera* and *Enteromorpha* and there is heavy use in January-March.

***Halimionetum portulacoides* saltmarsh community: SM14**

This is a closed, species-poor association in which sea purslane *Atriplex portulacoides* is constant and conspicuous as a bushy canopy up to 50cm high or as a carpet. Common saltmarsh-grass *Puccinellia*

maritima is also constant and there is frequently a little annual seablite *Suaeda maritima* and sparse records for a variety of species from both low-and upper marsh. Epiphytic algae are often abundant on the lower stems of the sea purslane *Atriplex portulacoides*.

The *Halimionetum portulacoides* association occurs on a variety of substrates including clays, sands, shingle and occasionally soils of a high organic content. Most commonly it develops on silty clay of low organic content, with some free calcium carbonate and a pH in the range 7.0-8.0. It appears tolerant of a range of submersion regimes and on Scolt Head the *Halimionetum* extends from about 100-400 submergences per year. Within these rather wide limits, the association occurs in two distinct situations, as an extensive belt of variable position in the general zonation or as narrow ribbons on creek levees. The occurrences may reflect a need in sea purslane *Atriplex portulacoides* for a well-drained aerobic soil environment, at least for seed germination. Alternatively, levee occurrences may reflect a preference for a good supply of soil nutrients, particularly nitrogen and phosphate.

Halimionetum is generally absent from sheep-grazed marshes except for those creek-sides which are inaccessible to the stock. It is, however, found on a number of cattle-grazed marshes, notably around the Wash, and it will tolerate a certain amount of rabbit grazing. Dark-bellied Brent geese do not graze extensively on *Halimionetum portulacoides* when feeding on saltings.

Where *Halimionetum* occurs within the marsh zonation, its position is variable. It can be either above or below the *Puccinellia maritimae* and boundaries between the two associations can be marked by mosaics. The *Halimionetum* is most widespread and extensive in south-east England: it is estimated that the association covers 30% of the saltmarshes of The Wash. Sensitivity to grazing restricts its occurrences on the west coast.

Mid and mid-upper marsh communities

***Festuca rubra* and *Juncus gerardii* saltmarsh community: SM16**

The closed grasslands of the *Juncetum gerardii* are normally dominated by mixtures of red fescue *Festuca rubra* and creeping bent *Agrostis stolonifera* with a variety of herbaceous associates among which sea plantain *Plantago maritima*, sea milkwort *Glaux maritima*, thrift *Armeria maritima* and sea arrow-grass *Triglochin maritimus* are generally the most frequent and abundant. Saltmarsh rush *Juncus gerardii* itself is present in varying amounts: it is usually constant through all but the most anomalous of the *Juncetum* swards and in some cases is dominant or co-dominant. Much of the site-specific variation within the *Juncetum gerardii* is probably related to the unique grazing history of every site. If grazing pressure is generally low or if grazing ceases, Red fescue *Festuca rubra* is particularly responsive, growing tall and rank, excluding most potential competitors and eventually produces a characteristic tussocky, species-poor grassland.

The degree of water logging of the substrate probably has some effect on the proportions of red fescue *Festuca rubra***,** creeping bent *Agrostis stolonifera* and common saltmarsh-grass *Puccinellia maritima* in the vegetation. Red fescue *Festuca rubra* may suffer competitively against common saltmarsh-grass *Puccinellia maritima* under waterlogged and more saline conditions and against creeping bent *Agrostis stolonifera* in waterlogged and less saline situations. In general, the *Juncetum gerardii* occupies a position above the *Puccinellia maritima* in the saltmarsh zonation. In the south-east, the association is of very limited extent and occurs only at high levels in the marsh, most often forming a discontinuous zone in contact with the *Limonium-Armeria* sub-community of the *Puccinellietum* (Rodwell, 2000).

***Seriphidium maritimum* saltmarsh community: SM17**

Stands of sea wormwood *Seriphidium maritima* are generally small and fragmentary but they range from rank grassy patches dominated by red fescue *Festuca rubra* with prominent sea wormwood *Seriphidium maritimum*, to open bushy vegetation with sea wormwood over low sea purslane *Atriplex portulacoides*. There is usually a little sea plantain *Plantago maritima;* Sea lavender *Limonium* spp. and common saltmarsh-grass *Puccinellia maritima* is also frequent.

The *Seriphidium maritimae* is an upper marsh community occurring on a variety of substrates, though often in association with tidal litter and washed shell fragments. Its most usual habitat is on creek levees where it forms small patches on the usually heavy clay soils which frequently show organic enrichment in the upper part of the profile. It is also found on ridges and mounds on the upper marsh and sometimes forms a fringe along the foot of sea walls or around stands of *Atriplici-Elymetum pycnanthi*. The association is normally found as a patchy zone between *Halimionetum* and *Atriplici-Elymetum pycnanthi*. Junctions with the former may be marked by an intermediate zone with abundant *Festuca rubra*. This zonation may reflect a succession related to increase in marsh height with sediment accretion. The *Seriphidietum* is widespread in East Anglia and along the south coast and it extends north into Scotland. West coast occurrences are scattered and restricted mainly to ungrazed marshes.

Sea rush *Juncus maritimus* - Sea arrowgrass *Triglochin maritimum* saltmarsh community: SM15

Tall tussocks of *Juncus maritimus* are always overwhelmingly dominant in this association and the associates are rather variable. However, sea arrowgrass *Triglochin maritimum* and sea plantain *Plantago maritima* are constant in usually small amounts in the understorey and various *Puccinellia* species, such as common saltmarsh-grass *Puccinellia maritima,* rayed sea aster *Aster tripolium,* thrift *Armeria maritima* and sea milkwort *Glaux maritima,* occur frequently throughout. The association differs from the *Juncus maritimus* saltmarsh community in the relative infrequency of creeping bent *Agrostis stolonifera,* red fescue *Festuca rubra* and saltmarsh rush *Juncus gerardii.*

Sea rush *Juncus maritimus* is tolerant of a wide range of salinities and soil moisture conditions and the association occurs at all levels on saltmarshes and on a variety of substrates. In the south-east, a narrow belt of the association occurs normally between the *Puccinellietum maritimae, Limonium-Armeria* sub-community, and the *Atriplici-Elymetum pycnanthi* or the tall *Festuca rubra* sub-community of the *Juncetum gerardii.* The association grades smoothly into the *Puccinellietum* which effectively constitutes the understorey of the *Juncus-Triglochin* vegetation. The association is the most widespread community dominated by *Juncus maritimus* in Great Britain and is the major *Juncus maritimus* community in south-east England.

Transitional communities

On the landward side particularly in North Norfolk tidal reedbeds are developed generally where there are springs and freshwater seepages. These are extensive in places and are the *Atriplex prostrata* subcommunity of the *Phragmitetum*. Although dominated by reed *Phragmites australis* other saltmarsh plants are present including sea club-rush *Bolboschoenus maritimus*, sea aster *Aster tripolium* and sea milkwort *Glaux maritima* particularly towards the seaward edge.

Mediterranean saltmarsh scrubs
Shrubby seablite (*Suaeda vera*) saltmarsh community: SM25

The association is most characteristic of drift-lines at saltmarsh / shingle interfaces. The association marks a particular type of transition from the upper marsh to other maritime communities and the drift line stands are probably stable in time. The low-level stands of the *Halimione* sub-community overlap the habitat of the sea heath *Frankenia laevis* sub-community of the *Suaeda vera - Limonium binervosum* saltmarsh and at some sites in North Norfolk there is a mosaic of the two communities. The balance between them could be controlled by rabbit-grazing and it has been suggested that Matted sea lavender *Limonium bellidifolium* declined on Scolt Head because of the increased vigour of sea purslane *Atriplex portulacoides* following the reduction there of rabbit grazing.

Shrubby seablite (*Suaeda vera*) and rock sea lavender *Limonium binervosum* saltmarsh community: SM21

The rather open vegetation of this community is generally dominated by scattered bushes of Shrubby seablite *Suaeda vera* and sea purslane *Atriplex portulacoides* up to 40 cm high with a patchy cover of

herbaceous halophytes between. Among the constants, common saltmarsh-grass *Puccinellia maritima* and rock sea lavender *Limonium binervosum* are usually abundant with smaller amounts of thrift *Armeria maritima.* Shrubby seablite *Suaeda vera* is fairly frequent throughout. The community is characteristic of saltmarsh / dune interfaces, spit laterals, eroded dunes and some sand dune lows where there is a base of shingle covered with varying amounts of blown sand and in-washed silt. In general the community occupies a stable position at the uppermost end of the saltmarsh zonation.

The community is endemic to Great Britain and occurs at the North Norfolk coast and Gibraltar Point. Sea heath *Frankenia laevis,* matted sea lavender *Limonium bellidifolium,* rock sea lavender *Limonium binervosum* and shrubby seablite *Suaeda vera* are all members of the Mediterranean element in the British flora. Although it is only matted sea lavender *Limonium bellidifolium* that is not found outside North Norfolk and Gibraltar Point.

Transitional communities

The Mediterranean saltmarsh scrub community occurs at the highest point of the saltmarsh where there is usually a sharp transition to either dune, shingle or grassland communities developed on sea banks or higher ground.

Appendix VI Current (1999) information on qualifying species and populations of birds that use the Wash SPA

Internationally important populations of Annex 1 species

Avocet	wintering	139	6.4% of GB population
	breeding	40 pairs	6.6% of GB population
Golden Plover	wintering	12717	5.1% of GB population
	autumn passage	5004	2.0% of GB population

Internationally important populations of migratory species

Pink-footed Goose	wintering	24977	11.1% of International population
Dark-bellied Brent Goose	wintering	21765	7.3% of International population
Shelduck	wintering	12815	4.3% of International population
Oystercatcher	wintering	19161	2.1% of International population
	autumn passage	20219	2.2% of International population
Ringed Plover	wintering	739	1.5% of International population
	spring passage	725	1.5% of International population
	autumn passage	1472	2.9% of International population
Grey Plover	winter	10101	6.7% of International population
	spring passage	13543	9.0% of International population
	autumn passage	11854	8.0% of International population
Lapwing	wintering	22778	1.1% of International population
Knot	wintering	78101	22.3% of International population
	spring passage	25347	7.2% of International population
	autumn passage	84802	24.2% of International population
Sanderling	autumn passage	1777	1.8% of International population
Dunlin	wintering	36083	2.6% of International population
	spring passage	35930	2.6% of International population
	autumn passage	33388	2.4% of International population
Black-tailed Godwit	wintering	1792	2.6% of International population
	autumn passage	3883	5.5% of International population
Bar-tailed Godwit	wintering	13685	13.7% of International population
	spring passage	1326	1.3% of International population
	autumn passage	12373	12.4% of International population
Curlew	wintering	3622	1.0% of International population
	autumn passage	9733	2,8% of International population
Redshank	wintering	2985	2.0% of International population
	spring passage	2402	1.6% of International population
	autumn passage	6622	4.4% of International population
Turnstone	autumn passage	966	1.4% of International population

Internationally important assemblage of over 20,000 non-breeding waterfowl

In addition to the internationally important populations of Annex 1 species and the internationally important populations of migratory species listed above, the following bird species occur at levels of national importance and form a part of the assemblage :-

Gadwall	wintering	81	1.0%	of GB population
Eider	wintering	783	1.0%	of GB population
Red-breasted Merganser	wintering	103	1.0%	of GB population
Sanderling	wintering	463	2.0%	of GB population
Turnstone	wintering	678	1.1%	of GB population

(The following species also forms a part of the assemblage but occurs on SPA habitats outside but adjacent to the European Marine Site boundary :-

Little Grebe	wintering	88	2.9%	of GB population)

The Wetland Bird Survey 5 year peak mean of total waterfowl numbers for The Wash SPA for the period 1993/94 - 1997/98 is :- 312167

NOTES

8. Population data given above for wintering, spring passage and autumn passage are Wetland Bird Survey(WeBS) 5 year peak means for the period 1993/94 - 1997/98. Breeding population data are 5 year means for the period 1995 - 1999.

Appendix VII Current (1999) information on qualifying species and populations of birds that use the North Norfolk Coast SPA

Internationally important populations of Annex 1 species

Red-throated Diver	wintering	51	1.0%	of GB population
Slavonian Grebe	wintering	22	1.0%	of GB population
Bittern	wintering	5	>1.0%	of GB population
Marsh Harrier	breeding	11.8 nesting females	7.6%	of GB population
Hen Harrier	wintering	16	2.0%	of GB population
Avocet	wintering	256	25.6%	of GB population
	breeding	177 pairs	29.0%	of GB population
Golden Plover	wintering	2859	1.1%	of GB population
Ruff	wintering	55	7.8%	of GB population
Mediterranean Gull	breeding	2.2 pairs	7%	of GB population
Sandwich Tern	breeding	3457 pairs	25%	of GB population
Common Tern	breeding	422 pairs	3.4%	of GB population
Roseate Tern	breeding	1-2 pairs	1-2%	of GB population
Little Tern	breeding	377 pairs	16%	of GB population

(The following Annex 1 species also occurs in internationally important numbers but on SPA habitats outside but adjacent to the European Marine Site boundary :

Bittern	breeding	3 booming males	17%	of GB population)

Internationally important populations of migratory species

Pink-footed Goose	wintering	35070	16.0%	of International population
Dark-bellied Brent Goose	wintering	11883	4.0%	of International population
Wigeon	wintering	14230	1.1%	of International population
Pintail	wintering	1249	2.1%	of International population
Ringed Plover	autumn passage	1460	2.9%	of International population
Grey Plover	wintering	1541	1.0%	of International population
Knot	wintering	8856	2.5%	of International population
Sanderling	autumn passage	1050	1.0%	of International population
Bar-tailed Godwit	wintering	2253	2.1%	of International population
Redshank	wintering	3557	2.4%	of International population
Black-headed Gull	wintering	52750	2.6%	of International population
Common Gull	wintering	20677	1.3%	of International population

Internationally important assemblage of over 20,000 non-breeding waterfowl

In addition to the internationally important populations of Annex 1 species and the internationally important populations of migratory species listed above, the following bird species occur at levels of national importance and form a part of the non-breeding assemblage :-

Little Grebe	wintering	69	2.3%	of GB population	
Red-necked Grebe	wintering	8	8.0%	of GB population	
Cormorant	wintering	401	3.1%	of GB population	
White-fronted Goose	wintering	364	6.1%	of GB population	
Shelduck	wintering	1130	1.5%	of GB population	
Teal	wintering	2982	2.1%	of GB population	
Scaup	wintering	203	1.8%	of GB population	
Common Scoter	wintering	2901	8.3%	of GB population	
Velvet Scoter	wintering	48	1.6%	of GB population	
Goldeneye	wintering	185	1.1%	of GB population	
Red-breasted Merganser	wintering	114	1.1%	of GB population	
Ringed Plover	wintering	458	1.6%	of GB population	
Sanderling	wintering	535	2.3%	of GB population	
Dunlin	autumn passage	4423	2.2%	of GB population	
Black-tailed Godwit	wintering	77	1.1%	of GB population	

(The following species also form a part of the assemblage but occur on SPA habitats outside but adjacent to the European Marine Site boundary :

Gadwall	wintering	223	2.8%	of GB population
Shoveler	wintering	181	1.8%	of GB population)

The Wetland Bird Survey 5 year peak mean of total waterfowl numbers for the North Norfolk Coast SPA for the period 1993/94 - 1997/98 is : 118676

NOTES

9. *Population data given above has been calculated as follows :-*
wintering and autumn passage = WeBS 5 year peak mean 1993/94 - 1997/98.
breeding = 5 year mean 1994 - 1998.
Exceptions to this are:-
a) wintering Redshank - undercounted by WeBS. Figure quoted is max count from winter low tide survey commissioned by EN 1997/98 (Lawton et al - in prep).
b) wintering Black-headed Gull and Common Gull - not effectively counted by WeBS. Figures given are maxima from winter roost survey commissioned by *EN* 1998/99 *(Lawton et al - in prep).*

Internationally important assemblage of over 20,000 breeding waterfowl

In addition to the internationally important populations of Annex 1 species listed above, the following species occur at levels of national importance and form a part of the breeding assemblage :-

Shelduck			151	pairs		1.4%	of GB population
Wigeon	7.6	pairs			1.9%	of GB population	
Gadwall			82.8	pairs		10.8%	of GB population
Pintail			0.8	pairs		4.0%	of GB population
Garganey			2.6	pairs		3.7%	of GB population
Shoveler			69.8	pairs		5.6%	of GB population
Pochard			25.2	pairs		7.7%	of GB population
Water Rail			10.7	pairs		1.6%	of GB population
Oystercatcher			782	pairs		2.1%	of GB population
Ringed Plover			237	pairs		2.8%	of GB population
Redshank			717	pairs		2.2%	of GB population
Black-headed Gull			6546	pairs		3.9%	of Gb population
Bearded Tit			56	pairs		15%	of GB population

NOTES

1. Of the species listed above, only Shelduck, Oystercatcher, Ringed Plover, Redshank and Black-headed Gull make significant use of SPA habitats within the European marine site. The remainder are concentrated in freshwater and/or sand dune habitats.

10. The breeding assemblage data has been calculated on a site by site basis within the SPA, the site totals then being summed to give an SPA total, The WeBS Sectors cover the whole SPA and have been used to define sites.

11. For each site where data is available a five year mean has been calculated for the period 1994-98. Few sites have this level of data for all species and in these cases the best available data for the 1994-99 period has been used.

12. In a few instances best estimates have had to be made. This has been done in consultation with relevant Site Managers and other specialists. The only species for which the SPA total includes a significant number of estimates is Shelduck.

Appendix VIII Wash and North Norfolk Coast European marine site mapped information which will be available to assist the development of a management.

Interest Feature	Survey	Map
Large shallow inlet and bay	Bob Foster-Smith	* Subtidal infaunal biotope distribution * Subtidal infaunal biotope distribution (with local variants) * Subtidal infaunal biota * Subtidal epifaunal biota
	NRA Wash Zone Report 1994	Sublittoral invertebrate distribution maps: * *Eteone longa* (bristle worm) * *Capitella capitata* (bristle worm) * *Nephtys cirrosa* (bristle worm) * *Nephtys hombergii* (bristle worm) * *Scoloplos armiger* (bristle worm) * *Sabellaria spinulosa* (ross worm) * *Lanice conchilega* (sandmason worm) * *Sabella pavonina* (peacock worm) * *Tubificoides benedii* (oligochaete) * *Hydrobia ulvae* (mud snail) * *Modiolus* sp. (horse mussel) * *Cerastoderma edule* (common cockle) * *Ensis* sp. (razor shell) * *Angulus tenuis* (thin tellin) * *Macoma balthica* (Baltic Tellin) * *Abra alba* (tellin) * *Ophiura albida* (brittlestar) * *Ophiura ophiura* (brittlestar) * *Corophium* sp. (burrowing amphipod) * *Pandalus montagui* (pink shrimp) * *Crangon crangon* (brown shrimp)
Subtidal sandbanks	Bob Foster-Smith	* Sediment distribution of the Wash and North Norfolk Coast * Infaunal biota distribution of the Wash and North Norfolk Coast * Epifaunal biota distribution of the Wash and North Norfolk Coast
	MNCR Intertidal Survey 1997, Hunstanton to --Thornham	* Biotope distribution * Biotope complex distribution
	Perrins, J. and F. Bunker. 1998. Biotope survey of the littoral sediments of the North Norfolk Coast candidate SAC. *Report to English Nature* **285**.	* Biotope complex distribution, Thornham to Cley * biotope distribution, Thornham to Cley * Biotope complex distribution, Thornham to Scolt Head * Biotope complex distribution, Scolt Head to Cley

		* Biotope distribution, Thornham to Scolt Head * Biotope distribution, Scolt Head to Cley
Eelgrass beds	McCallum, J. 1997. Zostera distribution, Wells to Cley, July 1997.	* Distribution of dwarf eelgrass *Zostera noltii*, Wells to Cley * Distribution of narrow leaved eelgrass *Zostera angustifolia*, Wells to Cley *Zostera noltii* * Blakeney Harbour * High Sand and Cabbage Creek * Wells Harbour * West Sands *Zostera angustifolia* * Blakeney Point * Wells Harbour * West Sands
Saltmarsh Communities	Posford-Duvivier	* Distribution of Annex I Saltmarsh interest features in the Wash and North Norfolk Coast cSAC
	Burd, F. 1987. Saltmarsh Survey of Great Britain	* Saltmarsh community distribution, Holme to Thornham * Saltmarsh community distribution, Brancaster to Burnham Overy * Holme Dunes (2 Maps) * West Thornham (4 Maps) * Thornham (11 Maps) * Brancaster Marsh (6 Maps) * Burnham Deepdale (2 Maps) * Burnham Norton (2 Maps) * Burnham Overy
North Norfolk Coast SPA	Lawton, N.M. In prep. Winter Gull roost survey of the North Norfolk Coast SPA, 1998/99.	* Location of gull roosts on the North Norfolk Coast SPA, Winter 1998/99 Individual roosts: * Thornham * Titchwell * Brancaster Harbour * Burnham Overy * Wells Harbour * Wareham/Stiffkey * Blakeney Harbour
	Lawton, N.M. and M. Rooney. Brent Goose Roost Survey of the North Norfolk Coast SPA.	* Location of dark-bellied brent roosts on the North Norfolk Coast SPA Individual roosts: * Thornham Harbour * Scolt Head/Brancaster Harbour * Burnham Overy * Wells Harbour * Wareham * Blakeney Harbour

	Lawton, N.M. and M. Rooney. Breeding Redshank survey of the North Norfolk Coast SPA, 1998.	* Distribution of breeding Redshank on saltmarshes * Density of breeding Redshank on saltmarshes
	Lawton, N.M. and M. Rooney. In prep. Lowtide bird survey of the North Norfolk Coast SPA 1997/98.	* Habitat distribution * Total count of all birds * Total count of passerines * Total count of waterfowl <u>Wildfowl - Winter distribution:</u> * Cormorant * Dark-bellied Brent Goose * Eider * Goldeneye * Grey Heron * Little Grebe
		<u>Waders - Winter distribution:</u> * Avocet * Bar-tailed Godwit * Black-tailed Godwit * Curlew * Dunlin * Golden Plover * Greenshank * Grey Plover * Jack Snipe * Knot * Lapwing * Little Egret * Oystercatcher * Redshank * Ringed Plover * Ruff * Spotted Redshank * Sanderling * Snipe * Turnstone
		<u>Wildfowl - Winter distribution:</u> * Cormorant * Dark-bellied Brent Goose * Eider * Goldeneye * Grey Heron * Little Grebe

		* Mallard * Mute Swan * Pintail * Red-breasted Merganser * Shelduck * Teal * Water Rail * Wigeon
		<u>Passerines - Winter distribution:</u> * Twite * Reed Bunting * Rock Pipit * Skylark * Meadow Pipit * Linnet * Snow Bunting * Shore Lark * Lapland Bunting
	Wetland Bird Survey: Winter 5 year peak means by sector, 1993/4 to 1997/8.	<u>Waders:</u> * Ringed Plover * Grey Plover * Knot * Sanderling * Ruff * Snipe * Black-tailed Godwit * Curlew * Redshank * Oystercatcher * Avocet * Golden Plover * Lapwing * Dunlin * Bar-tailed Godwit * Turnstone
		<u>Wildfowl:</u> * Little Grebe * Wigeon * Gadwall * Teal * Pintail

		* Shoveler * Red-breasted Merganser * Red-throated Diver * Little Egret * White-fronted Goose * Dark-bellied Brent goose * Shelduck * Goldeneye
	Wetland Bird Survey: Spring 1998 by subsector.	* Ringed Plover * Sanderling * Ruff * Black-tailed Godwit
	Wetland Bird Survey: Autumn 5 year peak means by sector 1994 to 1998.--	* Ringed Plover * Sanderling * Ruff * Black-tailed Godwit * Curlew * Redshank
	Wetland Bird Survey: Autumn 1998 by subsector.	* Ringed Plover * Sanderling * Ruff * Black-tailed Godwit * Curlew * Redshank

Appendix IX English Nature's Habitats Regulations Guidance Note: The Appropriate Assessment (Regulation 48)

Appendix X The Wash and North Norfolk Coast candidate Special Area of Conservation citation maps

Appendix XI Citation maps for The Wash, North Norfolk Coast, and Gibraltar Point Special Protection Areas

Appendix XII Maps of features and sub-features