European Community Directive
on the Conservation of Natural Habitats
and of Wild Fauna and Flora
(92/43/EEC)

Second Report by the United Kingdom under Article 17

on the implementation of the Directive from January 2001 to December 2006

Conservation status assessment for :

H1160: Large shallow inlets and bays

Please note that this is a section of the report. For the complete report visit http://www.jncc.gov.uk/article17

Please cite as: Joint Nature Conservation Committee. 2007. *Second Report by the UK under Article 17 on the implementation of the Habitats Directive from January 2001 to December 2006*. Peterborough: JNCC. Available from: www.jncc.gov.uk/article17

H1160 Large shallow inlets and bays

Audit trail compiled and edited by JNCC and the UK Inter-Agency Marine Monitoring Group

This paper and accompanying appendices contain background information and data used to complete the standard EC reporting form (Annex D), following the methodology outlined in the commission document "Assessment, monitoring and reporting under Article 17 of the Habitats Directive, Explanatory Notes and Guidelines, Final Draft 5; October 2006". The superscript numbers below cross-reference to the headings in the corresponding Annex D reporting form. This supporting information should be read in conjunction with the UK approach for habitats (see 'Assessing Conservation Status: UK Approach').

1. National-biogeographic level information

1.1 General description and correspondence with National Vegetation Classification (NVC) and other habitat types

Table 1.1.1 provides a summary description of H1160 and its relations with UK classifications. Large shallow inlets and bays are large indentations of the coast, generally more sheltered from wave action than the open coast. They are relatively shallow (with water less than 30 m over most of the area), and in contrast to 1130 Estuaries, generally have much lower freshwater influence.

In the UK, three main sub-types can be identified that meet the Annex I definition (Jackson and McLeod 2000):

- Embayment. A type of marine inlet where the line of the coast typically follows a concave sweep between rocky headlands, sometimes with only a narrow entrance to the embayment.
- Fjardic sea loch. A series of shallow basins connected to the sea via shallow, sometimes intertidal, sills. Fjards are found in areas of low-lying ground which have been subject to glacial scouring. They have a highly irregular outline, no main channel and lack the high relief and U-shaped cross-section of fjordic sea lochs.
- Ria. A drowned river valley in an area of high relief; most have resulted from the post-glacial rise in relative sea level. In Scotland this sub-type is called a voe.

The upper limit for a 'large shallow inlet and bay' within the UK has been set by JNCC at 62,000 ha (620 km^2), which is the size of The Wash. The lower limit is 200 ha (2 km^2) for open coast bays; 100 ha (1 km^2) for enclosed coast rias, voes, embayments and sealochs.

'Large shallow inlets and bays' are habitat complexes which comprise an interdependent mosaic of subtidal and intertidal habitats. Several of these habitat types (1140 Mudflats and sandflats not covered by sea water at low tide, 1110 Sandbanks which are slightly covered by sea water all the time and 1170 Reefs) are listed as Annex I habitats in their own right.

Table 1.1.1 Summary description of habitat H1160 and its relations with UK vegetation/habitat classifications.

Classification	Correspondence with Annex I type	Comments
EU Interpretation Manual	= H1160	Large indentations of the coast where, in contrast to estuaries, the influence of freshwater is generally limited. These shallow 13 indentations are generally sheltered from wave action and contain a great diversity of sediments and substrates with a well developed zonation of benthic communities. These communities have generally a high biodiversity. Several physiographic types may be included under this category providing the water is shallow over a major part of the area: embayments, fjards, rias and voes (European Commission 2006).
Biodiversity Action Plan (BAP) priority habitat type	Inshore sublittoral rock, inshore sublittoral sediment, littoral rock, littoral sediment	These habitats may encompass the whole or only part of the Annex I type depending on the composition of the reef at an individual site.
Common Standards Monitoring (CSM) reporting categories	Inlets and Bays, eel grass beds	These habitats may be found as part of or the whole of an occurrence of the Annex I type.

2. Range [2.3]

2.1 Current range

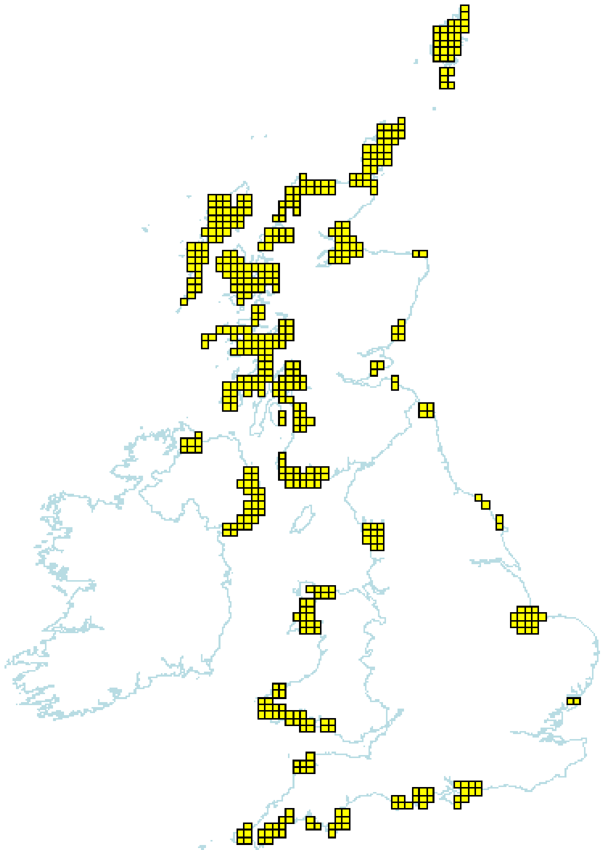
Range surface area [2.3.1]: 7, 646 km²
Date of calculation [2.3.2]: May 2007
Quality of data [2.3.3]: Good

As this feature is defined by its physiographic nature rather than by a specific biological community, the range surface area is considered to be equivalent to UK extent (section 3), which was calculated using data extracted from the UKSeaMap dataset (Connor *et al*. 2006) (the method of this calculation is provided in 3.1).

'Large shallow inlets and bays' are widespread throughout the coasts of Europe, although their specific character varies significantly from region to region. Fjardic sea lochs are scarce outside the UK, whilst rias are a particular feature of France and northern Spain as well as Britain.

As can be seen from Map 2.1.2 'large shallow inlets and bays' are distributed widely around the UK, but some sub-types are localised in their distribution (though these are not shown on the map). Rias occur only in southern Wales, south-west England, and Shetland (where they are known as voes), and fjards are restricted to western Scotland and Northern Ireland (Jackson and McLeod 2000). There are 259 'large shallow inlets and bays', according to data held by JNCC as part of the UKSeaMap project (Connor *et al*. 2006).

Maps 2.1.1 and 2.1.2 show the range and distribution of H1160 in the UK

Map 2.1.1 Habitat range map [1.1] for H1160	**Map 2.1.2** Habitat distribution map [1.2] for H1160
	
This map uses data from UKSeaMap (Connor, *et al.* 2006). Because range is equal to area for this feature, this map is better described as an area map.	This map uses data from UKSeaMap (Connor, *et al.* 2006). Each blue square represents a 10x10km square of the National Grid and shows the known and/or predicted occurrence of this habitat.

2.2 Trend in range since c.1994

Trend in range[2.3.4]: **Stable**
Trend magnitude[2.3.5]: **Not applicable**
Trend period[2.3.6]: **1994-2006**
Reasons for reported trend[2.3.7]: **Not applicable**

'Large shallow inlets and bays' are features defined by their physiographic nature rather than by a specific biological community. Therefore, we do not consider that the range of 'large shallow inlets and bays' within the UK has changed significantly over time.

2.3 Favourable reference range

Favourable reference range[2.5.1]: **7,646 km^2**

Due to their physiographic nature, the favourable reference range is equal to the current range of H1160.

2.4 Conclusions on range

Conclusion[2.6.i]: **Favourable**

The feature is at 'favourable reference range', and there is no evidence that its range has changed within relevant timescales. Therefore the judgement for this parameter is Favourable.

3. Area [2.4]

3.1 Current area

Total UK extent [2.4.1]: **7,645.6 km^2**

Date of estimation [2.4.2]: **May 2007**
Method [2.4.3]: **3 = Ground based survey**
Quality of data [2.4.4]: **Good**

Table 3.1.1 provides information on the area of H1160 in the UK.

The area of 'large shallow inlets and bays' in the UK was calculated using data extracted from the UKSeaMap dataset (Connor *et al*. 2006). All UK bays, embayments and sealochs were first identified, and using soundings data those with an average depth less than 30 m were then identified, of which there were 259 in total. The area of these 'large shallow inlets and bays', calculated in Geographical Information System (GIS) was determined to be approximately 7,645.6 km² (764,562 ha). This is an updated and slightly higher figure from that provided by Jackson and McLeod (2000).

Table 3.1.1 Area of H1160 in the UK.

	Area (ha)	**Method [2.4.3]**	**Quality of data [2.4.4.]**
England	166,456.13	3	Good
Scotland	419,354.35	3	Good
Wales	114,558.65	3	Good
Northern Ireland	64,193.55	3	Good
Total UK extent [2.4.1]	764,562.68	3	Good

Method used to estimate the habitat surface area: 1 = only or mostly based on expert opinion; 2 = based on remote sensing data; 3 = ground based survey. Only the most relevant class is given if more than one applies.
Quality of habitat surface area data: 'Good' e.g. based on extensive surveys; 'Moderate' e.g. based on partial data with some extrapolation; 'Poor' e.g. based on very incomplete data or on expert judgement

3.2 Trend in area since c.1994

Trend in area[2.4.5]: **Stable**
Trend magnitude[2.4.6]: **Not applicable**
Trend period[2.4.7]: **1994-2006**
Reasons for reported trend[2.4.8]: **Not applicable**

Some anthropogenic processes can reduce the area of individual 'large shallow inlets and bays', for example the reclamation of intertidal land. Some figures of historical reclamation are available (Davidson *et al*. 1991) for a small number of 'large shallow inlets and bays', indicating that a total of 49,340 ha of area has been lost from 'large shallow inlets and bays' in the UK since Roman times. However, there is no indication that the area of 'large shallow inlets and bays' has changed significantly since 1994.

3.3 Favourable reference area

Favourable reference area[2.5.2]: **7,645.6 km²**

No major change in area has occurred for this feature in recent times. Therefore, the favourable reference area is equal to the area of the feature.

3.4 Conclusions on area covered by habitat

Conclusion[2.6.ii]: **Favourable**

'Large shallow inlets and bays' are physiographic features whose area is determined primarily by physical and geological processes which take place over long timescales. There is no indication of a decrease in the area of 'large shallow inlets and bays' since 1994 and the distribution pattern within the range has not altered. Therefore in accordance with EC guidance, the conclusion for area is Favourable.

4. Specific structures and functions (including typical species)

4.1 Main pressures [2.4.10]

200 Fish and Shellfish Aquaculture

210 Professional fishing
211 fixed location fishing
212 trawling
220 Leisure fishing
221 bait digging
240 Taking / Removal of fauna, general
250 Taking / Removal of flora, general
313 Exploration and extraction of oil or gas
400 Urbanised areas, human habitation
410 Industrial or commercial areas
420 Discharges
504 port areas
510 Energy transport
512 pipe lines
520 Shipping
600 Sport and leisure structures
621 nautical sports
700 Pollution
701 water pollution
860 Dumping, depositing of dredged deposits
300 Sand and gravel extraction
302 removal of beach materials
800 Landfill, land reclamation and drying out, general
801 polderisation
802 reclamation of land from sea, estuary or marsh
871 sea defense or coast protection works
900 Erosion
954 invasion by a species
960 Interspecific faunal relations
973 introduction of disease
969 other forms or mixed forms of interspecific faunal competition

Detail of these pressures is provided in section 5.1.2:

- Fisheries (200, 210, 211, 212, 220, 221, 240, 250)
- Anthropogenic disturbance and coastal development (313, 400, 410, 420, 504, 510, 512, 520, 600, 621, 700, 701, 860)
- Coastal erosion and sea level rise (300, 302, 800, 801, 802, 871, 900)
- Climate change (871, 900)
- Non-indigenous species (954, 960, 969, 973)
- Wasting disease of eelgrass beds

4.2 Current condition

There exist few data that examine the structure and function of ‘large shallow inlets and bays’ as units, rather data tend to focus on particular habitats and biological communities which may be found within this Annex 1 feature. None of these habitats and communities, however, are either always found or exclusively found within ‘large shallow inlets and bays’. Therefore establishing the status of this feature from a structure and function perspective is difficult. Data coming from the Common Standards Monitoring (CSM) process does, however provide one source of data, though these data relate only to those large shallow inlets and bays within UK Special Areas of Conservation (SACs) (Williams 2006).

4.2.1 CSM condition assessments

Condition assessments based on CSM (see http://www.jncc.gov.uk/page-2199) provide a means to assess the structure and functioning of H1160 in the UK. The following attributes were examined for all CSM assessments relevant to the habitat:

- Extent of entire feature.
- Diversity of component habitats.
- Distribution/spatial pattern of habitats.
- Water quality.

SAC condition assessments

Table 4.2.1 and Map 4.2.1 summarise the CSM condition assessments for UK SACs supporting habitat H1160. These data were collated in January 2007 and refer to data collected between 2000 and 2006. The maps give an impression of the overall spread of where unfavourable and favourable sites exist (summary statistics for the map are given in Section 7.2). The combined assessments show that of the SACs assessed:

- 36% of the area and 33% of the number of assessments was unfavourable; and
- at least 11% of the total UK habitat area was in unfavourable condition.

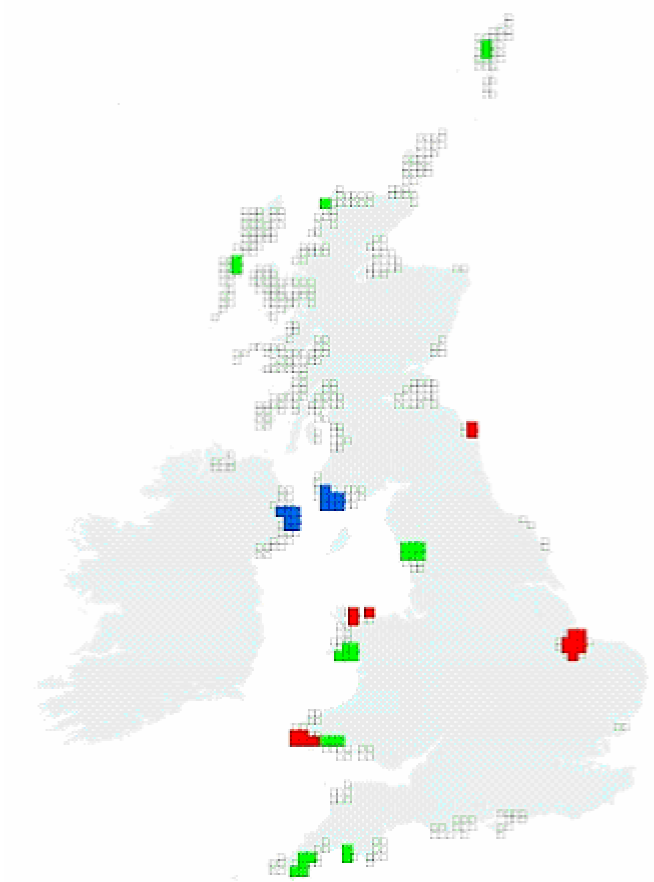
Table 4.2.1 CSM condition assessment results for UK SACs supporting H1160. See notes below table for details. Information on the coverage of these results is given in Section 7.2

Condition	Condition sub-categories	Area (ha)	Number of site features
Unfavourable	Declining	82,497	3
	No change		
	Unclassified		
	Recovering	4,553	1
	Total	87,050	4
	% of all assessments	***36%***	***33%***
	% of total UK resource	***11%***	***unknown***
Favourable	Maintained	90,188	5
	Recovered		
	Unclassified	63,958	3
	Total	154,146	8
	% of all assessments	***64%***	***67%***
	% of total UK resource	***20%***	***unknown***

Notes

1. Data on features that have been partly-destroyed have been excluded from this table because they are not relevant to the consideration of present condition.
2. The data included are from CSM assessments carried out between April 1998 and March 2005, as used for the JNCC Common Standards Monitoring Report 2006.

For 'large shallow inlets and bays', 32% of the total resource has been assessed by CSM and 36% of the assessed resource has been assessed as 'unfavourable'. There is no reason to believe that 'large shallow inlets and bays' outside SACs are in better condition than those within, and therefore, it is very likely that were the remaining 68% of large shallow inlets and bays within the UK to be assessed, the unfavourable proportion would be the same or higher.

Current Condition of H1140 on Common Standard Monitoring condition assessments (See Sections 4.2 and 7.2 for further information)
Map 4.2.1 SAC assessments

Key: Red = unfavourable, i.e. the square contains at least one SAC where this habitat feature is present and has been judged to be unfavourable Green = favourable, i.e. the square contains at least one SAC where this habitat feature is present and has been assessed as favourable but there are no unfavourable SAC features Blue = SAC not assessed, i.e. the square contains at least one SAC supporting this habitat feature but no assessment has been reported Transparent = SAC feature not present, i.e. the square does not contain any SAC features of this habitat type

4.3 Typical species

Typical species[2.5.3]: **None used**

Typical species assessment[2.5.4]: **Not applicable**

'Large shallow inlets and bays' are not defined by the presence of particular species, nor are they structurally dependent upon particular species. 'Large shallow inlets and bays' are habitat complexes which comprise an interdependent mosaic of subtidal (and intertidal) habitats and span the full geographic range of the UK. The feature also contains a range of substrate types dependent on the sub-type and location of individual features. As such, it is not meaningful to produce a typical species list that is relevant to the feature at the UK level. The following information is provided for context only and has not been transferred to Annex D.

There is considerable physical diversity between individual features, and species typical to one 'large shallow inlet and bay' may be found in very low numbers, or indeed not at all in another. 'Large shallow inlets and bays' vary widely in habitat and species diversity according to their geographic location, size, shape, form and geology. There is considerable variation between hard (rock) and soft (sediment) coasts. The degree of wave exposure is a critical factor in determining habitat and species diversity, affecting communities both on the shore and in the sublittoral zone. The range of plants and animals associated with this habitat type is therefore very wide. The issue of site size is also important, as larger sites tend to encompass the greatest variety of constituent habitats and have the greatest potential for maintenance of ecosystem integrity.

Intertidal rock communities may be dominated by wracks *Fucus* spp., particularly in more sheltered locations. Extensive beds of mussels, *Mytilus edulis*, may be present on mixed substrates. Sediment shores vary widely, depending on the degree of exposure. Very exposed conditions may result in shingle beaches, whilst less-exposed shores may consist of clean sand, and in sheltered conditions shores may consist of fine sand and mud. Very exposed sediment shores are generally unable to support animal populations. On less-exposed shores, communities of crustaceans and polychaete worms develop, while shores of fine sand and mud are characterised by polychaete and bivalve communities and beds of eelgrass, *Zostera* spp. In the sheltered conditions of Scottish fjards, loose-lying mats of green algae and the unattached wrack *Ascophyllum nodosum ecad mackaii* may occur.

In the sublittoral zone, more exposed rocky coasts support forests of kelp *Laminaria hyperborea*, with forests of sugar kelp, *L. saccharina*, occurring in more sheltered conditions. Communities of ephemeral algae and maerl (including *Phymatolithon calcareum* and *Lithothamnion corallioides*) may be present on wave-exposed or tide-swept coasts, whilst sheltered shallow sediments may be covered by communities of filamentous red and brown algae, by loose-lying mats of algae, or by beds of eelgrass, *Zostera marina* (Jackson and McLeod 2000).

Animal-dominated rocky communities in the sublittoral zone also vary according to local conditions of wave exposure and tidal streams. On more wave-exposed coasts, soft corals, anemones, sponges, sea-fans, featherstars and hydroids may be dominant, whilst more sheltered coasts support different species of sponges, hydroids, brachiopods and solitary ascidians. A particular feature of rias and fjards is the presence of sublittoral rock in conditions of strong tidal flow but negligible or no wave action. Particular growth forms of sponges and ascidians, as well as specific biotopes, occur in these unusual conditions. In tide-swept areas communities of hydroid and bryozoan turfs or beds of brittlestars may be dominant. Beds of horse mussel, *Modiolus modiolus*, characterise some seabeds. Animal-dominated sediment communities range from gravels and coarse sands dominated by burrowing sea cucumbers, large bivalves and heart-urchins, through finer sediments supporting communities of polychaetes and small bivalves, to fine muds with beds of sea-pens, large burrowing crustaceans and bottom-dwelling fish.

Eelgrass (*Zostera marina*) beds are generally found in marine inlets and bays but also in other sheltered areas, such as lagoons and channels. The plants stabilise the substratum, are an important source of organic matter, and provide shelter and a surface for attachment by other species. Eelgrass is an important source of food for wildfowl, particularly Brent goose and Widgeon which feed on intertidal beds (UK BAP 2006).

Maerl beds (composed of free-living *Corallinaceae*) typically develop where there is some tidal flow, such as in the narrows and rapids of sea lochs, or the straits and sounds between islands. Live maerl has been found at depths of 40 m, but beds are typically much shallower, above 20 m and extending up to the low tide level. Maerl beds are found off the southern and western coasts of the British Isles, north to Shetland, but are particularly well developed around the Scottish islands and in sea loch narrows, around Orkney, and in the south in the Fal Estuary. Maerl beds also occur in other western European waters, from the Mediterranean to Scandinavia (UK BAP 2006). For additional information, see the FCS Assessment for Maerl Beds (S1376 *Lithothamnion corallioides* and S1377 *Phymatolithon calcareum).*

4.4 Conclusions on specific structures and functions (including typical species)

Conclusion[2.6.iii]: **Unfavourable – Bad and deteriorating**

The EC Guidance states that where “more than 25% of the area of the habitat is unfavourable as regards its specific structures and functions”, the conclusion should be Unfavourable – Bad. In the UK this was generally taken to mean that more than 25% of the habitat area is in unfavourable condition.

36% of 'large shallow inlets and bays' assessed in CSM are currently in unfavourable and declining condition. This is based on a 32% sample of the entire resource, which if taken as representative of the resource as a whole, means that an Unfavourable – Bad and deteriorating assessment must be given.

5. Future prospects

5.1 Main factors affecting the habitat

5.1.1 Conservation measures
Elements of this habitat are covered by several national action plans under the UK BAP (see http://www.ukbap.org.uk), with targets to maintain, improve, restore and expand the resource.

In addition, 40% of the estimated extent of the feature is covered in the SAC series with conservation objectives to maintain the resource or restore sites to favourable condition. Thirteen SACs have H1160 as the primary qualifying feature; while for a further one SAC, H1160 is a qualifying feature but not the primary reason for site selection.

5.1.2 Main future threats[2.4.11]
The most obvious major future threats to H1160 are listed below, several of which are referred to in Section 4.1.
200 Fish and Shellfish Aquaculture
210 Professional fishing
211 fixed location fishing
212 trawling
220 Leisure fishing
221 bait digging
240 Taking / Removal of fauna, general
250 Taking / Removal of flora, general
313 Exploration and extraction of oil or gas
400 Urbanised areas, human habitation
410 Industrial or commercial areas
420 Discharges
504 port areas
510 Energy transport
512 pipe lines
520 Shipping
600 Sport and leisure structures
621 nautical sports
700 Pollution
701 water pollution
860 Dumping, depositing of dredged deposits
300 Sand and gravel extraction
302 removal of beach materials
800 Landfill, land reclamation and drying out, general
801 polderisation
802 reclamation of land from sea, estuary or marsh
871 sea defense or coast protection works
900 Erosion
973 introduction of disease
960 Interspecific faunal relations
969 other forms or mixed forms of interspecific faunal competition
954 invasion by a species

- Fisheries (200, 210, 211, 212, 220, 221, 240, 250)

Fishing activities are the most widespread source of anthropogenic physical disturbance of benthic communities in Northern Europe and represent the most significant human activity causing change in the UK marine environment (de Groot and Lindeboom 1994; Laffoley and Tasker 2004). Of the six "Class A - Priority Human Pressures" identified by OSPAR, fisheries account for three (OSPAR 2000). The effects of fisheries include (Laffoley and Tasker 2004):

(i) Removal of target species (including genetic effects) – given the size of most fish stocks the fishing pressure exerted upon them is outside safe biological limits.
(ii) Mortality of non-target species.
(iii) Physical disturbance of the seabed.
(iv) Shifts in community structure.
(v) Indirect effects on the food web.

There is also evidence indicating that over-fishing is often a precondition for eutrophication, disease outbreaks, or species introductions (Jackson *et al*. 2001). The combined effect of all these impacts is to reduce the overall stability of marine ecosystems (Royal Commission on Environmental Pollution, 2004). It is often difficult to establish direct relationships between specific fisheries activities and ecological effects as many ecosystem properties and components that are affected directly or indirectly by fishing also show substantial natural variability. In addition, there are many gaps in our knowledge of marine ecological processes and so it is not always possible to establish clear links between ecological change and environmental or anthropogenic factors. Unlicensed commercial fishing is considered to be one of the most significant threats to marine biodiversity (Boyes *et al*. 2006) However, the effect of this is currently unquantified due to lack of data on unlicensed activities of vessels under 11 m.

All types of fishing activity can take place in 'large shallow inlets and bays' (Sewell and Hiscock, 2005), and for the UK as a whole, it is likely that 'large shallow inlets and bays' are subject to all kinds of fishing activity. Some areas are also suitable for bait collection and aquaculture that can be a threat to sensitive eelgrass beds. Intertidal mudflats, sandflats, subtidal sandbanks and reefs are all constituent features of 'large shallow inlets and bays', and therefore they are subject to the same risks. Refer to the assessments for these constituent Annex I Features for descriptions of specific effects.

- Anthropogenic disturbance and coastal development (313, 400, 410, 420, 504, 510, 512, 520, 600, 621, 700, 701, 860)

The development of the coastal area or construction of hard defences of any kind in the region of large shallow inlets and bays has the potential to greatly influence the feature. However, there is a presumption against coastal development in the UK which is described by the following documents: NPPG 13 (Scottish Executive 1997), TAN 14 (Welsh Assembly 1998), PPG 20 (Department of Environment, England 1992). For example, the following text is taken from NPPG 13.

"The presumption against development includes projects for which a coastal location is not required; projects that are approved should be accommodated on the developed coast, reuse available and suitable brownfield land, incorporate conservation interests and work within natural processes at work on the coast. In addition where potential damage to the environment is both uncertain and significant, a precautionary approach is required and the criteria required by the various bodies responsible for environmental protection should be met".

Thus, future coastal development is not considered to be the most significant threat to 'large shallow inlets and bays'. With a number of notable exceptions, few major coastal construction projects are currently planned or in progress and those that are in the planning stages are required to provide mitigation for areas of habitat loss (Defra 2005). Barrage schemes for water storage, amenity, tidal power and flood defence continue to pose a threat to the integrity and ecological value of mudflats in estuaries and 'large shallow inlets and bays' (UKBAP 2006). However, future impact of development along the coast should not be downplayed as certain developments that require coastal locations are on the increase in some areas.

- Coastal erosion and sea level rise (300, 302, 800, 801, 802, 871, 900)

It is accepted that global climate change will modify habitats and ecosystems worldwide, not least in the marine environment. Shoreline areas will be affected by sea level rise and an increase in storms and winds resulting in changes to the distribution and composition of some shoreline habitats (Brooker and Young 2005). Sea level rise will also significantly impact the intertidal zone resulting in a decrease in area in some places.

Changes in the length of growing and breeding seasons, community composition and species ranges are likely to continue (Brooker and Young 2005). Increasing temperatures can alter the timing of ecological processes and there is therefore potential for temporal mismatch between trophic levels. Generally, warm water species are likely to replace cold water species, with cold water species moving to more northerly latitudes or greater depths (Brooker and Young 2005). Patterns of species response to climate change are not straightforward, due to factors such as current flow, which may also change, and barriers to species movement. The positive effects of increased temperatures, for example increased primary productivity may be offset by the negative impacts of increased disturbance from wave and storm surge action (Brooker and Young 2005). There has already been a change in plankton species composition and abundance with a major shift in trends recorded in the early 1980s (Hays *et al*. 2005). This shift affects a large area of the North Atlantic and appears to be linked to changes in the North Atlantic Oscillation and climate (Hays *et al*. 2005).

Uncertainties exist for many predictions including: species specific responses to climate change; the capacity of species from different habitats to migrate in response to a changing climate; the possible influx of new invasive species; the impact of increasing ocean acidity due to absorption of atmospheric CO_2. In addition, changes in certain activities as a result of climate change, in particular those caused by sea level rise could also have an impact on the marine environment. For example, managed retreat to enable persistence of some coastal habitats might be inhibited by coastal development and construction of sea defences, whilst changes in fishing policy will substantially alter the pressure on the marine biodiversity resource.

Sedimentary areas already protected by hard defences or bordered by developed land will suffer the greatest impact in the event of sea level rise (Boorman *et al.* 1989). The combined effects of coastal erosion, sea level rise and the high cost of maintaining sea defences in areas such as the south-east are matters of concern. Erosive forces would become increasingly dominant and losses of fine sediment would lead to narrower intertidal within large shallow inlets and bays. Though more sheltered areas might initially experience increased deposition and extended areas of fine sediment and marsh, this process would cease once the sediment supply was reduced and ultimately erosion would dominate (Boorman *et al.* 1989). Therefore coastal development, coastal erosion and sea level rise and all considerable concerns in both hard and soft-sediment dominated large shallow inlets and bays.

Although current anthropogenic activities such as future coastal development may be a threat, sea level rise will have the effect of squeezing the intertidal zone against existing developed land, which will ultimately reduce the intertidal area within 'large shallow inlets and bays'. In The Wash, for example, the low water mark has not changed for 100 years, though persistent land claim has squeezed the intertidal area into a smaller and smaller space. Any sea level rise would further exacerbate this situation in The Wash and elsewhere. Pye and French (1993) estimated that England alone would suffer losses of 8,000 – 10,000 ha of intertidal mud and sand flats (which can be components of 'large shallow inlets and bays') over twenty years (to 2013). However, data at present is insufficient to indicate to what extent the area of 'large shallow inlets and bays' is currently being reduced as a result of these threats.

- Climate change (871, 900)

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Young 2005). Sea level rise will also significantly impact the intertidal zone resulting in a decrease in area in some places.

Changes in the length of growing and breeding seasons, community composition and species ranges are likely to continue (Brooker and Young 2005). Increasing temperatures can alter the timing of ecological processes and there is therefore potential for temporal mismatch between trophic levels. Generally, warm water species are likely to replace cold water species, with cold water species moving to more northerly latitudes or greater depths (Brooker and Young 2005). Patterns of species response to climate change are not straightforward, due to factors such as current flow, which may also change, and barriers to species movement. The positive effects of increased temperatures, for example increased primary productivity may be offset by the negative impacts of increased disturbance from wave and storm surge action (Brooker and Young 2005). There has already been a change in plankton species composition and abundance with a major shift in trends recorded in the early 1980s (Hays *et al*. 2005). This shift affects a large area of the North Atlantic and appears to be linked to changes in the North Atlantic Oscillation and climate (Hays *et al*. 2005).

Uncertainties exist for many predictions including: species specific responses to climate change; the capacity of species from different habitats to migrate in response to a changing climate; the possible influx of new invasive species; the impact of increasing ocean acidity due to absorption of atmospheric CO_2.

In addition, changes in certain activities as a result of climate change, in particular those caused by sea level rise could also have an impact on the marine environment. For example, managed retreat to enable persistence of some coastal habitats might be inhibited by coastal development and construction of sea defences, whilst changes in fishing policy will substantially alter the pressure on the marine biodiversity resource.

- Non-indigenous species (954, 960, 969, 973)

Non-indigenous species (NIS) present a significant threat to the marine environment and their effects can have both economic and ecological ramifications, including biodiversity loss (e.g. Ruiz *et al*. 1997; Cohen and Carlton 1998). The deleterious impacts of NIS have been shown across global regions, habitat types, and taxonomic groups worldwide, including marine systems (Ruiz *et al*. 1997; Cohen and Carlton 1998; Ruiz *et al*. 2000). Within marine systems, ships' ballast water, used to improve ship stability and trim, is one of the primary mechanisms for the transport and introduction of non-indigenous marine species to ports worldwide (Carlton 1996). Given the continued growth of global trade and the complexity of shipping patterns globally, with numerous different source regions, ship types and routes operating worldwide, it is clear that NIS will continue to be transferred to UK waters for the foreseeable future.

There is some legislation currently in place to reduce the introduction of NIS via Ballast Water through the International Maritime Organization (International Maritime Organization, 2004). This legislation aims to limit the number of viable organisms within ballast tanks in the future, but NIS remain a grave concern, and could potentially lead to habitat alteration and biodiversity loss within marine Annex I habitat features. Our ability to predict invasions is severely limited by the complexity of the invasion process itself, and therefore it is difficult to identify those marine Annex I features that are at greatest risk. Nonetheless, certain areas are known to be at a particularly high risk:

(i) Areas within the vicinity of ports. Because the marine environment is essentially an open system, there is also potential for rapid and widespread secondary transfer of NIS within the UK once species establish reproducing populations.

(ii) Areas with a high diversity of habitat types (including diversity of substrate, salinity and temperature regimes and exposure). These habitats are most likely to be successfully invaded because, as the number of habitat types increases, so does the chance that a particular species will locate a suitable habitat for its establishment.

(iii) Areas already altered or damaged by anthropogenic effects.
(iv) Areas that have already been invaded by high numbers of NIS.
(v) Areas of low indigenous species richness. Brackish water conditions, for example, such as those found in estuaries generally support low diversity.

For 'large shallow inlets and bays', it is unlikely that we will be able to accurately predict which species will arrive, establish or what their impacts might be on native communities in the future. Though impacts can be minimal, they can also include massive population growth and subsequent displacement of native species with potential knock on effects on community assemblages/food webs etc.

- Wasting disease of eelgrass beds

Wasting disease, which affects eelgrass (*Zostera marina*) beds is a significant threat to 'large shallow inlets and bays'. The disease causes eelgrass to die away over time, the leaves detaching from the main plant and the regenerative shoots decay. This disease appears to have occurred globally during the 1920s and 1930s and re-occurred in the 1980s (Butcher 1933; Giesen *et al*. 1990; Short *et al*. 1986). The causes of the disease are not fully understood, and theories range from sunshine deficiency, extremes of temperature to pathogenic causes such as protozoan, fungal or bacterial infection (Butcher 1941 and other references cited in Davison 1997); the cause has never been clearly established. It is known that the disease is still present, thus future epidemics seem likely and are of grave concern as die-offs of up to 90% of plants within a population have been reported (Whelan and Cullinane 1987).

5.2 Future condition (as regards range, area covered and specific structures and functions)

5.2.1 CSM condition assessments

The CSM condition assessments reported in Sections 4.2.1-2 provide a basis to predict the potential future condition of H1160 in the UK. This involved treating all assessments currently identified as either 'favourable' or 'unfavourable recovering' as 'future-favourable': remaining categories were treated as 'future-unfavourable' – see Table 5.2.1.1. There are a number of caveats to this approach, which are set out beneath this table.

SAC condition assessments

Table 5.2.1 and Map 5.2.1 summarise the predicted potential future condition of H1160 on UK SACs. This is based on the approach described above. The maps give an impression of the overall spread of where 'future-unfavourable' and 'future-favourable' sites are predicted to occur (summary statistics for the map are given in Section 7.2). The combined assessments show that of the SACs assessed:

- 66% of the area and 75% of the number of assessments fall within the future-favourable category; and
- at least 11% of the total UK habitat area falls within the future-favourable category.

CSM data indicates that 34% of the assessed resource will be in an 'unfavourable (declining)' condition in the future (CSM 2006), which represents 11% of all 'large shallow inlets and bays' in the UK (Table 5 and Figure 2). CSM assessments were conducted on 32% of the total UK resource (See Annex 1), and therefore it is likely that the unfavourable proportion would be the same or higher if 'large shallow inlets and bays' outside of SAC were also considered.

Table 5.2.1 Predicted future condition of UK SACs supporting H1160 based on current CSM condition assessments. See notes below table for details. Information on the coverage of these results is given in Section 7.2

Future condition	Present condition	Area (ha)	Number of site features
Future-unfavourable	Unfavourable declining	82,497	3
	Unfavourable no change		
	Unfavourable unclassified		
	Total	82,497	3
	% of assessments	***34%***	***25%***
	% of total UK extent	***11%***	***Unknown***
Future-favourable	Favourable maintained	90,188	5
	Favourable recovered		
	Unfavourable recovering	4,553	1
	Favourable unclassified	63,958	3
	Total	158,699	9
	% of assessments	***66%***	***75%***
	% of total extent	***21%***	***Unknown***

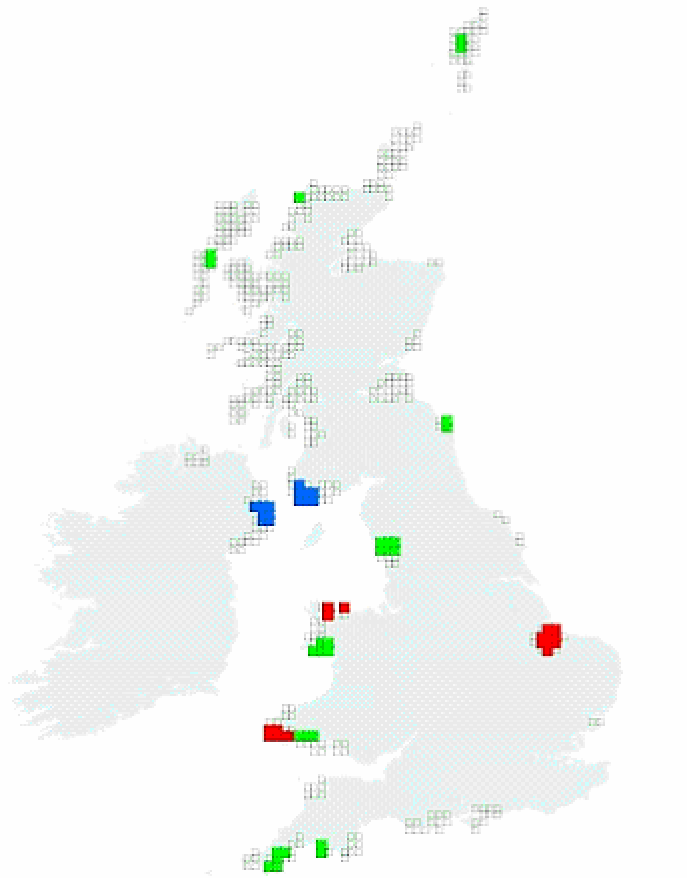
Note that the scenario presented above is based on the same information as used to construct the Table in section 4.1 It is based on the following premises:

(i) the unfavourable-recovering condition assessments will at some point in the future become favourable;

(ii) all unfavourable-unclassified sites will remain unfavourable, which is probably overly pessimistic;

(iii) sympathetic management will be sustained on sites already classified as favourable and these will not be seriously damaged by any unforeseen events.

IMPORTANT NOTE: We do not have information on the timescale of the predicted recovery, which may be influenced by many past, natural and human related factors. A sustained, sympathetic management regime is more likely to result in 'favourable' condition being attained.

Predicted Future Condition of H1140 based on CSM condition assessments (See Sections 5.2 and 7.2 for further information on these maps)
Map 5.2.1 SAC assessments

Key: Red = future-unfavourable, i.e. the square contains one or more SACs where this habitat feature is present and has been predicted to be future-unfavourable Green = future-favourable, i.e. the square contains at least one SAC where this habitat feature is present and has been predicted to be future-favourable Blue = SAC not assessed, i.e. the square contains at least one SAC supporting this habitat feature but no assessment has been reported Transparent = SAC feature not present, i.e. the square does not contain any SAC features of this habitat type

5.2.2 Water Framework Directive Risk Assessment

For the Water Framework Directive (WFD) (Environment Agency 2006a), the Environment Agency (EA; England and Wales), the Scottish Environmental Protection Agency (SEPA) and Environment and Heritage Service, Northern Ireland (EHS) conducted risk assessments of their transitional and coastal water bodies (which includes some large shallow inlets and bays) to assess the likelihood of waters failing to achieve ‘Good Ecological Status’ (GES) by 2015 (Environment Agency 2006b). The risk is an aggregation of the likely effects of the following: point source pollution (including effluent discharges from sewage treatment and industry); diffuse source pollution (including run-off from the land and acid rain); water abstraction and flow regulation (including the removal of water for public supplies or manufacturing and the control of river flows for hydro-electric power, navigation, water supplies or other purposes); physical or 'morphological' alteration to water bodies (including land claim for development, flood defence structures or channel modifications); non-indigenous species.

Note that there is not a direct match between WFD waterbodies and the Annex 1 Feature: ‘large shallow inlets and bays’. However, it was possible to assign a risk category to those ‘large shallow inlets and bays’ falling within a WFD waterbody that had been assessed. Figures in Table 5.2.2 (below) represent an overall risk value for the range of pressures and threats that affect coastal waterbodies (see above). From these combined EA and SEPA figures ~ 22% of UK 'large shallow inlets and bays' are at significant risk of failing to meet GES. Approximately another 14% are "probably at significant risk". This suggests that 36% of 'large shallow inlets and bays' will fail to meet the standards laid out in the WFD. Though this is a high percentage, it should be noted that this is a risk assessment only and does not constitute an actual assessment of these features.

Table 5.2.2 Risk that 'large shallow inlets and bays' will fail to meet Good Ecological Status under the Water Framework Directive.

Risk Category*					
	1a	**1b**	**2a**	**2b**	**Total**
England	22	8	1		28
Northern Ireland	2	3			
Scotland	26	20	67	94	214
Wales	5	5			10
% of total	22%	14%	26%	37%	254

*The level of risk has been assigned to those 'large shallow inlets and bays' contained within individual waterbodies:
1a - Water body at significant risk of failing objectives;
1b - Water body probably at significant risk of failing objectives;
2a - Water body probably not at risk of failing objectives;
2b - Water body not at risk of failing objectives (data from Coastal Waters Risk assessments by EA TRAC Risk Assessment and SEPA Risk assessment)

5.3 Conclusions on future prospects (as regards range, area covered and specific structures and functions)

Conclusion[2.6.iv]: **Unfavourable – Bad and deteriorating**

The EC Guidance states that where "habitat prospects are bad, with severe impacts from threats expected and long-term viability not assured", the judgement should be Unfavourable – Bad. In the UK, this was generally taken to mean that habitat range and/or area are in decline, and/or less than 75% of the habitat area is likely to be in favourable condition in 12-15 years.

CSM data indicates that 34% of assessed 'large shallow inlets and bays' will be unfavourable in the future and this is taken as being representative of the resource as a whole. The feature also faces some serious future threats, most significantly those posed by fishing activity and potential climate change impacts, although these threats remain largely unquantified to date.

The judgement for this parameter is therefore Unfavourable – Bad and deteriorating.

6. Overall conclusions and judgements on conservation status

Conclusion[2.6]: **Unfavourable - Bad and deteriorating**

On the basis of Structure and Function and Future Prospects, the overall conclusion is Unfavourable – Bad and deteriorating.

Table 6.1 Summary of overall conclusions and judgements

Parameter	Judgement	Grounds for Judgement	Confidence in judgement*
Range	Favourable	Range is stable and not smaller than the favourable reference range. We would strongly suggest, however that reporting of range for this feature is not a useful indicator of conservation status. Its range is determined primarily by physical and geological processes occurring over very long timescales and is not affected by the status of the biological communities supported by the feature.	1
Area covered by habitat type within range	Favourable	Area is stable and not smaller than the favourable reference area.	1
Specific structures and functions (including typical species)	Unfavourable – Bad and deteriorating	More than 25% of the habitat area is considered to be unfavourable as regards its specific structures and functions. 36% of 'large shallow inlets and bays' assessed in CSM are currently in unfavourable and declining condition. This is based on a 32% sample of the entire resource, which if taken as representative of the resource as a whole.	2
Future prospects (as regards range, area covered and specific structures and functions)	Unfavourable – Bad and deteriorating	Habitat prospects over next 12-15 years considered to be bad, with severe impact from threats expected and long term viability not assured. CSM data indicates that 34% of assessed 'large shallow inlets and bays' will be unfavourable in the future and this is taken as being representative of the resource as a whole. The feature also faces some serious future threats, most significantly those posed by fishing activity and potential climate change impacts, although these threats remain largely unquantified to date.	2
Overall assessment of conservation status	Unfavourable – Bad and deteriorating	One or more Unfavourable – Bad and deteriorating.	2

* Key to confidence in judgement: 1 = High; 2 = Medium; 3 = Low

7. Annexed material (including information sources used 2.2)

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7.2 Further information on CSM data as presented in Sections 4.2 and 5.2

Table 7.2.1 Summary of the coverage of the data shown in Tables 4.2.1 and 5.2.1

Status	Number of squares	Proportion of all squares
Current – Unfavourable (red)	21	11%
Current – Favourable (green)	29	15%
On SAC but not assessed (blue)	14	7%
Not on SAC (transparent)	130	67%
Total Number of 10km squares (any colour)	194	
Future – Unfavourable (red)	19	10%
Future – Favourable (green)	31	16%

Table 7.2.2 Summary of grid square map data shown in Maps 4.2.1-3 and 5.2.1-3

Data	Value
Number of SACs supporting feature (a)	14
Number of SACs with CSM assessments (b)	12
% of SACs assessed (b/a)	86
Extent of feature in the UK – hectares (c)	764,562
Extent of feature on SACs – hectares (d)	303,340
Extent of features assessed – hectares (e)	241,196
% of total UK hectarage on SACs (d/c)	40
% of SAC total hectarage that has been assessed (e/d)	80
% of total UK hectarage that has been assessed (e/c)	32