PEN LLŶN A'R SARNAU CANDIDATE SAC DRAFT MANAGEMENT PLAN

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1.0 INTRODUCTION

This section provides an introduction to the legal framework for Special Areas of Conservation (SACs) and describes the purpose and underlying management principles for the Pen Ll_n a'r Sarnau cSAC.

1.1 Legal background: Where do SACs come from and what legal obligations do they entail?

1.1.1 The Habitats Directive

The Habitats Directive[1] came into being to fulfill part of the commitments to conserve biodiversity that were made by European countries at the "Earth Summit" in Rio de Janeiro in 1992. This European Directive requires natural habitats and species of European importance to be maintained at, or restored to, favourable conservation status (see Appendix 1.1). One of the main mechanisms for achieving this is through the establishment and management of a European network of Special Areas of Conservation (SACs), which are to be designated on land and at sea. Each SAC is selected for the particular habitats and species it contains.

In SACs, conservation measures must be established which correspond to the ecological requirements of the habitats and species for which the sites are selected, and appropriate steps must be taken to avoid deterioration of habitats and disturbance to species for which sites have been designated. Developments likely to affect the sites must be subject to assessment of their potential impacts.

1.1.2 The Habitats Regulations

In the UK, the Habitats Directive is given effect by national legislation that is commonly referred to as the 'Habitats Regulations'[2]. These Regulations set out in detail the duties and powers of the organisations responsible for implementing the Directive. The Regulations are long and complex, and relevant extracts are given in Appendix 1.2. The key provisions in relation to marine SACs in can be summarised as follows:

i. All public and statutory bodies must have regard to the requirements of the Habitats Directive in exercising all their functions;

ii. in relation to marine areas, all public and statutory bodies with functions relevant to marine conservation, must exercise them in accordance with the requirements of the Directive;

iii. certain types of statutory bodies, called relevant authorities (see section 1.4 below), may establish management schemes for marine SACs, under which they shall exercise their functions;

iv the nature conservation body (the Countryside Council for Wales (CCW) in Wales) must advise the other relevant authorities as to the conservation objectives for a site, and any operations which may cause deterioration or disturbance to the habitats or species for which a site is designated. This is a separate duty to the establishment of a management scheme (iii above),

[1] Council Directive 92/43/EEC. The conservation of natural habitats and of wild flora and fauna.

[2] The Conservation (Natural Habitats, &c.) Regulations 1994. (Some relevant extracts are given in Appendix 1.2). There are similar regulations for Northern Ireland.

although the scheme is to be guided by this advice. CCW's advice to the other relevant authorities for the Pen Ll_n a'r Sarnau cSAC is contained in a separate document which can be obtained from CCW.

At the time of writing, the Pen Ll_n a'r Sarnau cSAC site is a candidate SAC. This means that it has been proposed by the UK government to Europe, but not yet designated. Designation is timetabled to occur by 2004. This means that the obligations outlined above do not yet apply as a matter of law. However, it is the policy of the UK Government and the National Assembly for Wales (NAW) that candidate SACs should be protected as if they were already designated.[3]

1.2 Selection of the Pen Ll_n a'r Sarnau cSAC

The Pen Ll_n a'r Sarnau cSAC has been selected for its reefs and estuaries. These are two of the marine habitat types listed in the Habitats Directive for which SACs can be selected. (Chapters 2 and 3 contain detailed information on the wildlife and conservation importance of the cSAC).

The process by which the cSAC was selected was as follows:

March 1995 — UK Nature conservation agencies (including CCW) submit proposed list of SACs to Government.

March 1995 — Government approves list of possible SACs for public consultation, including Pen Ll_n a'r Sarnau.

March - June 95 — Public consultation on possible SACs.

October 1995 — Following consultation, nature conservation agencies recommend Pen Ll_n a'r Sarnau to Government as a candidate SAC.

January 1996 — Government submits Pen Ll_n a'r Sarnau candidate SAC (along with many others) to EC.

1.3 Preparation of management schemes

The conservation of the reefs and estuaries in the area around Pen Ll_n, north Cardigan Bay and the Meirionnydd coast is of local, national and international importance. The relevant authorities for this cSAC (see section 1.4 below) with the support of local interests have agreed that it is necessary to prepare a management scheme (plan) for the site in order to meet the obligations resulting from the Habitats Directive. The purpose of this management plan is to set out how the relevant authorities intend to meet these obligations in relation to the Pen Ll_n a'r Sarnau cSAC in order to secure the conservation of the site features.

[3] DETR. 1998. 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. Pbl. HMSO. See also: Planning Guidance (Wales): Technical Advice note (5) Nature Conservation and Planning. HMSO.

This management plan:

- is based on the current state of knowledge about the reefs and estuaries of the site;
- is a working document for use by the authorities responsible for managing the cSAC, and others;
- is subject to periodic review;
- identifies and attributes actions to be taken to conserve the reefs and estuaries of the cSAC;
- identifies gaps in knowledge and how they should be addressed, and will help identify resource requirements;
- facilitates communication between the authorities with responsibility for preparing it, and the wider constituency of interested parties.

1.4 Competent and relevant authorities

No single statutory body has overall responsibility to achieve the appropriate management of a SAC. The responsibility for SAC management is vested in a large number of statutory bodies, termed "competent authorities"[4]. Each competent authority is required to exercise those of its functions which are relevant to the management of SACs in a way which secures compliance with the requirements of the Habitats Directive. In addition, certain types of competent authority, called "relevant authorities",[5] are empowered to establish management schemes under which they shall carry out those functions.

Rather than creating significant now powers for competent/relevant authorities, the Habitats Regulations provide for the management of marine SACs primarily by placing additional responsibilities on these authorities in the exercise of their existing functions.

1.4.1 Relevant authorities

There are ten relevant authorities for the Pen Ll_n a'r Sarnau cSAC (listed in Box 1.1). The development of the Pen Ll_n a'r Sarnau cSAC management plan is their joint responsibility. The relevant authorities have formed a working group to enable all of them to contribute towards the development and implementation of the management plan. Their functions and responsibilities with respect to the cSAC are summarised in Appendix 1.4.

[4] Defined in Regulation 6 of the Habitats Regulations (see Appendix 1.2)
[5] Identified in Regulation 5 of the Habitats Regulations (see Appendix 1.2)

Box 1.1 Relevant authorities for the Pen Ll_n a'r Sarnau cSAC

Ceredigion County Council
Countryside Council for Wales
D_r Cymru Welsh Water
Environment Agency
Gwynedd Council
North Western & North Wales Sea Fisheries Committee
Powys County Council
Severn Trent Water
Snowdonia National Park Authority
Trinity House Lighthouse Authority

No single relevant authority can have overall responsibility for the Pen Ll_n a'r Sarnau cSAC, since none has all the necessary powers. Each relevant authority is individually responsible for complying with its own obligations. However, by jointly preparing, implementing and reviewing this plan, it is anticipated that the relevant authorities will be able to more effectively achieve the aims of the Habitats Directive in relation to this site, than if they each acted alone. This joint approach also enables communication with local people and other interested parties about the plan as a whole. Although the plan is written by the relevant authorities, there are decisions affecting the site that are within the remit of other competent authorities (e.g. see section 1.4.2 below).

Conserving the habitats and species of SACs forms only one of the many functions of each of the relevant authorities, all of which exist primarily for other purposes and who act under other legislation. However, all the relevant authorities must, of course, comply with their obligations. All are committed to the conservation of the reefs and estuaries of the Pen Ll_n a'r Sarnau cSAC and to the successful implementation of this management scheme.

1.4.2 Competent authorities

There are many competent authorities, since the term essentially includes any publicly funded body or any body exercising statutory functions. Aside from the relevant authorities, the competent authorities that are most likely to have involvement in the management of the Pen Ll_n a'r Sarnau cSAC are:

· National Assembly for Wales (NAW): Along with the UK Government, the NAW has ultimate responsibility for implementation of the Habitats Directive in Wales, both generally and in relation to individual SACs. NAW is also the authority for some fisheries matters, and the disposal of material at sea. Controls are operated by MAFF on behalf of the NAW.

· DTI (Department for Trade and Industry): Regulates oil and gas development and energy generation.

• DETR Ports Division Issues consents for various types of works associated with harbours and navigation.

· Railtrack	Major coastal landowner with responsibility for coastal defence to protect the coastal railway between Aberystwyth and Pwllheli.
· Crown Estate Commissioners	Owners of most of the foreshore, seabed and minerals found therein.

1.5 Liaison Framework for the cSAC

In addition to the statutory provisions for competent and relevant authorities, the management of the cSAC needs to take into account public and community interests, through involving such interests in the development and implementation of the management plan.[6]

The Pen Ll_n a'r Sarnau cSAC is a large site and is of interest to a large variety of different interest groups spread over a wide and varying geographical area. It is important that the management plan takes into account the views, suggestions and concerns of the wider public, in particular members of the local communities and people actively using the sea and coast. In order to help achieve this, two publicity leaflets and a questionnaire were published and widely distributed during the period 1998-1999 to publicise the existence of the cSAC and elicit feedback which would assist the relevant authorities in identifying interested parties. Although interest was initially quite limited, the responses to the questionnaire eventually enabled a series of public meetings to be held (October 1999 to February 2000) to hear peoples' views about the site and the development of the management plan. The discussions at these meetings led to the establishment of a Liaison Group of representatives of the different interests around the site, who are now working with the relevant authorities to develop the management plan.

The Liaison Group members were selected, by consensus, to represent different interest areas and provide a conduit by which interested people can input their views into the developing management scheme (the terms of reference for the Liaison Group are in Appendix 1.5). Open-to-all public meetings will continue to provide a mechanism for a larger number of people to have an input to the management plan and the cSAC.

Liaison arrangements:

Northern Forum ——————————— **Southern Forum**

Open to all | Open to all

Liaison Group

Representatives of interest groups for the CSAC. Includes representatives of commercial and recreational fishing, farming, industry, recreation, tourism and environment, local authorities and community councils.

|

Relevant authorities group

Representatives from the relevant authorities

[6] Government guidance document: 'European marine sites in England & Wales' (Welsh Office and DETR, 1998)

1.6 The UK Marine SACs Project

The work undertaken to prepare this management plan has been financially supported as part of a UK-wide project funded by the European LIFE-Nature Programme, called the UK Marine SACs Project. Initiated in 1996, the aim of the project is to facilitate, over a four year period, the establishment of management schemes on 12 of UK's marine SACs, including Pen Ll_n a'r Sarnau. Further information about the work carried out under this project is provided in Appendix 1.6.

2. SITE DESCRIPTION

The purpose of this section is to describe the site in terms of its location, its wildlife and the surrounding marine environment. Various sources of information are also described

2.1 Site location and boundary

The Pen Ll_n a'r Sarnau cSAC is located off northwest and west Gwynedd and north Ceredigion (see Figure 2.1). It extends from Penrhyn Nefyn on the north Ll_n coast to the mouth of the Afon Clarach north of Aberystwyth. The boundary of the cSAC was determined to encompass the features for which the site was selected. The seaward boundary was drawn to encompass the underwater reefs around Pen Ll_n and in the northeast/northern part of Cardigan Bay. The coordinates of the seaward boundary are given in Appendix 2.1.

In the Dwyryd, Mawddach and Dyfi estuaries the boundary extends up to the limit of tidal influence as defined on the OS (1:50,000) map. In the Dyfi estuary, the boundary follows mean high water mark. In the Mawddach and Dwyryd estuaries, currently only the low water channels of the estuaries are included, even though the site has been selected on the basis of the whole estuaries. This is due to a stipulation by Government that intertidal areas have to be notified as Sites of Special Scientific Interest (SSSI) before they can be included within the boundary of an SAC. There will be future consultations about including the remainder of these estuaries within the cSAC boundary.

The rest of the landward boundary currently follows mean low water mark ordinary tides for most of the cSAC, except at Porth Dinllaen SSSI where it extends to mean high water mark. This, again, is due to the government requirement with respect to SSSI explained above. Other intertidal areas may be considered for inclusion within the cSAC and there will be consultation about any such future proposals.

2.2 Environmental Information

2.2.1 Biological: Habitats and species of the cSAC features

The Pen Ll_n a'r Sarnau cSAC has been selected for two habitat types listed in the Habitats Directive: "Reefs" and "Estuaries". The reefs and estuaries of this site provide spectacular wildlife habitats supporting a huge variety and abundance of marine animals and plants. Describing the reefs and estuaries of the site is complex because although they are listed as 'habitats' in the Directive, reefs and estuaries are, in reality, broad physiographical features which are comprised of many biological components together with the physical processes which sustain them

The following sections (2.2.1.1 - 2.2.1.3) provide a summary of the biological components of the reefs and estuaries (i.e. the different wildlife communities and the habitats in which they live). The aim has been to try and keep the description reasonably brief by using references to other sources of information. A summary of the physical components of the site is provided in sections 2.2.2.1 - 2.2.2.11.

The reefs, in particular, pose certain difficulties when it comes to collecting data about the marine wildlife communities living on them. Most of the reefs are permanently submerged which means that

either teams of divers or remote recording methods have to be used, both of which have their own limitations. Furthermore, the nature of the marine environment itself (tidal currents, frequent rough seas, limited visibility and physical inaccessibility) affects survey work in a far more fundamental way than for most terrestrial habitats. The detailed information about the reefs in particular is derived primarily from marine biological surveys. These "point-source" data provide detailed information about a location on the seabed, but no contextual information as to how this relates to the wider area. Fortunately, remote acoustic data and the results of CCW's "Phase I" intertidal survey are now available for much of the site - both of these provide a broadscale overview of the distribution of habitats in the subtidal and intertidal, respectively, against which point source data can be considered.

2.2.1.1 Reef habitats and species

As explained above, reefs are broad physiographical features which comprise many biological components together with the physical processes which sustain them. Reefs may be formed from either hard substrata such as bedrock, boulders and cobbles (with their associated wildlife living on, under or around them), or they may consist of biogenic concretions, where the reefs themselves are formed by living animals. Rock reefs provide a solid surface that marine animals and plants can attach themselves to. Spaces under boulders or in cracks and fissures in the rock provide a suitable home for some species, whilst other reef animals are mobile species that roam around the seabed or live in the surrounding water.

Reefs can be present both on the shore and the seabed, although guidance from the EC[7] (see Appendix 2.2) says that for reefs on the shore to qualify as a feature of an SAC, they need to be part of a reef that continues into the subtidal. The majority of the reefs currently within the Pen Ll_n a'r Sarnau cSAC are located below mean low water mark ordinary tides; the only area of seashore (intertidal) reef currently within the cSAC is at Porth Dinllaen on the north Ll_n coast. There are other rocky shore areas around the coast of the cSAC that would qualify as reefs but are not currently included within the boundary due to the requirement concerning notification of SSSI explained in section 2.1 above.

The reefs of the cSAC are exposed to a wide variety of environmental conditions such as wave action, tidal streams and depth variation. As a result, the reefs of the cSAC support an exceptional variety of communities which reflect local conditions prevailing at any one location. The presence of islands, peninsulas and areas where the reefs extend from the shore into deep water result in a wide range of physical factors and a large variety of marine communities.

The reefs of the site can be divided into three main components: (i) the rocky reefs of Pen Ll_n, Ynys Enlli and surrounding coastal waters, (ii) the Sarnau reefs, and (iii) biogenic reefs. Each of these components are described below.

i. The rocky reefs of Pen Ll_n, Ynys Enlli and surrounding coastal waters

The reefs of Pen Ll_n ,Ynys Enlli and the surrounding coastal water are distributed along the coast and offshore on all sides of the peninsula and around the island. The general pattern of distribution of seabed substrata around Ll_n is shown on the indicative broadscale acoustic map in Figure 2.3. Whilst this gives an indication of the likely areas of reef habitat around Ll_n, it is not precise enough to

[7] European Commission. 1996. *Interpretation manual of European Union Habitats.* European Commission, DG XI - Environment, Nuclear Safety and Civil Protection.

accurately map the boundaries of particular reef communities[8]. Forty eight different reef communities (or "biotopes"[9]) have been recorded to date from this part of the site. A list and brief description of the different reef communities found within the cSAC is provided in Appendix 2.2.

Some of the reefs in this part of the cSAC are composed of bedrock, whilst others are made up of boulders, cobbles and pebbles. In addition to the variation in substrata, the position and shape of the headlands and islands in this northern part of the site mean that there is wide variation in the physical forces influencing the reefs, for example varying degrees of water movement from waves and currents. Tidal streams and scour from sand and silt carried in the water both play an important role in shaping many of the reef communities here. Most of the reefs occur in a range of water depths from low water mark to over 30m deep (parts of the cSAC off Ll_n are between 40-60m deep).

Underwater, reef wildlife shows a distinctive pattern of zonation. From shallow to deep water, this zonation is related primarily to light intensity. In shallow water where light levels are highest, marine plants can readily grow. Light, however, is absorbed by water, as light levels decrease in deeper water, plants are not able to survive and only animals can live. There are however other factors which influence which species live where, principally the degree of exposure of a reef to wave action or tidal currents, type of seabed and biological competition between species. The following description of the rocky reef communities follows primarily the pattern of zonation with depth, starting with the wildlife communities in shallow water.

Shallow water communities

In shallow water around Pen Ll_n and Ynys Enlli, the bedrock and large boulder reef communities are dominated by large brown seaweeds (kelp - *Laminaria* spp.). The particular species found in any one location varies depending on how exposed it is to wave action. A rich red seaweed turf occurs amongst and below the kelp supporting a number of mainly ephemeral and scour tolerant species (including for example *Dilsea carnosa*, *Calliblepharis ciliata*, *Ceramium* spp., *Polysiphonia* spp., *Heterosiphonia plumosa*, *Plocamium cartilaginum* and *Brongniartella byssoide*s). In slightly deeper water and where the substratum tends to be seasonally unstable there are other ephemeral red seaweed communities made up of other species such as *Halarachnion ligulatum* and *Scinaia* sp.

Along the south coast of Ll_n from Llanbedrog to Criccieth, the reefs are mainly composed of boulder and cobble, supporting communities similar to some of those occurring on the Sarnau (see below). On these more unstable boulder and cobble reefs which are usually near to areas of mobile sandy sediment, the seaweed communities support dense sugar kelp (*Laminaria saccharina*) and 'groves' of other brown seaweed such as *Desmarestia* spp. and pod weed, *Halidrys siliquosa*, often with patches of sea firs (hydroids) growing on the brown seaweed. In other locations where the seabed is more mixed (cobble and pebble reefs with sandy sediment), there are dense stands of the long, thin bootlace seaweed *Chorda filum*, often together with red seaweeds.

Deeper water communities

The variety of reef communities continues below the main seaweed zone but increasingly becomes dominated by animal species in deeper water. The bathymetry of the site means that these deeper

8 Further information about the methodology used to produce the broadscale acoustic map is provided in Sanderson et al. (In prep.)

9 A biotope can be defined as a community of plants and animals in association with their physical habitat

water communities are found primarily off the north Ll_n coast and around SW Ll_n and Ynys Enlli. On boulder and bedrock reefs in deeper water there are communities made up of a wide variety sponges, soft corals, sea anemones, sea firs (hydroids) and sea mats (bryozoans) together with other animal species. In any one location, these reef communities may be dominated by cushion or stalked sponges (for example, *Esperiopsis fucorum*, *Axinella* spp., *Stelligera stuposa*), soft coral (*Alcyonium digitatum*), sea firs (for example, *Tubularia indivisa*, *Nemertesia antennina* and *Sertularia* spp.) or other species depending on the prevailing conditions. Off the north Ll_n coast, there are reef communities that are made up primarily of sea squirts (ascidians) forming a distinctive component of the reefs of this part of the site. In some areas, vertical rock faces are covered by dense sea mat-dominated communities (*Bugula* spp. and *Scrupocellaria* turf) with cushions of sponges. In areas where stronger currents increase the scouring effect of water-born silt and sand, dense stands of the bryozoan hornwrack *Flustra foliacea* with robust hydroids such as *Abietinaria abietina* and *Nemertesia antennina* and sponges (for example, *Dysidea fragilis*, *Polymastia boletiformis* and *Cliona celata)* occur.

Other species that live in current-swept areas are the hydroid *Tubularia indivisa* and jewel anemones *Corynactis viridis*. In much more exposed locations experiencing very strong tides, such as in Bardsey sound, crusts of barnacles, tube worms (serpulids) and bryozoans are found with occasional tufts of hydroids such as *Sertularia argentia* and *Hydrallmania falcata*.

There are eight nationally rare species and two nationally scarce species that have been recorded from the reefs around Ll_n and Ynys Enlli. These are listed in Appendix 2.4.

Warmer-water 'south western' species occur in the Pen Ll_n a'r Sarnau cSAC. One such species of note is the yellow star anemone *Parazoanthus axinellae*. This colonial anemone, which is generally found in warmer waters around south-west Britain and the Mediterranean, occurs predominantly on the eastern side of Ynys Enlli, although it has also been recorded from other locations around the island and on SW Ll_n. These are amongst the most northerly records for this species in the UK. It is often found living as part of a reef community which includes several stalked sponge species some of which, such as *Axinella dissimilis,* are also considered to be warmer water species.

Mobile fauna of the of Pen Ll_n/Ynys Enlli reefs

The reef communities also include many different species of associated mobile fauna. Although these species are not generally used to characterise particular biotopes, they are components of the reef features. For some species, the reefs may provide an essential habitat for all of part of their lifecycle, and in such cases these species should be considered to be a part of the reef feature. The range of species is too extensive to list here but includes many different species of fish (for example, the reefs are good nursery ground for territorial species such as wrasse (ballan, cuckoo, corkwing, goldsinny and rock cook)), crustaceans (e.g. lobster and crab), molluscs, echinoderms and others.

Other marine communities around Ll_n and Bardsey Island

A variety of sediment communities occur amongst and around the reefs of Pen Ll_n and Ynys Enlli. In places these are characterised by robust polychaete worm and amphipod species, and in others by bivalve molluscs and the heart urchin *Echinocardium cordatum*. Around SW Ll_n in particular, there are extensive areas of subtidal sandbanks made up of coarse, mobile sediments and, elsewhere in and around the cSAC, of more stable sandy expanses. These sediment areas are important elements in the dynamics, structure and function of the cSAC as a whole and have an important influence on the reef

communities of the area, e.g. sand scour. In Tremadog Bay, there is an area of much finer sediment, Muddy Hollow, which supports a very different community to the sandbanks.

There is an area of seabed to the east of the St Tudwall's Islands where a free living form of calcareous red algae (known as maerl) is found on the surface of a muddy gravel plain. Mearl beds are rare in Wales and are know to support a species-rich community of crustaceans (including the nationally scarce mantis shrimp *Rissoides desmaresti*), small fish (mainly gobies and blennies) bivalves and echinoderms.

ii. The Sarnau

The Sarnau (Sarn Badrig, Sarn-y-Bwlch and Sarn Cynfelyn) are very unusual shallow subtidal reefs which extend south-west into Cardigan Bay. The largest of the reefs, Sarn Badrig, extends about 24km offshore. The Sarnau are thought to be the remains of glacial moraines formed during the last glaciation, and are considered to be unique sublittoral reef features in the British Isles (Coastal Geomorphology Partnership, in prep). In contrast to the reefs of Pen Ll_n and Ynys Enlli, the Sarnau are located only in shallow water (in places the top of the reefs are exposed at low spring tides) and they are composed entirely of boulders, cobbles and pebbles with various grades of sediments mixed in. The general pattern of distribution of seabed substrata around Sarn Badrig is shown on the indicative broadscale acoustic map in Figure 2.3.

The three Sarnau support similar communities which reflect the exposure of the reefs to a variety of tidal stream and wave action conditions. The mobility of the reef substratum (the boulders, cobbles and pebbles) and the high degree of scour from surrounding sediments are two important factors influencing the presence and distribution of the different Sarnau reef communities.

The communities on the Sarnau are typically composed of ephemeral seaweed species that grow rapidly during the summer or are very robust species that resist scour caused by winter storms. Some species, such as kelps, that are common on the shallow reefs around Pen Ll_n and Ynys Enlli are unable to survive the harsh environment provided by the Sarnau, although small patches of sugar kelp and other kelps have been recorded from Sarn Badrig

Only a limited number of reef biotopes have been recorded from the Sarnau (see Appendix 2.3), but they have a similar pattern of distribution across the three reefs, related primarily to depth. Seaweed communities are dominant over much of the reef habitat. In shallow water and over the reef crests, there are dense 'forests' of bootlace weed. On more stable boulders and cobbles generally below about 4m depth, there is a more species-rich turf of seaweed which is distributed on either side of each of the Sarnau and is most extensive on Sarn Badrig. This community is characterised by pod weed *Halidrys siliquosa* and filamentous red weeds such as *Polysiphonia elongata, Plocamium cartilagineum*, and *Brongniartella byssoides*; in places this seaweed turf is densely covered with hydroids and bryozoans.

Below about 10m the pod weed and red seaweed turf is replaced by a faunal turf of hydroids and bryozoans (including *Hydrallmania falcata*, *Aglaophenia pluma*, *Nemertesia* spp., *Scrupocellaria* spp., *Flustra foliacea*, *Crisia* spp. and *Bugula* spp.).

Off the west end of the Sarnau, between about 10 and 20 m depth, the reefs provide a deeper water boulder and cobble habitat which supports rich communities of hydroids and bryozoans.

There are patches of sediment interspersed between areas of hard substrata on the Sarnau. Even in these transition areas between the dense cobbles and sediment there are reef communities supporting a sparse seaweed community including pod and scour-resistant seaweed such as *Halarachnion ligulatum, Ahnfeltia plicata*, *Scinaia* sp, *Naccaria wiggii* and *Halurus equisetifolius*.

Mobile reef species

As with the Pen Ll_n and Ynys Enlli reef communities, there are a number of mobile species which form an important component of the Sarnau reefs. Again, these include a wide variety of fish, crustacea and other species.

Other marine communities around the Sarnau

The areas between and surrounding the Sarnau are composed of sediments. A large proportion of this is composed of clean, well-sorted fine sand characterised by the sand mason worm *Lanice conchilega*, razor shells *Ensis* spp. and heart urchin *Echinocardium cordatum*. In some inshore areas the fine sand habitat is rich in bivalves. Where sufficiently shallow, these bivalves are banded wedge shell (*Donax vittatus*), whereas further offshore, away from the estuary mouths where there is less mud in the sediment, trough shells (*Spisula elliptica*) are found with other species. Species-rich muddy gravel communities are also found in places and other muddier sediments in the area contain polychaetes, bivalves, and brittle stars such as *Amphiura filiformis*.

iii. Biogenic reefs

There are biogenic reefs (reefs formed by particular animals), offshore and around the coast of Ll_n and along other parts of the cSAC shoreline. Biogenic reefs are solid, massive structures which are created by accumulations of animals, usually rising from the seabed, or at least clearly forming a substantial, discrete community of habitats which is very different from the surrounding seabed. The structure of the reef may be composed almost entirely of the reef building animal and its tubes or shells, or it may to some degree be composed of sediments, stones and shells bound together by the population of the reef-building animal. Biogenic reefs often form structures that provide an important habitat for other species and many biogenic reefs provide species-rich communities.

Off north Ll_n there is horse mussel (*Modiolus modiolus*) reef extending across a large area of the seabed (4 km x 2 km) forming a distinct raised reef structure on the seabed. This is a nationally scarce biotope which support a rich variety of other species. The mussels themselves are long-lived (in excess of twenty five years), slow growing animals and there is only slow and sporadic recruitment of juveniles to the horse mussel community.

Also off north Ll_n, there is another mussel which forms reef-like structures, this is the small mussel *Musculus discors*. *Musculus* mussels usually occur as single mussels attached to the seabed, but in places off north Ll_n they form a thick layer binding together a matrix of mud and pseudofaeces amongst their byssus threads.

The common mussel *Mytilus edulis* also forms biogenic reefs in the cSAC
Also off north Ll_n, it is worth noting the small concretions (mini biogenic patch reefs) formed by the worm, *Sabellaria spinulosa*. While these do not form extensive continuous biogenic reefs, they are a common component of many of the other reef communities in this part of the site forming a near-continuous crust over rocky substrata in places. They may be important to the ecology of the area providing stabilisation to the substrata by concreting loose rocks together. Other species, particularly

sea squirts, have been recorded attached to the concretions of *Sabellaria spinulosa* and the old worm tubes contribute to the gravel substrate between rock outcrops.

A related worm species the honeycomb worm, *Sabellaria alveolata*, forms more extensive and intricate biogenic reef structures on the shores of south Ll_n, Meirionnydd and Ceredigion. These accurately named 'honeycomb worm reefs' are considered to be a nationally important community (JNCC, 1996) as well as constituting a reef feature under the terms of the Habitats Directive. The honeycomb worm reefs form extensive sheets and hummocks on bedrock and boulder/cobble shores; they are important in stabilising the shore and have a rich associated fauna.

2.2.1.2 Estuary habitats and species

Although the three estuaries of the cSAC, the Glaslyn/Dwyryd, the Mawddach and the Dyfi, are more visible and probably more familiar than the reefs, most of their wildlife is still largely hidden from view. The three estuaries are the best examples of small, drying, bar-built estuaries in Britain and, with their mountainous catchment areas, have some of the lowest nutrient inputs of any estuaries in Wales. The Dyfi is also the largest estuary that flows into Cardigan Bay and both the Dyfi and the Glaslyn/Dwyryd estuaries have important sand dune systems adjacent to the estuary mouths. Also, on the southern flank of the Dyfi lies the estuarine raised mire of Cors Fochno (Borth Bog) which has the most extensive area of primary raised bog in the lowlands of the UK, together with rare maritime transitions.

All three estuaries are predominantly sandy-sandy/mud, unlike others such as the Dee and Severn which have a higher proportion of mud, particularly in the intertidal zone. The main communities in each of the three estuaries have been mapped as part of the CCW intertidal Phase 1 survey (Wyn, *et al*., 2000). Figures 2.4, 2.5 and 2.6 show the broadscale intertidal habitat maps for the Glaslyn/Dwyryd, Mawddach and Dyfi estuaries, respectively.

Similar marine communities have been recorded within each estuary, but there are notable differences between them (for example, the proportions of muddy and coarse sand, and the extent of hard rock with associated intertidal communities bordering the edges of each estuary; the latter being most extensive in the Mawddach). There is a continuous gradient between clean sands near the entrance to the sea and mud or muddy sands in the sheltered landward extremes of the estuaries (particularly in association with salt marsh communities). Although the entrances of the estuaries are exposed to prevailing winds, the bar at the mouth of each estuary provides protection from wave action.

Even at low tide much of the wildlife of the estuaries lies hidden from view. The most abundant species are the worms, crustacea and molluscs which live in the sandy and muddy sediments. The sediment communities that have been recorded from each of the three estuaries are listed and described in Appendix 2.5. The more mobile sand in the mid and lower shores is characterised by small burrowing crustacea (amphipods and isopods such as *Erydice pulchra*). In some areas the sand is very soft and aerated, supporting only burrowing amphipods and occasional bivalve molluscs. In areas where the water movement is less (for example on the outside of meanders and 'blind' channels), well sorted fine sand with burrowing errant polychaete worms and the thin tellin shell *Angulus tenuis* occurs. Muddy sand in the mid shore of the estuaries is dominated by the lugworm (*Arenicola marina*) and bivalves such as the cockle *Cerastoderma edule*, the baltic tellin *Macoma balthica*, the sand gaper *Mya arenaria* and the tellin *Angulus tenuis*. Patches of muddy gravel in areas of increased water movement, for example on the outside of meanders, may be characterised by polychaetes and some oligochaetes. Clumps of the edible mussel *Mytilus edulis* have also been recorded from the mid shore on fine mud in both the Mawddach and the Dwyryd.

Along the sides of each estuary there are areas of saltmarsh. Mature saltmarsh dominates the top of the shore while pioneer saltmarsh (*Salicornia* sp. and *Spartina* sp.) grows at the seaward edge. The extent of the saltmarsh varies within each estuary, and is greatest in the Dyfi (556 ha, compared with 219 ha in the Mawddach and 348 ha in the Glaslyn/Dwyryd) where relatively large expanses of mature saltmarsh occur. Many of the channels within the saltmarsh, often in the lower and middle reaches of each estuary, are dominated by the polychaete worm *Hediste diversicolor* and the peppery furrow shell *Scrobicularia plana*. In the steep muddy banks adjacent to the saltmarsh a community made up of sparse polychaete and oligochaete worms and the amphipod *Corophium* sp. is often found.

Unusually for estuaries, there is quite a lot of rocky habitat in each estuary. This occurs primarily as a thin band around the shore, dominated by yellow and grey lichens and the tar lichen *Verrucaria maura* at higher elevations, with fucoid seaweeds (*Pelvetia canaliculata*, *Fucus* spp. and *Ascophyllum nodosum*) lower down. The brown seaweed *Fucus ceranoides* is also present, reflecting the reduced salinity of the estuaries. Lower shore rocky biotopes are not present due to the influence of the sand level. Large dense clumps of the edible mussel *Mytilus edulis* do, however, occur in the lower shore on rocky outcrops in the Mawddach and the Dwyryd.

In the upper reaches of the estuaries, oligochaete worms are the main species present in the lower shore muddy sand and gravel habitats. In the Mawddach and Glaslyn/Dwyryd mobile sand with the amphipods *Bathyporea* sp. and *Haustoriuous arenarius* characterises the more exposed mobile sand in the lower shore nearer the entrance to the estuary. In the upper estuary mobile sand with a community of the amphipods *Bathyporea* sp. and *Corophium* sp. is common.

Mobile estuary species

There are a number of different mobile animal species which form part of the estuary features. In addition to large crustacea, such as crabs, there are many different fish species associated with each estuary (for example, thirty species of fish have been recorded from the Dyfi estuary).

The estuaries, in particular the saltmarsh creeks, form important nursery areas for different fish species; the three estuaries have been designated as nursery areas for bass *Dicentrarchus labrax*, and the Dyfi is also an important nursery area for mullet.

The animals living in the sediments form an important food source for other species, so it is not surprising that there are a number of bird species that feed in and are dependant on the estuaries (see section 2.2.1.3 below). The infauna is a vital food source for waders, notably curlew and oystercatcher, together with shelduck which feed on the small marine snail *Hydrobia* sp.

2.2.1.3 Other marine fauna and flora

i. Zostera

The largest seagrass or eelgrass (*Zostera marina*) bed in NW Wales is located at Porth Dinllaen. Seagrass is a nationally scarce habitat in Britain (Stewart, et al., 1994: Davison & Hughes, 1998) and is one of the species/habitats being targeted through the UK's Biodiversity Action Plan. *Zostera marina* is a nationally scarce species. Smaller, more dispersed patches of seagrass also occur in shallow water at a number of locations along the south Ll_n coast.

Seagrass beds are highly species rich, particularly subtidal beds of *Zostera marina*; many algal species grow on and amongst the seagrass plants and complex communities of fish and invertebrate species are supported by the seagrass community. Subtidal seagrass beds are one of the most productive of shallow-water coastal ecosystems. Relatively few species possess the capacity to digest seagrass leaves directly, but the detritus formed by the decomposition of the seagrass tissue fuels food-chains both within the beds and outside them (Davison and Hughes, 1998).

ii. Cetaceans

Several species of cetaceans are sighted within the Pen Ll_n a'r Sarnau cSAC. In the cSAC as a whole, the most common of these are bottlenose dolphins and harbour porpoise. Several other species have also been observed in the NW part of the site, in particular around Ynys Enlli and SW Ll_n. Here, relatively large numbers of Risso's dolphins have been recorded as being present during the summer months, and there are records of common dolphin, pilot whale and killer whale.

iii. Seals

Grey seals *Halichoerus grypus* are present within the cSAC, with the main concentration of seals at Ynys Enlli. Regular counts of seal numbers are made by the Bardsey Bird and Field Observatory (Jones & Meredydd, 1994; Stansfield, 1998) and these indicate an increasing population of grey seals around the Island; the maximum count in recent years has been about 130 seals.

iv. Birds

High numbers of seabirds breed on the sea cliffs of the Ll_n coast, particularly on Bardsey Island (Ynys Enlli), the Gwylan Islands and the St. Tudwal Islands. In the most recent surveys of the islands, undertaken in 1999 and 2000, the number of adult birds recorded have included, for example, over 1,500 guillemot, c. 1,000 razorbill, c. 800 herring gull, c. 500 kittiwake and c. 140 shag. An estimated 524 pairs of puffin nest on the Gwylan islands.

The Glannau Aberdaron and Ynys Enlli Special Protection Area, which consists of the island of Bardsey, part of the tip of the Ll_n Peninsula and the two Gwylan islands, supports nationally important populations of breeding and wintering chough and an internationally important breeding population of Manx Shearwaters of c. 7,000 pairs.

Other, generally smaller colonies of seabirds are found scattered around the mainland coast between Llanbedrog and Tudweiliog. Of these, the colonies in the vicinity of Cilan Head are the most sizeable with, for example, over 2,000 adult guillemots and c.200 kittiwakes (Stansfield, in prep.)
Nationally important concentrations of great crested grebe, common scoter and red breasted merganser as well as an internationally important concentration of red-throated diver are present off the south Ll_n and Meirionnydd coast during the non-breeding season. The area is also important as a feeding area for manx shearwater during the breeding season.

Diving birds have been recorded in large numbers in north Cardigan Bay and have been observed feeding over the Sarnau reefs and in the estuary mouths, in particular over the period autumn to spring. Nationally important numbers of red-throated diver and common scoter and regionally (Wales) important numbers of eider have been recorded in the cSAC.

There are varied bird assemblages present in the estuaries. The Glaslyn/Dwyryd estuary is nationally important for pintail and the Dyfi estuary is of national importance for its overwintering population of

Greenland white-fronted geese and its population of widgeon. Other species recorded from the estuaries include shelduck, red breasted merganser, teal, dunlin, redshank, oystercatcher and curlew.

v. Saltmarsh species, e.g. invertebrates

The Dyfi saltmarshes are of notable significance for the range and quality of their invertebrate faunas. Characteristic ground beetles such as *Bembidisa laterale*, *B. minimum* and *B. iricolor* are present and the scarce scarabaeid *Aphodius plagiatus* is frequent amongst strandline debris. In addition, Roesel's bush -cricket occurs on the upper saltmarsh of the Dyfi, its only location in Wales.

vi. Biodiversity Action Plan habitats and species

In addition to the seagrass there are a number of other marine species and habitats present within the cSAC that have been targeted for consideration under the UK's Biodiversity Action Plan. These are listed in Appendix 2.6.

2.2.2 Physical

There are many physical influences operating in and around the Pen Ll_n a'r Sarnau cSAC. The wide variation in the scale and nature of these physical elements is largely a result of the size and location of the site.

The cSAC is, for the most part, located within two large bays that are separated by the Ll_n Peninsula, these are Caernarfon Bay (encompasses the north Ll_n reefs), and Cardigan Bay (encompasses the south Ll_n reefs, the Sarnau and the three estuaries). This physical division in the site means that there is variation in the scale and nature of the marine processes operating in and around the 'northern' and 'southern' parts of the cSAC. The situation is further complicated with respect to the estuaries, where some of the main physical influences originate in the landward catchment areas around each estuary.

The following sections provide a summary of the varying physical processes operating over the site as a whole. A more comprehensive review of the environment of Cardigan Bay can be found in Nicholls et al (1992). Most of the summary information about the coastal processes relevant to the Sarnau and estuaries is taken from CGP (in prep). Further information can also be found in a variety of other reports listed in Chapter 8.

2.2.2.1 Climate

The northeast Atlantic can be divided into several distinct biogeographical areas. Boreal waters (cold temperate) extend down the Irish Sea, whilst Lusitanian waters (warm temperate) spread up the east Atlantic coast from the Mediterranean. Cardigan and Caernarfon Bays are just within the boreal biogeographical region - warmer Lusitanian waters extend north as far as the Celtic deep. The general climate is temperate and there is strong seasonality for a number of environmental parameters such as temperature, rainfall, water turbidity and wind strength.

2.2.2.2 Exposure

Both Cardigan Bay and Caernarfon Bay have mainly open coastlines exposed to the prevailing south-westerly and westerly winds. The majority of the open coast of the cSAC is therefore classed as 'moderately exposed' or 'exposed' to wave action, although small embayments and the lee side of headlands provide more sheltered conditions. Although the mouths of the three estuaries are exposed

to prevailing winds, the sand/shingle spit or bar at the entrance of each estuary protects the estuaries themselves from most wave action.

The Irish Sea is relatively sheltered in terms of oceanic swell, and the majority of waves reaching the coast in Cardigan and Caernarfon Bays are locally generated, of fairly short period and hence steep. A substantial swell develops during prolonged periods of high winds.

Southwesterly gales generally occur from October through to March. During the winter months, when strong winds are common, the wave height has been recorded as exceeding 1m for almost 50% of the time, compared to summer when wave height in excess of 1m has been recorded for less than 25% of the time.

2.2.2.3 Turbidity

Cardigan and Caernarfon Bays have a marked seasonal variation in turbidity due to the generally shallow nature of the bays and the seasonality of wind strength and rainfall. Turbidity is generally at its lowest levels during the summer when calmer conditions mean that sediments suspended in the water settle out onto the seabed. In winter, the effect of stronger winds is to stir up bottom sediments into the water column which increases the turbidity of surface waters. The turbidity of inshore waters is also affected by outflow from rivers; when the rivers are in spate the increased outflow carries sediments into the adjacent coastal waters.

2.2.2.4 Temperature

In general, the waters of the Irish Sea are well mixed with little variation in the mean annual sea temperature; the mean annual sea temperature in St. George's Channel is 11°C. In shallow coastal waters, however, there are larger fluctuations in water temperature influenced by the proximity of land, the shallowness of the water and seasonal changes. During winter, the coastal waters are generally cooler than the central part of the Irish Sea; surface temperatures in coastal waters are lowest in February and in Cardigan and Caernarfon Bays mean surface temperatures between 5° - 7°C have been recorded. During the summer, the reverse situation is true with coastal waters generally being much warmer than the central Irish Sea. In Cardigan and Caernarfon Bays mean surface temperatures recorded in August are generally in the range 14° - 16°C, although surface temperatures up to 20°C have been recorded in Tremadog Bay. Average seabed temperatures are only slightly lower than those of the surface waters in winter, but in summer they may be up to 2°C lower at depth.

2.2.2.5 Salinity

The salinity of the coastal waters in Cardigan and Caernarfon Bays is influenced by freshwater inputs from rivers and estuaries, rainfall and evaporation over the sea, and the effects of currents and mixing. The surface salinity generally falls within the range 34 ppt - 34.25 ppt, with lower salinity present closer inshore. Seasonal variations have been recorded with surface salinity in summer (August) in Cardigan Bay ranging from less than 34.5 ppt in the outer part of the Bay to less than 34.2 ppt in the inner part, and in winter (February) ranging from less than 34.6 ppt in the outer part of the Bay to less than 33.3 ppt.

2.2.2.6 Stratification and Fronts

Studies in Cardigan Bay have shown that for at least part of the summer the inshore water in the Bay is stratified, with warm relatively fresh water overlying cooler, more saline water. This stratification

breaks down along a line running south of Trwyn Cilan and along this line, the Cardigan Bay front, there are strong horizontal gradients for surface temperature, salinity, density and water clarity. It is thought that the weak currents within the Bay contribute to the stratification. Strong winds are likely to break down the stratification and it is considered that there is no stratification in the Bay during the winter.

2.2.2.7 Tides

Within the Irish Sea, the tide enters through St George's Channel in the south and travels northward to meet the southward-moving tide from the north in the vicinity of the Isle of Man. The general pattern of tidal flow, therefore, is northward during the flood tide and southward during the ebb, although there are variations in localised current patterns due to the influence of headlands and islands. Within the cSAC, high or low water times are progressively later as one moves north along the Cardigan Bay coast and around the Ll_n Peninsula into Caernarfon Bay. The tidal range within the cSAC is between 2m (neap tides) - 4.5m (spring tides).

Tidal currents within the cSAC are at their weakest in north east Cardigan Bay. Current strength increases to the south and west in the Bay (generally less than 2 knots (1m/sec) during spring tides), but stronger tidal flows occur off the north coast of the Ll_n Peninsula and around headlands whilst the strongest currents within the site occur in Bardsey Sound; the Admiralty chart indicates currents of up to 6 knots (3m/sec) at the southern entrance to the Sound.

2.2.2.8 Sediment transport

The coast of England and Wales has been divided into a number of major littoral cells and sub-cells, each defining a section of coast within which sediment erosion and accretion are inter-related and largely independent of other cells. These cells are being used to develop Shoreline Management Plans (see Appendix 5.2) which aim to provide a framework for dealing with coastal defence by setting out a strategy for sustainable coastal defence within each 'sediment cell'. The following summary of sediment transport within the cSAC is based on the knowledge available for the sediment cells relevant to the site. There is currently limited information available describing the scale and nature of more localised sediment transport regimes operating at specific locations within the site.

In the southern part of the cSAC south of Tremadog Bay, there is moderate littoral drift in a northward direction. This longshore movement of sediment has been a major factor in the formation of the elongated spits on the southern shores of the Dyfi, Mawddach and Glaslyn estuaries. The accreting sediment is supplied largely by erosion of glacial till cliffs; there are a number of locations in this part of the bay where beaches are eroding. The Sarnau reefs control the inshore wave patterns and hence the rates of longshore and cross-shore sediment transport, and therefore assert a degree of control on the geomorphology of the coastline

Sediments have been accreting in the three cSAC estuaries (the Dyfi, the Glaslyn/Dwyryd and the Mawddach) since the end of the last Ice Age. The thickness of sediment in each of the three estuaries is over 30m deep. Sediments are continuing to be deposited in these estuaries; at present these sediments are dominated by sands, much of which are transported into the estuary from the nearshore and offshore sea areas by tidal currents.

Along the south coast of the Ll_n Peninsula, littoral drift is to the east and increases in magnitude in that direction. Accretion and erosion are occurring a various locations along this coast.

Along the north coast of the Ll_n, there is a low, north-eastward littoral drift towards the Menai Strait. The main points of erosion and accretion lie to the north east of the cSAC (although the rocky cliff at Nefyn is one of the known erosion points).

2.2.2.9 Geology and Geomorphology

Geology and both past and present geomorphological processes in the marine environment exert a fundamental influence on the type and abundance of marine life living in any one place. The lithological characteristics of the seabed, whether it is composed of rock or unconsolidated sediment, determine the main types of communities that are likely to occur, whilst more detailed characteristics, such the hardness of the rock, its inclination and orientation, and the coarseness of the local sediment, further influence the type and abundance of the individual species present at any one location.

The area of the cSAC has an underlying solid geology which is dominated by rocks of Precambrian and Lower Palaeozoic age. The oldest rocks are exposed around the western coastline of Ll_n where a variably metamorphosed Precambrian basement, composed of mélange, gneiss, mylonitic schist, basalt and granite, has been brought to surface along a deep-seated, steeply inclined crustal fracture termed the Ll_n Shear Zone (Gibbons and McCarroll, 1993; BGS, 1994). To the east of the shear zone, much of the coastal fringes of Ll_n are underlain by a Lower Paleozoic cover sequence composed of marine sedimentary and extrusive igneous rocks, ranging in age from Lower Cambrian to Upper Ordovician (BGS, 1999; Young *et al.*, in press). These rocks have locally been intruded by granitic plutons which form prominent topographical features around the coastline, for example the Mynydd Tir-y-cwmwd microgranite at Llanbedrog and the granitoids between Nefyn and Trefor. On the western flank of the Harlech Dome, between the Afon Dwyryd and the Afon Mawddach, the solid geology immediately inland of the coastline is dominated by marine sedimentary rocks of Lower Cambrian age, although the hanging wall of the north-south striking Mochras Fault has preserved a thick sequence of Tertiary silts and clays which occurs beneath glacigenic Quaternary deposits along the entire coastal fringe, north of Llanaber (BGS, 1982; Allen and Jackson, 1985). Between the Mawddach and Dyfi estuaries, the solid geology of the coastline is characterized by a composite sequence of sedimentary and minor volcanic rocks ranging in age from Upper Cambrian to Lower Silurian, the youngest rocks occurring on the northern flank of the Dyfi Estuary (Cave and Hains, 1986; BGS, 1995; Pratt *et al.,* 1995). A north-south striking fault, the Tonfanau Fault, intersects the coastline at Tonfanau, where a borehole has proved the presence of Tertiary clays, silts and sands which lie in the hanging wall offshore. South of the Dyfi Estuary, rocks of Lower Silurian age crop out along the coastline between Upper Borth and the outfall of the Afon Clarach (BGS, 1984; Cave and Hains, 1986).

During Pleistocene times, north-west Wales was affected by a series of glacial episodes, the latest of which occurred during Late Devensian times and culminated approximately 18,000 years ago (Campbell and Bowen, 1989). During this episode, the coastal fringe of north-west Wales was invaded by ice emanating both from the Irish Sea Basin and from Welsh centres of dispersal, the two ice-sheets having coalesced in Cardigan Bay. On Ll_n, evidence from glacigenic deposits exposed, for example, at Aberdaron, Porth Ceiriad and Porth Neigwl reveal the influence of an Irish Sea ice-sheet which spread southwards across the peninsula into Cardigan Bay. Gravel-rich glacigenic deposits in the cliffs of southern Ll_n around Glanllynnau and Criccieth record the westward spread of local Welsh ice which reached at least as far west as St Tudwal's Peninsula (Campbell and Bowen, 1989). South of the Afon Dwyryd, the coastal fringe was influenced solely by local Welsh ice which extended out into Cardigan Bay as a series of thick lobes for some 20-30km. This ice continued to excavate the deep, partly fault-guided valleys occupied onshore, for example, by the Afon Mawddach and Afon Dyfi, formed the large moraines represented offshore by Sarn Badrig, Sarn-y-Bwch and

Sarn Cynfelyn, and deposited thick deposits of boulder clay as, for example, at Llandanwg, along the coastal fringe between Tywyn and Llwyngwril, and north of Clarach (Allen and Jackson, 1985; Cave and Hains, 1986; Pratt *et al*., 1995). Marine erosion of the unconsolidated till deposits which form these coastal cliffs provides a source of locally-derived cobbles and boulders to the subjacent foreshore. Borehole and geophysical evidence from channels beneath the Mawddach Estuary indicate the presence of over 43m of superficial deposits, mainly comprising laminated muds and clays, suggesting that sea level during late Pleistocene times may have stood some 90m below present-day ordnance datum (Allen and Jackson, 1985). Muddy Hollow, located in central Tremadoc Bay north-west of Sarn Badrig, continues the line of the Glaslyn/Dwyryd Estuary, and this deep channel which is buried beneath Morfa Harlech may have continued in use throughout much of late Pleistocene times.

The configuration of the modern coastline reflects the complex interaction between rising sea levels during the Holocene, tidal and fluvial influences, and sediment supply. North of the Afon Clarach, northward sediment transport *via* longshore drift processes led to the development of the west-facing Ynyslas Spit, together with its distal dune complex and protective shingle ridge, during the past 5,000 years (Wilks, 1979). Farther north and beyond the west-facing Ro Wen spit, the cuspate-shaped foreland at Morfa Dyffryn is swash-aligned, oriented south-westwards towards the direction of maximum fetch, a geometry which is mimicked by the spit and beach at Morfa Harlech to the north. Although a reduction in longshore sediment supply to these systems followed from construction of the railway line during the 19th Century, their continued stability suggests that the primary source of sand may be from the substantial submarine glacial deposits which lie on the floor of Cardigan Bay with, in the case of Morfa Harlech, some sediment exchange taking place between estuarine sands and the distal end of the spit (Clayton and Bird, in press.). The south coast of Ll_n also exhibits a series of south-westerly aligned beaches, as for example at Aberdaron Bay, Porth Neigwl and those east of Criccieth (Lewis, 1938), the former two beaches being confined by rocky headlands which both reflect and refract incoming waves. Whilst subsurface data indicate that the seabed off southern Ll_n is covered by a veneer of sand, gravel and minor quantities of mud (BGS, 1999), in the case of Porth Neigwl there is no evidence to suggest an offshore source of beach sediment (Clayton and Bird, in press.), most of which is derived by marine erosion of unconsolidated glacial and fluvioglacial sediments which form the supradjacent cliffs.

2.2.2.10 Topography

Cardigan Bay and Caernarfon Bay are relatively shallow and gently sloping embayments. In both cases, the 50m depth contour occurs in the outer part of each bay. Most of the portion of the cSAC located in Cardigan Bay is less than 20m deep and consists of gently shelving seabed (a notable exception is where the ridges of the Sarnau reefs occur).

Along the north coast and south west tip of the Ll_n and around Bardsey Island, however, there is deeper water close inshore and much of this part of the cSAC is in water 30-50m deep. In several locations the rocky seabed forms a very steep slope from the coast into deep water, before flattening off and continuing as a more gentle slope.

Although very detailed bathymetric information for the cSAC is not available, the Admiralty charts for the Area (see Appendix 2.7) and recent acoustic surveys (see section 2.2.1.1) provide further information about the bathymetry in specific parts of the site.

2.2.2.11River flows

There are a number of principal rivers flowing into the Cardigan Bay part of the cSAC. In addition to those feeding into the Glaslyn/Dwyryd, Mawddach and Dyfi estuaries, there is the Soch (discharges at Abersoch), the Erch (discharges at Pwllheli), the Dwyfor and Dwyfach (discharge near Criccieth), the Atro (discharges at Mochras), the Ysgethin (discharges on the coast north of Barmouth) and the Dysynni (located between the Mawddach and Dyfi estuaries).

The size of mean river flow within the three main cSAC estuaries varies between the estuaries and also within each estuary (e.g. in response to seasonal changes). The peak flow of a major river may be many times larger than the average flow; river levels can change rapidly in response to heavy rainfall, and such flood conditions often have an important role in initiating channel mobility within the estuaries.

The freshwater discharges from the three estuaries, as well as other rivers within the vicinity, can influence the characteristics of the receiving coastal waters by, for example, localised changes in salinity and water temperature, as well as discharge of sediments.

2.2.3 Chemical

Chemicals may enter the cSAC by various routes and the potential impacts of these are influenced by the physical features of Cardigan and Caernarfon Bays, migration by tidal movements and through sediment transport. The ingress of river water from the adjacent land and direct discharges of effluents may also influence the water quality of the cSAC.

No marine water quality monitoring is undertaken within the cSAC. The limited marine monitoring carried out at the site below Aberystwyth that covers Cardigan and Caernarfon Bays has found the water quality to be good.

The riverine inputs are influenced by land use and the subsequent run off and discharge of effluents have the potential to enable chemicals to pass down the rivers into the estuaries and other areas of the cSAC.

The majority of the discharges to the cSAC, consented by Environment Agency Wales (EAW), are of domestic sewage effluent with a few being from an industrial source. However diffuse run off, effluent and inputs from agricultural land and historic mining activity provide significant inputs to parts of the cSAC. The consented discharges and all the significant freshwater inputs, e.g. Dyfi, Mawddach, Glaslyn, Dwyryd and Leri, are monitored by EAW for a variety of chemical determinands on a monthly basis. This provides some information on loadings of chemicals entering the Bay.

The only estuarine monitoring undertaken is that required under the Shellfish Waters Directive. Under this Directive, monthly samples for metals, organics and microbiological determinands are taken in the estuaries of the Dyfi, Mawddach and the Glaslyn/Dwyryd. The sampling commenced in 1999 following the announcement in September 1999 of the new designated waters under this directive.

Some limited microbial monitoring is also undertaken by EAW, Gwynedd Council and Ceredigion County Council over the summer months each year to assess the quality of bathing waters. Monitoring is undertaken by EAW at the EC Designated Bathing Waters at Clarach, Borth, Aberdyfi, Tywyn, Fairbourne, Barmouth, Talybont, Dyffryn/Llanedwyn, Llandanwg, Harlech, Craig Du, Criccieth, Pwllheli and Abersoch. Gwynedd Council and Ceredigion County Council undertake similar monitoring at the non-EC designated bathing waters at Ynyslas, Ynyslas Estuary, Garreg Wen, Criccieth East, Morfa Abererch, Llanbedrog, Porth Neigwl, Aberdaron and Porth Nefyn.

Generally the bathing waters comply with the Mandatory Standards specified in the Bathing Waters Directive while compliance with the guideline standards is variable.

2.3 Land and seabed ownership

As with most of British inshore waters, the sea bed within the Pen Ll_n a'r Sarnau cSAC is owned by the Crown and is managed on their behalf by the Crown Estate Commissioners (CEC).

Some parts of the site are leased by the CEC to third parties such as the local authorities (Gwynedd Council and Ceredigion County Council); Snowdonia National Park Authority do not lease any land below high water in the cSAC. These areas may be used, for example, for the placing of boat moorings or to enable management of certain activities, and specific conditions are applied to their use. Most of the open coast shore and much of the land within the estuaries between mean high water mark and mean low water mark adjacent to the cSAC is leased to the local authorities.

2.4 Maps of the site

2.4.1 Navigation, Bathymetry, Sea bed substrates, Tidal strengths, Sediment movement

Marine charts provide a variety of information from water depth (bathymetry) to seabed substrata, indicative tidal directions and strengths and obstructions. There are several different types of marine charts covering the Pen Ll_n a'r Sarnau cSAC and a list of the relevant ones available from the Hydrographic Office is given in Appendix 2.7.

Recent broadscale acoustic discrimination surveys of the area around Pen Ll_n and Sarn Badrig have developed maps of bathymetry and the distribution of seabed substrates. This data is held on GIS (Geographical Information System).

2.4.2 Geology and geomorphology

The British Geological Survey provide a series of charts of bedrock, quaternary and seabed sediments for Cardigan and Caernarfon Bays. A list of the relevant charts is given in Appendix 2.7

2.4.3 Marine communities: subtidal

Broad scale maps (and descriptions) of the underwater marine communities within Cardigan Bay and Caernarfon Bay are shown in the Marine Nature Conservation Review area summary reports (Brazier *et al*, 1999).

Recent surveys around Pen Ll_n and Sarn Badrig using a broad scale acoustic discrimination system has enabled the development of maps showing the indicative and general pattern of seabed substrata distribution in these areas. This data is held on GIS. Examples of the maps are shown in Figures 2.3 and 2.4.

2.4.4 Marine communities: intertidal

A large proportion of the Welsh coast has been surveyed and mapped by the Countryside Council for Wales Phase 1 Intertidal Survey. The cSAC estuaries and the more open coast intertidal area adjacent to the cSAC boundary is included within the area surveyed. This ongoing survey has resulted in the production of marine biotope maps of the intertidal, examples of which are shown in Figures 2.5, 2.6 and 2.7. This data is held on GIS.

2.4.5 Coastline

The Ordnance Survey provide a series of maps at a variety of scales covering the coastline and land mass adjacent to the cSAC. A list of the most commonly used scales and relevant maps is given in Appendix 2.7.

2.5 Photographic coverage

Most formal photographic coverage of the Pen Ll_n a'r Sarnau cSAC has been of satellite or aerial images of the coastline. In the late 1990's CCW commissioned aerial photographs of the cSAC coastline for their Phase 1 Intertidal Survey. These were taken at low water spring tide. A series of other aerial photographs (9 x 9 contact sheets) for parts of the cSAC coast are held by Gwynedd Council and the Coast and Countryside Section of Ceredigion County Council have a series of aerial photographs of the Ceredigion coast taken during the 1970's and recently updated. The Cardigan Bay Coastal Group have oblique aerial photographs for some parts of Cardigan Bay taken at low water.

Aerial photographs of the country, including coastal areas, have been taken regularly since the 1940's. There is a directory[10] of UK aerial photograph collections and aerial photographs are available from the Central Register for Air Photography in Cardiff. The Royal Commission for Ancient Monuments (RCAM) in Aberystwyth also hold many aerial photographs. The Commission has RAF photographic information taken between 1945 and 1960 (vertical and oblique) which includes a large part of the cSAC coastline.

[10] Directory of aerial photographic collections in the United Kingdom. 1999. NAPLIB. ISBN 9053043614

There is a limited photographic record of the seabed of the Pen Ll_n a'r Sarnau cSAC. Photographs and video footage have been taken as a result of the marine biological surveys conducted in the area (Rostron, 1984; Hiscock, 1984; Hiscock, 1985 & 1986; Brazier et al, 1999; Bunker, 1998; Sanderson *et al*, in prep). The majority of these are held by the Joint Nature Conservation Committee and/or the Countryside Council for Wales. Many additional photographs have been taken by recreational divers.

Old photographs of the coast do exist although no specific collections have been identified. These can provide an impression of the level and types of coastal activity that use to occur within the site. The Gwynedd Archives also hold selections of photographic and other material relevant to the site.

3. EVALUATION OF THE FEATURES OF THE cSAC

This section describes the important characteristics and components of the Pen Ll_n a'r Sarnau cSAC and evaluates the site in terms of its value for nature conservation, education and research.

3.1 Introduction

The Pen Ll_n a'r Sarnau cSAC is one of about 40 marine sites in the UK which have been selected to form part of the EC suite of Natura 2000 sites comprising both SACs and Special Protection Areas (SPAs) for birds. The reefs and estuaries of the Pen Ll_n a'r Sarnau cSAC represent part of the range and variation of the biodiversity of these features throughout the UK and the European Union. As part of the Natura 2000 suite of wildlife conservation areas, the Pen Ll_n a'r Sarnau cSAC plays an important role in contributing to the conservation of reef and estuary habitats and wildlife in the UK and Europe.

3.2 The features of the site and their important characteristics and components

The Pen Ll_n a'r Sarnau cSAC has been selected on the basis of its reefs and estuaries. A summary of the wildlife of these features and other wildlife of interest in the site is give in Chapter 2, and further details of the reef and estuary communities are provided in Appendices 2.3 and 2.5.

The aim of managing the cSAC is to maintain the reefs and estuaries in favourable condition. Favourable condition for the site is described in terms of the important characteristics and components of the reefs and estuaries. Defining/describing the favourable condition of the reefs and estuaries is also fundamental to establishing conservation objectives for the features and to determine quantifiable "performance indicators" of their condition (see section 4).

3.2.1 Important characteristics and components of the reef features

These focus primarily on the subtidal reef communities due to the proportion of subtidal to intertidal reefs in the cSAC. The characteristics of the reef features which contribute to their European importance for nature conservation are as follows:

<u>*Structure and function*</u>*:*

- The large extent and distribution of reef habitat and its wide variation in topography, slope and depth
- The wide variation in exposure to water movement (wave and tidal)
- The presence of extensive boulder/cobble/pebble reefs forming the Sarnau
- Limited variation in salinity and turbidity throughout the site
- Relatively low, but variable, concentrations of suspended sediments
- Good water quality
- Physical processes, especially sediment transport

Biological diversity:

- The wide variety and large extent of reef habitats, communities/biotopes[11] and species.
- The presence and distribution of a particular selection of communities.
- The diversity and abundance of reef communities/biotopes and species throughout the site, and across and along major physical and chemical gradients, particularly exposure to water movement.
- The presence and abundance of nationally rare, scare and uncommon communities and species (see Appendices 2.3, 2.4 and 2.6).
- The presence of reef components of particular nature conservation importance:
  - Large extent and quality, including zonation, of the characteristic reef communities on the Sarnau (see Appendix 2.3)
  - Extent and quality of the species-rich bedrock and boulder reef communities off North Ll_n, SW Ll_n and Ynys Enlli.
  - Presence, abundance and quality of 'edge of range species' (e.g. yellow star anemone *Parazoanthus axinellae*)
  - Extent and quality of biogenic reefs (subtidal and intertidal) e,g. the horse mussel *Modiolus modiolus* and the honeycomb worm *Sabellaria alveolata*.
  - Extent and quality of red algal communities around Pen Ll_n and Ynys Enlli.
  - Extent and quality of kelp communities around Pen Ll_n and Ynys Enlli.
  - Distribution and quality of predominant scour tolerant faunal communities around Pen Ll_n and Ynys Enlli
  - Extent and quality of communities on extreme tide-swept rock
  - Extent and quality of wave, tunnel and surge gully and overhang habitats and communities/biotopes
  - Extent and quality of intertidal rock habitats
  - Extent and quality of honey comb worm *Sabellaria alveolata* biogenic reefs
- Role of reef communities as nursery ground areas for fish and crustacea
- Presence and abundance of mobile species closely associated with the reef features and dependent on them for a significant proportion of their life history.
- Component Sites of Special Scientific Interest (intertidal)

Populations of ecologically key species

- Low population density of the common sea urchin *Echinus esculentus* (common sea urchins are efficient grazers on seaweed communities. The low population density in the cSAC enables rich red seaweed communities to develop)
- Extent of subtidal concretions built by the worm *Sabellaria spinulosa*

Sediment communities

- Presence of extensive areas of mobile sediment in close proximity to reefs (influence of sand scour)

[11] A biotope can be defined as a community of plants and animals in association with their physical habitat

3.2.2 Important characteristics and components of the estuary features

Structure and function

- Large extent and distribution of estuarine habitat
- Large extent and distribution of intertidal sandflats
- Small extent and distribution of intertidal mud
- Distribution and relative proportion of sandy and muddy sediments
- Sediment transport and patterns of accretion and erosion
- Extent of intertidal rock habitat
- Equilibrium ratio between estuary mouth and tidal prism
- Gradient of wave action exposure along the length of the estuaries
- Low nutrient levels and inputs
- Variable morphology in particular the channel
- Freshwater flow regime

Biological diversity

- Diversity of estuarine communities and species
- Species rich estuarine communities
- Presence of suite of estuarine communities reflecting the range of major physical gradients within the estuaries
- Extent and quality of a range of estuarine sediment communities, including:
  - Community composition of the major estuary communities/biotopes
  - Extent and quality of sheltered muddy communities/biotopes
  - Extent and quality of sheltered muddy gravel communities/biotopes
  - Extent and community composition of nationally rare, scarce and uncommon communities/biotopes
- Relative proportion of sandy and muddy communities/biotopes
- Large extent and quality of saltmarsh communities
- Presence and abundance of nationally rare/scarce species
- Extent and quality of saltmarsh invertebrate communities
- Assemblage (variety and abundance) of fish species in each estuary
- Role of the estuaries as nursery areas for bass and mullet.
- Presence and abundance of bird species dependent on the estuary habitats and species for a significant part of their life history.
- Presence and abundance of other mobile species dependent on the estuary habitats and species for a significant part of their life history
- Component Sites of Special Scientific Interest

Reef communities

- Extent and quality of intertidal rock communities/biotopes

3.3 Evaluation of the site

This section provides an evaluation of the site's value in terms of nature conservation, education and research.

3.3.1 Evaluation for nature conservation

This evaluation is based on the evaluation criteria developed by the UK Nature Conservancy Council in 1977 (Ratcliffe 1977: A Nature Conservation Review). These are the criteria that have provided, and still provide the standard which is used by the UK Nature Conservation Agencies in evaluating the conservation interest of any area.

3.3.1.1 Size

The Pen Ll_n a'r Sarnau cSAC encompasses a large sea and estuarine area. In terms of its total area it is the fourth largest marine cSAC in the UK. The Pen Ll_n a'r Sarnau cSAC was selected to include the known areas of reefs around Pen Ll_n and in north Cardigan Bay and to include the three large estuaries (the Glaslyn/Dwyryd, Mawddach and Dyfi).

In the marine environment, marine habitats are inextricably linked with one another through the movement of water, sediments, organic material and inorganic material in the water column. Although the cSAC encloses the areas where the features are physically present, the functioning of the reefs and estuaries features involves biological and physical processes that occur outside of the boundaries of the site and well as within them. The site management needs to take account of these processes.

The large extent of the reef features and the habitats within them is an important element of the cSAC. Although the estuaries are small relative to other estuaries in Wales and south-west Britain (e.g. Dee, Burry Inlet, Severn), they are the largest discharging into Cardigan Bay and are by far the largest indentations in an otherwise relatively smooth coastline. In order to maintain this extent, the management of the site needs to ensure that there is no reduction in the overall extent of the features or the individual components (where extent is an appropriate attribute).

3.3.1.2 Diversity

The Pen Ll_n a'r Sarnau cSAC supports a diverse variety of reef and estuary habitats and species. These are described in more detail in sections 2.2.1.1 - 2.2.1.3 and section 3.2 above. To date, 102 reef biotopes (intertidal and subtidal) and 19 estuary biotopes have been recorded. This diversity is important at the site level, but also needs to be considered in the wider context at a UK and European level. The diversity of the reef and estuary habitats and wildlife on the site represents part of the overall diversity of these features in the UK and in Europe, while the site-specific nature of the reefs and estuaries of this site is part of the jigsaw that makes up a picture of the overall diversity of reefs and estuaries in Europe. The fundamental aim of the Habitats Directive is to conserve biodiversity of natural habitats and their wildlife across Europe. The management of the Pen Ll_n a'r Sarnau cSAC as a site within the Natura 2000 series needs to ensure that there is no reduction in the reef and estuary biodiversity.

It is important to note in this context that the concepts of "diversity" and "biodiversity" are not simply about numbers of species. The 1992 International Convention on Biological Diversity (one of the key driving forces behind the adoption of the Habitats Directive) defined biodiversity as:

> "...the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems."

3.3.1.3 Naturalness

In comparison with terrestrial habitats, the marine environment is generally in a more natural state. Assessing naturalness in the marine environment, however, is very difficult due to the lack of knowledge of how much habitats and communities may have been altered by 'non-natural' impacts (defined here as those arising from human activities). This management plan is not the place for a detailed discussion of the importance of seeking to maintain a degree of naturalness in ecological systems. In terms of the statutory context of this plan however, it is worth noting that the maintenance of naturalness in ecological systems is an important element (though certainly not the only one) of the conservation of biodiversity as envisaged by the Habitats Directive. The first words of preamble to 1992 Biodiversity Convention are:

> "The contracting parties [are] conscious of the intrinsic value of biological diversity and of the ecological, genetic, social, economic, scientific, educational, cultural, recreational and aesthetic values of biological diversity and its components"

The Convention goes on to say that:

> "...the fundamental requirement for the conservation of biological diversity is the in-situ conservation of ecosystems and natural habitats and the maintenance and recovery of viable populations of species in their natural surroundings"

One means of assessing naturalness is to consider the degree to which human influences have altered the habitats and communities. Considering the Pen Ll_n a'r Sarnau cSAC in these terms would indicate that overall the area is relatively natural, but that there are distinct differences between the reefs and the estuaries, the latter having been quite extensively modified (see below). Most of the cSAC is adjacent to rural, undeveloped coast with little in the way of industry either at the coast or in the catchment area. Fishing activity is not highly intensive and does not depend on the use of a substantial amount of heavy, mobile benthic fishing gear, and most of the major shipping movements occur outside the area. The perceived high degree of naturalness of the area, especially of the coast and sea, is one of its main attractions.

Major changes to the natural habitats have, however, occurred in the estuaries. The most substantial of these has been the building of the Cob which impounded a large part of the Glaslyn estuary. Other changes have been brought about by the construction of other structures including embankments and sea defences as well as land reclamation. All of these have altered the configuration of the estuaries and, as a result, modified the equilibrium that the estuaries seek to establish. This has resulted in changes to the extent, distribution and quality of different estuarine habitats (Coastal Geomorphology Partnership, in prep.) Maintenance of the current level of naturalness both of the reefs and estuaries would require the prevention of any further increase in anthropogenic influences on them.

3.3.1.4 Rarity

Although temperate reefs and estuaries are not, as physiographic features, considered rare, the wide range of habitats and wildlife that they support means that certain reef and estuary components are considered rare. The Pen Ll_n a'r Sarnau reefs and estuaries support some communities/biotopes and species that are considered to be nationally rare as well as several nationally scarce communities/biotopes and species and uncommon communities/biotopes (see Appendices 2.3, 2.4 and 2.6). In addition to these, there are several habitats and species which, while not necessarily classed as nationally rare or scarce, are considered to be in need of special attention for their conservation. These have been identified though the UK Biodiversity Action Plan (see Appendix 2.7).

Rare, scarce and uncommon reef and estuary habitats and species are an important component of the overall diversity of the cSAC. The site management needs to ensure that these remain present on the site with no reduction in their extent or abundance (where these are considered important attributes).

3.3.1.5 Fragility

The habitats and wildlife of the reefs and estuaries are sensitive not only to short term impacts but also to long term cumulative, chronic impacts. Impacts which appear insignificant may, over the long term or in combination with other impacts, result in significant and irreversible damage to the reefs and estuaries. This situation is exacerbated by the fact that we currently have a limited knowledge about the causal links between many factors and their effects on reef and estuary habitats. Also, the nature of the marine environment means that detection of any effects is often difficult to undertake. Unless the impact of an activity is blatantly obvious, successful detection may take a considerable period of time, by when it may be too late to implement management actions to prevent or minimise permanent damage to the reef and estuary features.

Some components of the reefs and estuaries will be sensitive to small losses. For example, long-lived, slow growing species (for example the horse mussel *Modiolus modiolus*), or species with limited abundance or strict and therefore limited habitat preferences (such as erect sponge species, e.g. *Axinella dissimilis*) within the cSAC could be considered to be more fragile than some of the more abundant, faster-recruiting species. Similarly, reef or estuary habitats and communities which are restricted in their extent and distribution (such as sheltered muddy gravel estuarine habitats and communities) could be considered more fragile than more extensive, widespread examples, but this does not imply that the more extensive habitats are necessarily robust, particularly if subject to the cumulative effect of many small impacts over time. Currently there is a greater intensity of activities within and adjacent to the estuaries, meaning that these features are particularly vulnerable to potentially negative impacts.

3.3.1.6 Typicalness

Reefs and estuaries throughout the UK and Europe are very varied in extent, substrate type, scale and nature of physical and biological processes, and species and community diversity. The types of reef and estuary communities present in the Pen Ll_n a'r Sarnau cSAC do occur elsewhere in the UK but that does not mean that those present within the cSAC can automatically considered typical examples. The site-specific physical and biological factors and geographical position of the cSAC mean that several of the reef and estuary communities have Pen Ll_n a'r Sarnau specific characteristics that are not present in similar communities further afield. Some of these characteristics may reflect regional differences between different examples of the same community, while others may be more site-specific. There are reef and estuary communities that can be considered typical examples of their kind

The national biotope classification (Conner *et al*., 1997) provides details of species and communities of species that can be expected to occur in a given set of physical habitat conditions. The data used to assemble each biotope description are derived from field surveys, in some cases, from similar habitats all around the UK coastline. The species that occur regularly in any particular biotope are regarded as being characteristic of that biotope and are listed as part of the description. Species lists from biotope records from single or closely grouped sites (such as all the records of one biotope from Pen Ll_n) can be compared with those in the national descriptions. If there is a high level of agreement between the two lists then the Pen Ll_n examples would be said to be typical examples. There are some biotopes that have been recorded more often around North Wales (including within the cSAC) than anywhere else in the UK, such as Flu.HByS (characterised by scour-tolerant bryozoans and sponges). Individual records of this biotope therefore tend to correspond well with the description given in the national classification by default. However, regional variations within biotopes exist; some of the Pen Ll_n reefs support higher densities of certain species of seasquirts than their counterparts in, for example, Pembrokeshire and other parts of the UK and can therefore be said to be less typical for a specific reason.

It is important to maintain these regional and site characteristics as they contribute to the overall range and variation of the reefs and estuaries represented within the Natura 2000 series.

3.3.1.7 Recorded history

The purpose of this evaluation criterion is to accord higher conservation value - all other things being equal - to sites which are better documented, in other words those whose habitats are well mapped or inventoried and/or those which have been studied over a long period. While such information improves our ability to understand and manage these sites, it has always been a controversial basis for assessing conservation value, since, to put it bluntly, it appears to promote a philosophy of "if we don't know about it, it can't be important". Based on this criterion alone, it could be argued that no marine sites, or at least very few, would ever be selected as having nature conservation value, since our information base is so poor in comparison with most terrestrial habitats, particularly in terms of historical data. Again, it is pertinent to quote from the preamble to the 1992 Biodiversity Convention, which includes the following as part of the rationale for the conservation measures contained convention:

> "Aware of the general lack of information and knowledge regarding biological diversity and of the urgent need to develop scientific, technical and institutional capacities to provide the basic understanding upon which to plan and implement appropriate measures...."

In general in the UK, our understanding of the variety, distribution of marine communities and their natural patterns of change has, until relatively recently, been very limited. For many marine areas there is only a sparse historical record of biological information. Exceptions to this are often related to the location of the early marine biological stations or universities and, in these situations, habitat and species records may date back to the turn of the century. This general situation is reflected in the available recorded history for the Pen Ll_n a'r Sarnau cSAC. Although there are reports and papers from the earlier part of the last century documenting some aspects of intertidal communities within the site (notably the saltmarsh within the Dyfi and intertidal communities within Cardigan Bay), most of the main body of relevant literature stems from the 1980's and 1990's. While this has been sufficient for assessment of the importance of the site within a national context, it is only in the last five years that any systematic recording of the presence and distribution of the subtidal reef and

sedimentary estuary habitats and species has taken place. Relevant literature for the cSAC is given in the reference section at the end of this management plan.

As our knowledge about marine and estuarine habitats and species both within the cSAC and in the wider UK marine environment increases, our understanding about marine biodiversity, rarity/scarcity, natural change and sensitivity or marine communities will improve. These findings will need to be taken into account in the future management of the cSAC

3.3.1.8 Ecological position

The purpose of this criterion is to incorporate into the evaluation process, some assessment of the importance of the habitats and species of the area in question to wider ecosystem functioning. As an evaluation criterion therefore, it is more relevant to more narrowly defined ecological units - such as particular communities or even particular species, than to large, "all-encompassing" features like reefs and estuaries. With reefs and estuaries the "ecological unit" more or less is the ecosystem, rather than a specific component of it.

However, there is a geographic/spatial dimension to this criterion. The reef and estuary systems of the cSAC are vital elements of the maritime environment of north west Wales. Within and beyond the site they help support the populations of higher food chain predators such as marine mammals and birds as well as supporting commercially important fish stocks through juvenile and adult stages. Organic matter and spores and larvae will be transported from the reefs and estuaries to locations far removed from the cSAC. Conversely, processes occurring outside of the cSAC may ultimately have an impact on the reefs and estuaries within the site.

It will be important for management decisions to take account of these wider implications when considering potential impacts to the reefs and estuaries even when the issue at hand may appear unrelated.

3.3.1.9 Potential for improvement or restoration

There is potential to reduce the current levels of negative anthropogenic impacts on the reefs and estuaries. Work is required to identify the costs and benefits of reducing certain impacts taking account of long term, short term, cumulative and synergistic effects.

3.3.2 Evaluation of the site for public use, access, education and interpretation

Although marine mammals such as dolphins and seals attract interest and attention, the majority of our marine habitats and their wildlife are not well known to most people. The estuaries of the cSAC are more likely to be familiar to local people and visitors, as well as education establishments, although even here many people may not appreciate the variety of life that lives within them. The reefs, on the other hand, are essentially hidden from view. Few people are aware of the incredible diversity of life that lives a stone's throw from the shores of Pen Ll_n and north Cardigan Bay. The intertidal reefs do, however, provide a relatively accessible resource which enables people to see first hand and become familiar with some of the area's less well known marine wildlife.

In general, the majority of local people and visitors are unfamiliar with the wildlife for which the cSAC was initially selected and is aiming to conserve. Raising awareness about the reefs and estuaries and their value is an important aim for the management of the site. It can often be difficult for people to appreciate the need to conserve something with which they are not familiar, or do not even know

exists! There is considerable potential for interpretation of the reefs and estuaries and the wider marine environment, and to promote the importance of sustainability in managing local marine resources. Much of the reef and estuary wildlife is hidden from view and it is important to consider the use of innovative and novel approaches to its interpretation. The existing facilities around the site (e.g. schools, colleges, shops, local community centres, libraries) provide potential locations for interpretation, both formal and informal.

Currently little use is made of the reefs and estuaries for education and interpretation locally with the exception of the Dyfi. The University College Wales, Aberystwyth make regular use of the Dyfi for teaching of marine biology and every year a number of school and college groups use the saltmarshes at Ynyslas for successional and community studies. The University of North Wales also use parts of the site for teaching. Local schools and colleges make little direct use of the local marine environment as a teaching resource; this may, in part, reflect a lack of information and awareness amongst teachers about its potential as well as limited opportunities for field trips. A recent millennium initiative (May-July 2000) by the Bardsey Island Trust to enable all final year primary school pupils to visit Bardsey Island for a day has provided an innovative opportunity to raise awareness about the local marine environment.

There are currently only limited marine interpretation facilities within the immediate area. The National Nature Reserve information centre at Ynyslas contains a small marine aquarium which is stocked annually with marine life from Welsh coastal waters. The centre also contains displays and information relating to the Dyfi estuary and marine conservation issues. A seashore awareness activity is available and is used by a considerable number of primary school groups visiting Ynyslas. There is also a regular programme of guided walks which include seashore and estuary walks. There is a marine aquarium to the south of the site at Aberaeron, and two aquaria on the Anglesey shore of the Menai Strait to the north. All of these have a strong emphasis on the interpretation of local marine wildlife. There is also a marine wildlife interpretation centre in New Quay which focuses on cetaceans.

There is considerable potential for the site to provide an important education resource for educational establishments and the general public. It needs to be borne in mind there are situations where such use could adversely affect the condition of some of the site's reef and estuary communities and species e.g. by repeat trampling in one location) and that this needs to be addressed through appropriate management.

3.3.3 Evaluation of the site for research and study

There is considerable potential for the cSAC to be used for research and study of temperate reef and estuary communities and processes. There is still much to be learnt about the reefs and estuaries. Future work could address issues such as: improving our knowledge about the distribution of particular habitats and species within the site; better understanding the scale and nature of change in the biological communities; the role of physical and biological processes occurring within and around the site; and, studies to better understand the potential links between human activities and change in the natural environment. The findings from research and studies are important to both advise the future management of the cSAC and also to add to our overall knowledge of the UK's marine environment. The Dyfi has a long tradition of research use into aspects of geomorphology, marine biology and saltmarsh ecology. This usage continues, albeit at a somewhat lower level than in previous years.

Access to the subtidal reefs for research and study is not easy. The exposed nature of most of the reefs to prevailing winds is a potential hindrance, and at certain locations tidal conditions necessitate careful planning to avoid operating at times of strong current flow.

There is potential for research use to adversely affect the condition of some of the site's reef and estuary communities and species (e.g. through the use of destructive sampling techniques) and this needs to be addressed through appropriate management. As part of the site management it would be useful to establish and maintain a research project record and to address other mechanisms for good management of research and study activities which could further enhance the site's research value.

4.0 CONSERVATION OBJECTIVES AND MONITORING

This chapter contains the conservation objectives for the site, and also describes the principles on which they are based.

4.1 Introduction

The purpose of the conservation objectives is to define the nature conservation aspirations for the reefs and estuaries of the site, in particular:

(i) to give a clear purpose to the management of the site;

(ii) to make it possible to determine, through monitoring, whether or not the site is being managed in accordance with the requirements of the Habitats Directive;

(iii) to guide management decisions about operations with the potential to affect the site.

The Pen Ll_n a'r Sarnau cSAC reefs and estuaries are not static features, but are subject to inherent ('natural') change both in terms of their biological communities and their geomorphology. The conservation objectives need to accommodate the dynamic nature of these features.

The following sections are based on information provided by CCW in fulfilment of Regulation 33 of the Conservation (Natural Habitats, &c. Regulations) 1994, which require CCW to advise the other relevant authorities as to the conservation objectives for the site.[12]

4.2 Explanation of the structure of the conservation objectives

4.2.1 Rationale

The rationale for the conservation objectives is based on a combination of (a) the requirements of the Habitats Directive, and (b) the principles underpinning CCW's approach to management planning for designated sites and a common standards framework agreed by the UK nature conservation agencies.

4.2.1.1 Requirements of the Habitats Directive

The conservation objectives for an SAC must appropriately reflect the statutory objective of the Habitats Directive, which is the achievement of favourable conservation status (FCS) for the habitat or feature concerned. FCS is defined in Article 1 of the Habitats Directive, and the full definition is given in Appendix 1.1. According to guidance from the European Commission[13], FCS is also to be defined at the level of individual SACs. It is CCW's interpretation of the legislation and EC guidance that the achievement of a site-level FCS should be the basis of conservation objectives for individual SACs, and that the statutory definition of FCS is the "ultimate test" for decisions made in relation to the site. The term "favourable condition" equates to a site-level expression of FCS.

[12] A copy of this Regulation 33 information paper is available from CCW on request.

[13] European Commission (2000) *Managing Natura 2000 sites. The provisions of Article 6 of the "Habitats Directive" 92/43/EEC* (http://europa.eu.int/comm/environment/nature)

4.2.1.2 CCW's approach to management planning

A full explanation of the principles that underpin CCW's approach to conservation objectives can be found in the CCW (1996) publication *'A guide for the production of management plans for nature reserves and protected areas*', and in *'A statement on common standards monitoring*' (Joint Nature Conservation Committee 1998). This framework addresses the role of conservation objectives as "performance indicators", that is standards against which the observed condition of the features (obtained by monitoring) can be compared so that judgements can be made about whether the condition is considered favourable, and about the appropriateness of site management.

Each conservation feature is represented by a series of "attributes", which are measurable indicators of the condition of that feature on the site (for example extent of a habitat, or presence of a particular species). For each attribute, a "target value" can be identified, which equates to the favourable condition of the feature (e.g. extent should be X hectares, species Y should be present at density Z). Taken together, the attributes and their targets represent the "standard of evidence" that will be compared with the results of monitoring of those attributes, to judge whether the overall feature condition is favourable or not. These judgements - and indeed the selection of attributes and targets themselves - must be made in the light of the definition of FCS in the Habitats Directive.

Because (a) all features can be expected to be variable, and (b) it is impossible and unnecessary to measure any attribute completely precisely, for a feature to be considered in favourable condition does not require each attribute to be exactly at its target value. Upper and lower limits can be defined for each attribute, within which its observed value can fluctuate without giving cause for concern. Monitoring is carried out to determine whether or not the actual values of the attributes lie within or outside the limits.

It is important to note that the failure of an attribute to meet its target/limits does not automatically lead to the conclusion of unfavourable condition. The purpose of upper and lower limits is to act as "triggers" for some form of response. In most cases, the cause of an observed change in the condition of a feature will not be known, and the initial action will be to seek to establish the cause of the change. Management action may or may not follow. Limits also need to reflect the effective precision with which monitoring can be undertaken.

4.3 Selection of attributes and targets for the Pen Ll_n a'r Sarnau reefs and estuaries

Defining the "performance indicators" element of the conservation objectives basically involves two elements, firstly the selection of attributes, and secondly the identification of targets. Each of these is considered in turn.

4.3.1 Selection of attributes

The selection of attributes for such large and complex features as reefs and estuaries is not a simple task. The attributes need to reflect the important characteristics and components of the features. The variety of these components for the Pen Ll_n a'r Sarnau cSAC (see section 3.2) illustrates the potential scale of what is required. Also, it is essential that the attributes are informative about the wider condition of the reefs and estuaries, rather than just being indicators of themselves. Finally, they must be measurable (monitorable) to a sufficient level of precision

The selection of attributes for the Pen Ll_n a'r Sarnau reefs and estuaries is still at an early stage of development. The potential attributes for the reefs and estuaries are shown in Tables 4.1, 4.2 and 4.3. A monitoring procedure to measure the attributes will then need to be developed. It is necessary to consider these as provisional at this stage, until more is known about their suitability as attributes (e.g. in terms of monitorabilty).

The potential attributes that have been selected for the Pen Ll_n a'r Sarnau reefs and estuaries lie along a continuum between those that reflect the more broadscale characteristics and components of the reefs and estuaries, to those which represent smaller scale, less widespread components, such as individual biotopes and their species. The more broadscale attributes, such as biotope richness (i.e. number of biotopes) and distribution of biotopes across the features, provide an essential across-site measure of the feature condition, within which the attributes considering smaller scale aspects of the feature condition can be developed. There is no differentiation between across-site versus smaller scale attributes in terms of their importance for gauging/defining feature condition.

Support from the LIFE-funded UK Marine SACs Project (see Appendix 1.6) has enabled work to be carried out during 1998 and 1999 in the cSAC to test and develop methods and strategies for measuring and monitoring some of the reef and estuary attributes (Sanderson *et al*, in prep.). Our current level of knowledge of the reef and estuary features is such that this programme of monitoring trials started by considering the broadscale attributes. As more is learned about the site and the specific nature of the features, more community or species-specific attributes will need to be addressed.

4.3.2 Identification of targets and limits

The setting of targets and limits requires judgements to be made about the condition that it is believed the feature - or components of it - *should* be in. Although ultimately value judgements, such decisions must be made with regard to the Habitats Directive definition of FCS, and they also rely on a scientific understanding of the features. Where knowledge of features is limited, the identification of the "right" targets is a difficult process.

The most widely-used approach with marine sites has been to initially base decisions on the assumption that the "current condition" (or rather that which was last observed, or that which we would observe if we went out and measured the feature tomorrow) equates to favourable. In other words targets for attributes are set at their "current" values, and future condition is monitored against this "baseline". The main reason for doing this is the difficulty, if not impossibility, of setting targets at any other level. In contrast to many terrestrial sites where there may be, for example, historical records showing attribute values through time (e.g. records of the changing extent of a woodland, or the year-to-year abundance of particular plant species), for many marine sites and features we have no quantitative information at all, or at best only a single record, let alone any historical data. In these circumstances, setting targets at any level other than what we know to be present now (or can establish in the short term), seems the only option. However, we may in future be in a position to set targets for some attributes at different levels, where for example we know that a feature has been damaged in the past, or is not capable of sustaining itself, and the target should be "higher" than current levels. An obvious example is where the abundance of a species is very low and we know that it used to be higher and/or that at current levels it cannot sustain itself.

Therefore, unless information is obtained to the contrary, it has been generally assumed that the current condition of the reef and estuary features represents favourable condition. In other words, target values for attributes will be derived according to their current values, once these can be established. It is important to note however that through ongoing survey, monitoring and research, our

knowledge and understanding of the features is improving, and it may be necessary to review this assumption. For example, it is common knowledge that the three estuaries of the cSAC have been substantially modified in the past. It is likely that they are still "adjusting" to these modifications and this process, together with their natural dynamism, is the cause of the changes that are being observed, for example in channel morphology (Coastal Geomorphology Partnership, in prep.). If we add this to the potential changes as a result of sea level rise, the assumption that the estuaries are currently in favourable condition may need to be revisited if, for example, man made structures impair the ability of the estuaries to evolve.

In setting limits for attributes a precautionary approach needs to be taken whereby the initial values will be taken to represent the minimum acceptable level. The limit and target values will be refined as our knowledge increases sufficiently to enable use to do so. Initial values will be determined either from a primary monitoring event once a monitoring programme is in place, or following a programme of surveillance of the features over time.

4.4 Conservation objectives, potential attributes, limits and monitoring

The objectives, potential attributes and notes on targets and limits for the reefs and estuaries are presented in tables 4.1, 4.2 and 4.3. Note that these tables must be subject to continual review, particularly to establish and refine the definition of attributes and targets that will be used.

Table 4.1 Pen Ll_n reefs (* indicates that some aspect of the attribute has been investigated as part of the LIFE-funded monitoring trials)	
To maintain the reefs of Pen Ll_n in favourable condition. The following attributes and targets will be used in monitoring to determine whether this objective is being met.	
Potential attribute	Possible targets and limits
* Biotope richness (number of biotopes)	The target value is likely to be the total number of biotopes. The lower limit for a single monitoring cycle may be less than 100% of the biotopes to take account of the likelihood of not recording a biotopes with a given level of effort. It may be necessary to ensure that 100% of the biotopes present are recorded over, for example, three monitoring cycles.
Presence and distribution of a selection of biotopes representative of the Pen Ll_n reefs	These biotopes should always be present. The suite of representative biotopes for the Pen Ll_n reefs is to be determined. The lower limit for this attribute will be the presence of all the representative biotopes.
Table 4.1 Pen Ll_n reefs (cont.)	
Potential attribute	Possible targets and limits
* Presence and distribution of selected[14] biotopes	All known examples of the listed nationally rare/scarce biotopes should continue to be present on the reefs. Their distribution may be represented by their recorded presence as indicated on a map.

[14] Biotopes and species may be considered important for a number of different reasons, e.g. they are very extensive examples; they are representatives; they are species rich; they are considered nationally rare or scarce; they are at the edge of their geographical range.

	The lower limit for this attribute will be the presence of the listed biotopes, and no reduction in their present distribution. The horse mussel (*Modiolus modiolus*) biogenic reef off north Ll_n was studied as part of the monitoring trials in relation to this attribute because it is a nationally scarce biotope. Additional biotopes need to be considered for this attribute.
* Extent of selected[2] biotopes	The lower limit for this attribute is likely to be no reduction from present extent. The horse mussel (*Modiolus modiolus*) biogenic reef off north Ll_n was studied as part of the monitoring trials in relation to this attribute because it is a nationally scarce biotope. Additional biotopes need to be considered for this attribute
* Structural integrity of selected[2] biotopes	Target and limits for this attribute are to be determined. These will depend on the specific aspects of structural integrity chosen for each selected biotope. The horse mussel (*Modiolus modiolus*) biogenic reef off north Ll_n was studied as part of the monitoring trials in relation to this attribute. Possible aspects of structural integrity for this community are age structure of the horse mussels, density/area covered by live horse mussels, and the continuity of the mussel reef as a whole. Additional biotopes need to be considered for this attribute
* Community composition of selected[2] biotopes (e.g. number and abundance of species)	Targets and limits for his attribute to be determined. These will depend on the specific aspects of community composition chosen for each selected biotope. The horse mussel (*Modiolus modiolus*) biogenic reef off north Ll_n was studied as part of the monitoring trials in relation to this attribute. Two aspects have been considered: epifaunal composition and infaunal composition. Additional biotopes need to be considered for this attribute

Table 4.1 Pen Ll_n reefs (cont.)

Potential attribute	Possible targets and limits
* Presence of selected[2] species	Lower limit for this attribute will be continued presence of selected species at specified monitoring stations. The yellow star anemone (*Parazoanthus axinellae*) was studied as part of the monitoring trials in relation to this attribute. This species was selected as it is considered to be at the edge of its biogeographic range. Additional species need to be considered for this attribute
* Abundance of selected[2]	Lower limit for this attribute is likely to be no reduction in present abundance.

species	The yellow star anemone (*Parazoanthus axinellae*) was studied as part of the monitoring trials in relation to this attribute. This species was selected as it is considered to be at the edge of its biogeographic range. Additional species need to be considered for this attribute
Population structure of selected[2] species	Targets and limits for this attribute to be determined. These will depend on the specific aspects of the population structure chosen for each selected species. This attribute is considered applicable to the yellow star anemone (*Parazoanthus axinellae*) because it is considered to be at the edge of its biogeographic range. Additional species need to be considered for this attribute
Condition of selected[2] species	Targets and limits for this attribute to be determined. Species need to be considered for this attribute.

Table 4.2	**Sarnau reefs (* indicates that some aspect of the attribute has been investigated as part of the LIFE-funded monitoring trials)**
To maintain the Sarnau reefs in favourable condition. The following attributes and targets will be used in monitoring to determine whether this objective is being met.	
Potential attribute	Possible targets and limits
Presence and distribution of a selection of biotopes representative of the Sarnau reefs	These biotopes should always be present. The suite of representative biotopes for the Sarnau reefs is to be determined. The lower limit for this attribute will be the presence of all the representative biotopes for each Sarn.
* Extent and distribution of selected[15] biotopes	The current condition for the extent of the main Sarnau biotopes is to be determined. The lower limit may be expressed as a proportion of positive samples rather than actual extent. There are relatively few biotopes present on the Sarnau compared with the Pen Ll_n reefs. The extent of this limited number of 'representative' biotopes is considered an important characteristic of the Sarnau. The extent of these biotopes will be influenced by the extent of available reef habitat, i.e. total extent of the Sarnau reef features.
* Structural integrity of selected[2] biotopes	Target and limits for this attribute are to be determined. These will depend on the specific aspects of structural integrity chosen for each selected biotope. Biotopes for this attribute need to be determined
* Community composition of selected[2] biotopes (e.g. number and abundance of species)	Targets and limits for his attribute to be determined. These will depend on the specific aspects of community composition chosen for each selected biotope. Biotopes for this attribute need to be determined
Presence of selected[2] species	Lower limit for this attribute will be continued presence of selected species at specified monitoring stations. Species for this attribute need to be determined.
Abundance of selected[2] species	Lower limit for this attribute is likely to be no reduction in present abundance. Species for this attribute need to be determined.
Population structure of selected[2] species	Targets and limits for this attribute to be determined. These will depend on the specific aspects of population structure chosen for each selected species.

	Species for this attribute need to be determined.
Table 4.2 Sarnau reefs (cont.)	
Potential attribute	Possible targets and limits
Condition of selected[2] species	Species, targets and limits for this attribute to be determined.

Table 4.3	**Glaslyn/Dwyryd, Mawddach and Dyfi estuaries. NB The potential attributes for each of the three estuaries are likely to be the same so a single table is presented here. (* indicates that some aspect of the attribute has been investigated as part of the LIFE-funded monitoring trials)**
To maintain the estuaries in favourable condition. The following attributes and targets will be used in monitoring to determine whether this objective is being met.	
Potential attribute	Possible targets and limits
* Relative proportion of sandy and muddy biotopes and communities	The target value may be the relative proportion of sandy to muddy biotopes. This may be indicated by a ratio of 'hits' on a broad scale sampling grid or as expanse on a series of transects. Use of remote sensing techniques may enable more direct measurement of areas of sandy and muddy biotopes within each estuary. The lower limit for this attribute is to be determined. It may, for example, be no more that x% increase in proportion of muddy biotopes within each estuary. The Mawddach estuary was selected as a trial site for work on this attribute as part of the monitoring trials.
* Distribution of major communities within the estuaries	The target value for the broad-scale distribution of the sandy and muddy biotopes may be represented in the form of a map of the biotopes distribution or as indicated from a broad-scale sampling grid or transect series. Proportions of the major communities present in described 'zones' of each estuary may provide an appropriate measure of target/limit setting. The Mawddach estuary was selected as a trial site for work on this attribute as part of the monitoring trials.
Presence of a representative suite of communities	The target value will be for these communities to always be present. The suite of representative communities for each estuary is to be determined. The lower limit for this attribute will be the presence of all the representative communities.
Community composition of selected[2] biotopes (e.g. number and abundance of species)	The targets and limits for this attribute are to be determined. They will depend on the specific aspects of indices of community composition for each selected biotope.

	Communities to be considered under this attribute are likely to include the major estuary biotopes, sheltered muddy biotopes and rare/scarce biotopes.

Table 4.3 Estuaries (cont.)

Potential attribute	Possible targets and limits
Presence of rare/scarce communities	The lower limit for this attribute will be the continued presence of selected communities at specified monitoring points.
Extent of intertidal rocky communities	The lower limit for this attribute may be no reduction in the extent of intertidal rocky communities. Extent may be represented as a proportion of records of intertidal rocky communities across a stratified broad-scale sampling grid.
Presence, abundance and condition of rare/scarce species	Species, targets and limits for this attribute to be determined.
Presence, abundance and condition of selected[2] species	Species, targets and limits for this attribute need to be determined.

4.5 Further work needed

A considerable amount of further work, beyond that recently undertaken, is required to refine the list of attributes and determine targets and limits for these. This work requires time and the knowledge required will emerge only slowly as information is gathered from monitoring and surveillance projects.

It is also important to see the site's conservation objective in a wider view, one in which we understand more fully the functioning of the reefs and estuaries. Whilst some of this information will undoubtedly come from monitoring and surveillance projects, some further targeted research will be required.

5. HUMAN ACTIVITIES, FACTORS WHICH INFLUENCE OR MAY INFLUENCE THE FEATURES, AND MANAGEMENT RESPONSE REQUIRED

This section describes the extent and location of the human activities occurring within the Pen Ll_n a'r Sarnau cSAC (sections under 5.4) and assesses a variety of human-induced and natural factors in terms of their possible influence on the reefs and estuaries of the cSAC. It summarises the mechanisms by which factors may affect the site features, describes the existing management regime for each factor and describes what, if any, management response is required.

5.1 Definition of terms

5.1.1 What are factors?

The features of the site will be subject to a variety of factors, both natural and man-induced, that may affect them in some way. As part of the process of developing a management plan for the site, it is important to identify all the significant factors which influence, or may influence the site and the site features. For those factors that are considered significant, it is necessary to determine the extent to which they affect the features and the implications for monitoring, surveillance and management. Factors may be both positive and negative in terms of their affect on the site.

5.1.2 Natural factors

There are many natural factors that may influence the site and its features, and affect site management. For the reefs and estuaries of the Pen Ll_n a'r Sarnau cSAC, these may be physical factors (for example, patterns of sediment movement, wave height and strength, tidal currents, water clarity, temperature) or biological factors (for example, population changes, competition between species). Natural processes can be altered by human influence.

5.1.3 Human-induced factors

Other factors are the result of human activities or operations. They may be the result of activities going on within or adjacent to the site, or they may be linked to activities or operations that are occurring outside of the site, sometimes many miles away.

5.1.4 Plans and projects

In addition to relevant authorities' functions in managing activities through the management scheme they, and other competent authorities, have certain specific statutory functions to decide on applications for consents, authorisations, license and permissions. These are 'plans or projects'. Plans and projects are, "in general, any operation which requires an application to be made for specific statutory consent, authorisation, licence or other permission. This is in contrast to activities which are controlled or managed by competent authorities on a continuing basis" (WO/DETR, 1998).

Plans and projects must be subjected to appropriate assessment in view of their implications for the conservation of the site. In these cases, existing legislative/administrative procedures exist within which any requirement for appropriate assessment is determined. Further information about the assessment of plans and projects is provided in Appendix 5.1.

5.2 Factors which may affect the features

The natural and human-induced factors that have been considered in terms of their possible affect on the reef and estuary features of the cSAC are described in sections 5.3 and 5.4

The factors have been selected on the basis that they have a reasonable likelihood of taking place (even if they are not occurring at present), and may have an adverse effect on the features of the site. The list of activities/operations and factors has been compiled by the relevant authorities (informed by CCW's draft Regulation 33 advice about operations likely to affect the features) and incorporates the views of the Liaison Group representatives and other interested groups and individuals who have participated in developing this management scheme. It will be necessary to keep the factors under review as our understanding of the site and the features increases and /or as the use of the site changes.

It is not known whether some of these activities are currently having a significant adverse affect on the reefs and estuaries, but it is considered appropriate to identify them here for consideration. Showing irrefutably that an activity is adversely affecting the reef and estuary features may be very difficult. Problems with identifying cause and effect may be due, for example, to lack of knowledge about the mechanisms whereby factors affect the features (including the likelihood of or combined interactions of more than one factor), a low level of knowledge about the levels of 'natural' change occurring and their habitats, insufficient scientific capabilities to record or detect change, or insufficient resources.

Some of the activities listed are known to have been occurring on the site for some time and, at current levels, are not likely to be having significant adverse affect. However, it is considered appropriate to consider them in the context of the management scheme since significant changes to the level of the activity may adversely affect the features.

It is essential that the 'precautionary principle'[16] is followed for the management of this cSAC to ensure that actions are taken early enough to minimise potentially serious or irreversible effects. Management decisions will need to take into account reasonable predictions of likely affects of human activities on the reefs and estuaries, despite a paucity of supporting scientific evidence.

In sections 5.3 - 5.4 each factor is considered in turn under the following headings:

[16] *'Precautionary Principle': "Even if it has not been demonstrated, but an activity is considered 'likely' to have a significant impact on the features, appropriate actions should be taken to manage that activity to prevent the impact"*

· Description of the extent and location of the activity/factor (both within site and adjacent to the site)

· How the activity/factor may affect the feature

· The existing management of the activity/factor and the organisation(s) responsible

· The type of management response required (including the rationale for the proposed response, and any management actions that are required.

(A summary list of all management actions that are identified in this section is provided in section 6.)

To help with determining the initial level of management response required for each factor, a set of 'generic' management responses has been developed and these are shown in table 5.1 below. These response categories have been applied to the factors in the sections 5.3 - 5.4.

Table 5.1 Generic management response categories

Category	Judgement	Management option
F1	**There is no known mechanism for the operation to affect the feature, and no evidence that it is having an effect.**	**Not considered further**
F2	**There is a known mechanism for the operation to have an effect, but no evidence to suggest that it is having a significant effect at present.**	**Surveillance. Possibly identify operational limits?**
F3	**There is evidence to suggest that an operation is having a significant effect, but the mechanism is unknown.**	**Research, or experimental/ trial management including operations limits**
F4	**The factor is considered to have a significant effect on the features, but is entirely outside any management control (i.e. natural process)**	**Surveillance**
F5	**There is evidence to suggest that an operation is having a significant effect and the mechanism is known.**	**Implement management measures (voluntary or statutory), with operational limits as appropriate**
F6	**The operation constitutes a plan or project.**	**Apply Habitats Regulations 48-53.**

5.2.1 Information from the UK Marine SACs Project

Considerable use has been made of various reports commissioned as part of the EC LIFE-funded UK Marine SACs Project (see section 1.6 and Appendix 1.5). Reports have been published, or are still in preparation, on the dynamics and sensitivities of marine features to various types of impact, and also reports assessing the interactions between human activities and the marine features. A list is given in Appendix 1.6.

The results of many of these studies have provided information to support the evaluation of the relevance of various activities to the features of the Pen Ll_n a'r Sarnau cSAC, and have helped to identify the management responses to human activities in this cSAC.

5.3 Natural factors

The existing environmental conditions within the Pen Ll_n a'r Sarnau cSAC are described in sections 2.2.2 and 2.2.3. Since these conditions support the varied habitats and wildlife of the reefs and estuaries (described in section 2.2.1), long term changes to environmental parameters such as wave exposure , tidal currents, water temperature and sediment regimes could affect the reef and estuary features and result in changes to their habitats and wildlife. Such changes could negatively affect the condition of the reefs and estuaries.

Although different natural factors are considered individually in the sections below, it is important to remember that they do not operate in isolation from one another. For example, the distribution of biological communities within the estuaries reflects the sediment characteristics, the degree of exposure to wave energy and the elevation of the intertidal with respect to the tidal frame. These factors interact with each other as well as being influenced by other natural factors such as sediment supply.

A considerable amount of the following information is taken from a draft report to CCW on coastal processes by the Coastal Geomorphology Partnership, University of Newcastle (CGP, in prep).

5.3.1 Geomorphological processes

Geomorphological processes have been, and will continue to be, fundamentally important to the creation, maintenance and future evolution of the reef and estuary features. The shape of the coastline of the cSAC is largely defined by the solid geology, except for the area north of the Mawddach and up to the Glaslyn/Dwyryd where the coastline appears unrelated to this.

Geomorphological processes influence the whole of the site. The estuaries in particular should be thought of as dynamic geomorphological landforms. Created as a result of glacial erosion of pre-existing river valleys and infilled by redistributed glacial deposits to their present morphology when the glaciers retreated and sea level rose, the three estuary systems will continue to respond to environmental change.

Each of the estuaries forms a single geomorphological unit and is best studied and managed as such. One approach for assessing the geomorphological well-being of an estuary is known as the "regime theory" which proposes that for each estuary there is a relationship between the tidal prism (the volume of water entering the estuary in each tidal cycle) and mouth area (cross-sectional area of the estuary mouth). The geomorphological processes in an estuary will operate so as to reach an equilibrium position where there is a balance between tidal prism, current velocities at the estuary mouth and thresholds for erosion and deposition of sediment. This approach forms a useful basis for recognising whether the estuary is in a form of equilibrium, or whether change is expected in the medium term. The dynamic nature of the estuaries means that modification to one of the estuary components, such as saltmarshes or mudflats, may have repercussions throughout the estuary as it tries to re-establish its equilibrium.

It is thought that the creation of the Sarnau is linked directly to the action of the glaciers during the last glaciation. The location and possibly even the existence of these reefs is thought to be a result of the "funnelling" of the glaciers into Cardigan Bay by the estuary and river valley topography.

Following the retreat of the glaciers, the coastal processes became the dominant mechanisms for further modifications to the coastline. Longshore transport is northwards in Cardigan Bay and sediment is being

eroded and deposited at different points along the coast. This pattern is modified by the presence of the Sarnau which, within north Cardigan Bay, control the inshore wave patterns and hence the rates of longshore and cross-shore sediment transport. The Sarnau therefore exert a major control on the geomorphology of the coastline and estuaries. Spatial variation in the rates of longshore and cross-shore sediment transport are likely to cause the coastline to alter shape and may influence the supply of material to the estuaries.

The estuaries rely on a supply of material for internal changes. The majority of the sediment is supplied from the marine environment as opposed to the surrounding land catchment area The nature and scale of the sediment sources that supply this material are not fully known.

The reef communities of the Sarnau and parts of south Ll_n are directly affected by the patterns of sediment movement. Seasonal or storm-related movement of sediment can alternately cover or expose areas of reef habitat. For example, this has been observed from the north side of Sarn Badrig, where a layer of sediment a few centimeters thick overlies cobbles and pebbles that are colonised by seaweeds, which would only have been able to establish themselves int he absence of he sediment. The presence of a large amount of relatively mobile sediment surrounding the Sarnau reefs means that scour (caused by sand held in suspension in the water) is an important influence on the species living on these reefs.

Sand inundation of rocky habitats also seems to occur around much of the Ll_n, particularly in areas where sand plains lie in proximity to the shallower rocky kelp forests. Changes in prevailing wind direction or storm events can partly bury boulders in sand resulting in the survival of only scour-tolerant species, if any.

The presence of the biogenic honeycomb worm reefs is dependent on a correct supply of sand. Too little sand and the reef structures do not develop, too much sand and they may become smothered. The presence of relatively extensive areas of honeycomb worm reefs within the cSAC reflect the suitability of the sediment supply for this species.

The geomorphological processes operating in the NW part of the site, around Bardsey Island and south west and north Ll_n are less well documented. There are large supplies of mobile sediment within close proximity to the reefs (e.g. the tripods, Bastram Shoal and Devil's Ridge) and it is known that periodic movement of sediment covers and uncovers areas of lag cobble seabed in some of the deeper areas in this area.

It can be seen from the foregoing that changes or interruptions to the geomorphological processes operating throughout the site are likely to have an impact on the reef and estuary features of the site.

5.3.2 Currents / tidal regime

Currents are one of the main mechanisms by which material in the marine environment is moved from one location to another, linking different components of not only the reefs and estuaries but other habitats with the wider sea area. They play a very important role in the distribution of spores and larvae, organic matter and other materials within the marine environment.

The tidal regime and strength of currents present within the different areas of the cSAC also have a direct influence on the type of community and hence species present in any one location. This is particularly so for the reefs where, for any given degree of exposure to wave action (one of the other main direct factors influencing the biological communities) variations in tidal strength can mean a dramatic change in the communities present.

Tidal influences also affect the movement of marine sediments, and this is an important consideration for the reefs and estuaries. Increased sediment erosion as a result of accelerated tidal flows, and increased sediment deposition as a result of decelerated tidal flows, may alter the pattern of distribution of different sediment types. In the estuaries, for example, such change could lead to an alteration of sand and mud substrata within each estuary, so effecting the communities and species present in any one area. Erosion and deposition may affect the reefs by exposing new areas of potential reef habitat or reducing reef extent by smothering the seabed and wildlife.

Currents are an important component in creating scour conditions. Sediment held in suspension in the water column and moved around by tidal currents may have a significant scouring effect on the reef communities. The presence of significant amounts of relatively coarse and mobile sediment within and adjacent to the cSAC provides a ready supply of material many of the reef communities of the cSAC are characterised by assemblages of species tolerant to scour.

5.3.3 Wave exposure

Wave exposure influences the degree of water mixing, water turbidity, dynamism of sea bed substrates and the level of physical turbulence that the shallow coastal waters and their marine life are subject to. Wave exposure is a very important factor in helping determine the presence and type of both reef and estuary communities within the cSAC. It is determined by the strength and direction of the prevailing winds and takes account of the orientation of the coast to this as well as the fetch (distance to the nearest land), the degree of open water offshore and the depth of water adjacent to the coast.

As described above in relation to exposure to tidal currents, wave exposure is one of the main direct factors influencing the presence and distribution of reef communities. Its influence is also reflected in the distribution of the estuarine communities. Here, those communities characteristic of more exposed conditions are predominant at the mouth of the estuary where levels of wave exposure are greatest, whilst those reflecting more sheltered conditions are found further up each estuary.

Changes to wave exposure (whether an increase or decrease) are likely to have a significant effect on both the reefs and estuaries. The nature of these effects may relate to increased sediment movement and its associated impacts such as alteration of seabed type, re-distribution of communities within different parts of the site to reflect a difference wave exposure regime and altered levels of turbidity.

5.3.4 Sea temperature

Sea temperature exerts an important influence on most marine species. Temperature may affect both the short and long term abundance and distribution of both sessile and mobile species and may influence certain behavioural aspects, such as timing and frequency of spawning and may influence the occurrence and rate of biological processes such as decomposition.

Throughout the UK there is a general pattern of warmer coastal waters in the south west and colder coastal waters in the north and central east coast. The warm water originating with the Gulf Stream and circulated around the western coasts of the UK by the North Atlantic drift supports this pattern of sea temperature distribution. The distribution of certain species reflect the pattern of sea temperature gradients with, as might be expected, a predominance of warmer water species in the south west. Sea temperature can influence whether introduced species become established in coastal waters. Thermal effluents and localised warming can be responsible for encouraging the introduction and establishment of exotic species.

5.3.5 Turbidity

Turbidity is a term used to describe the level of water clarity. Light is essential for plant growth, and reduced levels of light affect, in particular, seaweed communities. Increased levels of turbidity will limit the amount of light that penetrates the water column and consequently affects plant growth at different water depths. Studies in the Menai Strait (Lumb, 1989; Lumb, 1990) show that increased turbidity has reduced the depth at which red seaweed communities grow and that it can also influence the species composition of seaweed communities.

Changes in wave exposure and tidal currents may affect turbidity. The frequency of storms, both locally and within the area of fetch will affect wave formation locally and therefore turbidity. Turbidity can also be influenced by run-off and river flows.

5.3.6 Depth

Related to the issue of light penetration in water, it is not difficult to see how depth influences the distribution of different marine communities. This is more obvious for the reefs where the different zones of seaweed communities in shallow water merge into the animal-dominated communities in deeper locations, as a direct result of the effect of increasing water depth on light availability.

Depth, or rather changing depth, is also important in the estuaries. Long term increases in the water depth result in changes within estuaries to maintain their shape and position in the tidal frame (CGP, in prep).

5.3.7 Salinity

Salinity in the open sea is generally maintained at a relatively constant level. There may be marginal changes between winter and summer and between surface and bottom waters, but the most marked differences are found in enclosed or semi-enclosed waters. Inputs of freshwater will cause localised reductions in salinity and often result in the presence of specific species and communities able to survive in the less saline conditions.

The salinity regime in estuaries is particularly complicated and there are horizontal as well as vertical gradients which fluctuate with every tide. The distribution of the different community types from the seaward end of an estuary into the more freshwater reaches reflects the corresponding reduction in salinity.

5.3.8 Climate change

Climate change is known to have occurred naturally throughout the Earth's history, but in recent years it has become clear that human activities also have the potential to modify the earth's climate. Recently studied effects have included:

- Global warming, caused (in part at least) by an increase in anthropogenic 'greenhouse gas' emissions such as carbon dioxide and methane;

- Increased ultraviolet light exposure resulting from reductions in stratospheric ozone due to chemical reaction with anthropogenic chlorofluorocarbons (CFCs).

Climatic conditions are obviously major factors in determining where fauna and flora are able to successfully live (sections 5.4.1-5.4.6) and changes to these fundamental influences can result in significant changes to the quality and distribution of habitats and species populations.

The types of changes that climate change could cause in the UK are reasonably well predicted, but the rate and extent of the impacts are not certain. For the reefs and estuaries, changes to the following factors are likely to be most important (some of the possible effects of such changes are also considered).

5.3.8.1 Raised sea levels

Possible implications:

- A rate of 2mm per year rise in sea level is taken to be representative of Cardigan Bay. This corresponds to a 40mm rise after 20 years and a 100mm rise after 50 years.

- With increasing sea level rise, the depth of water above the Sarnau reefs will gradually increase. This may affect the controlling influence the Sarnau have on the geomorphological processes within north Cardigan Bay and, as a result, directly affect the coastline and estuaries.

- Sea level rise will affect wave refraction and the angle between the wave crests and the coastline. This will probably increase the rate of longshore transport (or initiate it where it is not presently occurring).

- Beaches and estuaries will respond by retreating landwards (known as roll-back). This may cause problems where natural beach retreat or estuary realignment cannot occur, e.g where sea defences are already in place to protect, for example, agricultural land and buildings. This process is known as "coastal squeeze".

- In the estuaries, increasing water depths in the outer parts allow larger waves to persist, resulting in increased erosion of the upper shore sandflats and mudflats. The material released from this increased erosion is transported landwards to the inner estuary where it is deposited on the upper intertidal areas. This is the mechanism by which the whole estuary moves landwards in response to rising sea level. If new sediment material is available, this will be used so the estuary can also rise in elevation in response to the changing sea level.

· In general it is predicted that for every 1mm rise in sea level a 10m landwards translation may be expected. While this might not sound a great deal, this equates to 0.4km after 20 years and 1km after 50 years. Where landwards translation is prevented by lack of space (e.g. due to the prevailing geology or human developments) there will be enhanced stress and potentially increased erosion.

5.3.8.2 Increased storminess (frequency and strength)

Possible implications:

· Generally increased exposure around the site and change in some communities as a result, particularly in areas exposed to the prevailing wind/wave direction. Increases in wave energy are likely to have major implications on the geomorphology of the area. For the Sarnau, increased wave action may result in the erosion of their surface and a coarsening of the substrate as finer material is winnowed away.

· An increase in storms and floods may result in increased intensity of periodic pollution and water turbidity.

5.3.8.3 Sediment transport

Possible implications:

· Increased rates of sediment movement as a result of changes in storminess may result in increased erosion at locations within the cSAC. Sediment mobility is also related to water depth and hence changes in sea level.

5.3.8.4 Alteration to tidal regime

Possible implications:

· Sea level rise and changing water depth will affect the behaviour of the tide. Tidal measurements show mean high water rising with no commensurate rise in mean low water, thus indicating increasing tidal range (CGP, in prep).

5.3.8.5 Changes to wind/wave direction

Possible implications:

· Future changes in wind and wave direction are not known. Cardigan and Caernarfon Bays are largely protected from the Atlantic swell waves by the Irish landmass. Atlantic waves may enter the bay from the south-west which presently coincides with the dominant local wind direction. The promontories of the Ll_n peninsula to the north and St David's Head to the south further project from northerly or southerly wave propagation in Cardigan Bay.

5.3.8.6 Increased average sea temperature

Possible implications:

- May affect the presence and distribution of particular species and communities. Species preferring warm waters will be favoured, possibly extending their range northward while the southern limit of species preferring colder waters will move northward. Rising average sea temperature may favour the invasion and spread of non-native species within the cSAC (see section 5.4.7.7). Migratory patterns of species, for example fish may alter as a result of altered sea temperatures and other changes associated with climate change. This may result in a need for reconsideration of management measures to protect them.

5.3.9 Management response

5.3.9.1 Type of response

Natural factors

F4: The factors are known to have a significant effect on the reefs and estuaries, but they are entirely outside any management control.

Climate change

F2: There is a known mechanism for the process to have an effect, but no evidence to suggest that it is having a significant effect at present.

F4: The factor is considered to have the potential to have a significant effect, but is outside any local management control

5.3.9.2 Rationale

Changes to geomorphological processes, current/tidal regime, wave exposure, sea temperature, turbidity, depth and salinity have the potential to affect the reef and estuary features and their wildlife, both directly and indirectly. Even in the absence of any human input or interference it would be expected that these environmental conditions would change over time. Such changes are outside of any management control, and any impacts on the reefs and estuaries as a result of 'natural' changes are considered acceptable. This position, though, is complicated by the fact that our understanding of the rates and type of natural change we may expect to see within the cSAC is limited, and more particularly it is extremely difficult to separate natural from human-induced change.

Many of the natural processes operating within the site can be influenced by humans to a lesser or greater degree. Indeed some of the processes described above are the mechanisms through which human activities can affect the features of the site, and these are considered in section 5.4 which deals with the range of "human activities" factors.

While it may be possible to manage individual activities within the site to reduce potential impacts on the features, human influence on the natural processes operating within the cSAC may also occur on a more global scale, as typified by the example of climate change. As with 'natural' changes to the environmental processes operating in the site, managing the impacts of human-induced climate change on the reefs and estuaries of the cSAC is clearly beyond the capabilities of the site's relevant and competent authorities. However, an important function of this management plan is to identify the role of wider, even global, processes on the site and to seek to better understand their interaction with factors operating at a more local scale. This will be essential to enable appropriate management decisions - including for example actions to moderate the impact of climate change on the site's features - to be made by the competent and relevant authorities.

5.3.9.3 Management actions

Actions

· Develop and establish a programme of surveillance for key aspects of the natural processes within the cSAC. There is already a certain amount of relevant work that has been, or is being carried out by the relevant authorities and others that is appropriate to this. CGP (in prep) reviews existing data sets and environmental surveillance programmes, and contains some recommendations for the types of surveillance needed to improve understanding of the effects of natural processes on the reefs and estuaries. The relevant authorities will need to consider the conclusions of this work in developing and undertaking future surveillance and research programmes.

· Maintain 'watching brief' surveillance of climate change and other natural processes affecting Cardigan and Caernarfon Bays through occasional liaison with relevant research institutions.

· Encourage and support policies and management within and around the site which will help minimise any potential impacts of climate change on the reefs and estuaries. For example, consider the potential implications of sea level rise and likely change in the estuaries when assessing development proposals in the estuaries.

Links to other programmes

- Existing beach profiling and estuary dredging carried out by Gwynedd Council and others
- Ongoing development of shoreline management plans (SMPs)
- Local Environment Agency Plans (LEAPs)

5.4 Human activities and human-induced factors

The information on extent and location of human activities within the cSAC in the following sections has been informed by a report[17] commissioned by CCW (with financial support from the LIFE UK Marine SACs Project) and through the input of Liaison Group representatives.

In addition to this management scheme/plan, there are a number of other plans and initiatives which operate within and around the Pen Ll_n a'r Sarnau cSAC. Some of these relate to the planning framework while others are concerned more specifically with issues such as shore defence, catchment management or biodiversity. Further information about these plans and the frameworks in which they operate is provided in Appendix 5.2. Some of these plans will be referred to in this section in relation to the existing management framework operating in the cSAC and management actions required.

The various reports on marine feature sensitivities and interactions between human activities and features, commissioned under the UK marine SACs project (see section 5.2.1 above), have informed the following sections.

5.4.1 Activities related to the construction of coastal and inshore structures

The coastline bordering the Pen Ll_n a'r Sarnau cSAC is not highly urbanised. The coast is, for the most part, rural and undeveloped. Existing coastal development is located the areas of the main coastal settlements of Nefyn, Aberdaron, Abersoch, Pwllheli, Criccieth, Porthmadog, Harlech, Barmouth, Fairbourne, Towyn, Aberdyfi and Borth.

Existing coastal developments mainly involve the development of land for housing, recreation, tourism and agriculture. Currently new development activity is low. The importance of the recreation and tourism industry to this part of Wales makes the undeveloped nature of much of the coast a very important economic asset.

[17] **'Pen Ll_n a'r Sarnau candidate SAC: Review of human activities' (Kathy Kennady 1998). This report was based on existing information held by the relevant authorities and other organisations and site users and on anecdotal information. It has been accepted as a valuable preliminary overview of the use of the site; not all the information found acceptance by some Liaison Group members.**

5.4.1.1 Construction of ports, harbours, marinas, slipways (and other similar coastal developments)

Associated activities such as land-claim, capital and maintenance dredging, disposal of dredged material and pollution from operational plant/equipment are addressed separately.

Extent of the activity

There are a number of harbours located around the coastline of the Ll_n Peninsula and the Meirionnydd coast and there is currently one marina at Pwllheli. There is also a marina with 100 berths at Aberystwyth to the south of the cSAC. In addition to these facilities, there are in the region of 1530 moorings located between Porth Dinllaen and Aberystwyth. There is the future possibility of applications for marina developments of some sort at Aberdyfi and at Barmouth.

There are a number of public and private slipways around the coast of the cSAC. Some of these are essentially 'unauthorised' as they have been constructed without planning permission being sought.

How the activity may affect the features

The potential impacts of coastal or estuarine infrastructure developments such ports, harbours, marinas and slipways may occur both when the facility is being constructed and while it is in use. There may be a large number of different activities associated with these types of development. The potential impacts of these, and the development as a whole may be physical, such as irreversible destruction and loss of habitat, or biological, such as changes in water quality as a result of the development. Some of the activities associated with the construction or operation of ports, harbours, marinas and slipways (e.g. dredging and dredge disposal) are covered in other sections below. The scale of the impacts on the cSAC features depends upon a variety of different factors such as the specific location and scale of the development, construction methods, operational requirements etc, and the environmental characteristics of the proposed location.

The organisation(s) involved in management

Gwynedd Council
Ceredigion County Council
Snowdonia National Park Authority
Countryside Council for Wales
Crown Estate (if the development involves Crown land)
MAFF (if works involve depositing of material on the seashore or seabed)
Land owners and occupiers

Existing management

The construction of ports, harbours, marinas and slipways will require planning permission[18] and will need to be considered in the context of the planning framework (see Appendix 5.2). Approval from the National Assembly of Wales under the Coast Protection Act 1949 may also be required. Development below mean low water mark would require Crown consent or an Act of Parliament. Planning applications are subject to statutory consultation requirements and in certain instances will require press notification (e.g. where development requires an environmental impact assessment; where development is contrary to the development plan).

Depending on the scale and location of the proposed development, an Environmental Assessment may be required under the Environment Impact Assessment Regulations 1999 (see Appendix 5.1).

If the construction requires the placing of material seaward of the Mean High Water Mark Spring Tides, a licence from MAFF will be required under the Food and Environmental Protection Act 1985.

Under the Habitats Regulations 1994, the construction of ports, harbours, marinas and slipways constitutes a plan or project and therefore is subject to the provisions of Regulations 48-53 (see Appendix 5.1). Under the Habitats Regulations, competent authorities are required to ensure that the potential impacts of any future port, harbour, marina, slipway construction on the reefs or estuaries of the cSAC are fully addressed.

The different activities associated with the operation of port, harbour and marina facilities (e.g. waste disposal) will be subject to other legislative requirements such as discharge licences.

Management response

Type of response

F2: There is a known mechanism for the activity to affect the features but no evidence to suggest that it is having a significant affect at present.

F6: The activity constitutes a plan or a project and is subject to the provisions under the Habitats Regulations 48-53.

Rationale

The construction of these types of facility has the potential to affect the reef and estuary features of the cSAC. Assessment of the potential impact of such developments is addressed by existing legislative requirements and the procedures that planning authorities (as Competent Authorities) are required to undertake in order to fulfill, in part, the requirements of the Habitats Regulations. There is a potential problem with the construction of unauthorised slipways within the cSAC.

[18] **Town & Country Planning Act 1990. Note: development seaward of mean low water mark is not within the jurisdiction of the Town and Country Planning Acts.**

Management actions required (including links to other policies/plans/measures)

i Actions:

· Treat the construction of ports, harbours, marinas, slipways and similar coastal developments as a Plan or Project. (Appropriate competent authorities).

· Competent authorities to review extant planning permissions for such developments. (Appropriate competent authorities).

· Review the extent of unauthorised slipway developments and take enforcement action where appropriate.

· Consider the preparation of a strategy for the northern Cardigan Bay area covering the future requirements for port, harbour, marina, and slipway developments to assist with planning future management of the cSAC within the framework of the Unitary Development Plan (UDP) process. (Gwynedd Council, Ceredigion County Council and Snowdonia National Park Authority to incorporate within their UDPs).

· Carry out an appropriate screening assessment of any port, harbour, marina, slipway developments (or other similar developments) likely to affect the Pen Ll_n a'r Sarnau cSAC. (Gwynedd Council, Ceredigion County Council and Snowdonia National Park Authority).

· Ensure that the SAC is taken fully into account in the preparation of strategic plans (e.g. Unitary Development Plans), and combined development proposals (e.g. in relation to European or other funding) and ensure a consistency of approach amongst the appropriate competent authorities. (Gwynedd Council, Ceredigion County Council, Snowdonia National Park Authority and other competent authorities).

ii Links:

· Cardigan Bay cSAC Management Plan – developments addressed within this may be relevant to the Pen Ll_n a'r Sarnau cSAC and vice-versa.

5.4.1.2 Shoreline defence structures, including maintenance and improvement of existing defences and construction of new defences

Extent of the activity

There are a number of locations around the site where shoreline defence structures already exist. In the current climate it is unlikely that any new structures will be built which are not associated with the existing coast protection measures. Shoreline Management Plans (strategic plans for coastal defence requirements based upon physical coastal processes; see Appendix 5.2) are being prepared to guide future planning for coastal defence works.

The majority of the work carried out today is reconstruction or refurbishment of existing structures or measures to address terminal erosion problems. With sea level rise and increased storminess there will always be a need to maintain and improve existing structures if communities are to be protected. The preferred alternative in many instances today is to restore beaches by importing or recycling material to recharge the beach to raise the overall level and therefore provide and enhanced level of defence. There are proposals for beach feeding as part of coastal defence at Traeth Crugan and Traeth Abererch.

How the activity may affect the features

Sea defence and coast protection structures are used to defend low lying land from the flooding by the sea (sea defence) or to defend sea cliffs from marine erosion (coast protection). Shoreline defences take a variety of forms, but typically involve the construction of structures at the base of cliffs or in the intertidal zone. There are potential impacts both during construction and post construction.

i During construction

Intertidal communities and species may be directly impacted by the structures themselves or the construction works (e.g. use of heavy plant), and there may be changes to, and sometimes loss of, existing habitats.

Disturbance to sediments as a result of the construction may cause localised sediment plumes to develop so affecting the water clarity (turbidity – see section 5.4.2.2 in the nearby sea area.

There is the potential for pollution of the shore and sea by the release of fuel oils caused by refueling spillage, machines becoming stuck/breaking down in the intertidal zone and being inundated by the sea, and by cement matrix being washed out before setting.

ii Post construction

Shoreline defences may act to alter the transport of beach material in some way which may cause increased erosion or siltation in other locations and this may affect habitats in other areas, possibly some distance away from the original works. The effect may occur in the short term and/or long term. The implementation of more modern, holistic approaches to the design of coastal defence in the future should prevent significant long-term disruption to littoral sediment movement. Suitable sediment supply is particularly important for some habitats or species, e.g. the reef–forming honeycomb worm *Sabellaria alveolata*.

The introduction of rock armour in front of vertical concrete/masonry sea wall may result in reduced wave reflection and toe scour along the edge of the hard defence. This may cause alterations to the environmental characteristics influencing the adjacent shore area and intertidal wildlife communities.
Some shoreline defence schemes involve and/or include beach feeding/intertidal recharge where materials are deposited on the shore to combat or slow down coastal erosion. Depending on the nature of the beach recharge material and the habitat at the site, this may cause smothering of intertidal habitats and species at the recharge site as a result of the initial placement of the material or due to accumulation over time. There is the possibility that sediments will be resuspended and redistributed, possibly smothering nearby communities. The scale and likelihood of these impacts depends on the nature of the beach recharge material, the existing habitats and the characteristics of the recharge locations. Beach recharge operations may help maintain certain habitat types (on the shore or adjacent coastal area (e.g. sand dunes) by ensuring a continued supply of suitable material.

Depending on their design, construction and location on the shore, shore defence structures may act in a similar way to artificial reefs providing a solid habitat for marine species to colonise.

The influence of changes associated with climate change such as sea level rise and increased storminess may exacerbate some of the effects of shore defence on the coastal and estuary habitats.

Organisation(s) involved in management
Gwynedd Council
Ceredigion County Council
Snowdonia National Park Authority
Environment Agency
Countryside Council for Wales
Railtrack
National Assembly for Wales
MAFF (if works involve depositing of material on the seashore or seabed)
Landowners and occupiers
Crown Estate (as a landowner)

Existing management

All new coastal defence works require planning permission[19] and will need to be considered in the context of the planning framework (see Appendix 5.2). Approval from the National Assembly for Wales under the Coast Protection Act 1949 is also required. Planning applications are subject to statutory consultation requirements.

Depending on the scale and location of the proposed development, an Environmental Assessment may be required under the Environment Impact Assessment Regulations 1999 (see Appendix 5.1).

[19] Town & Country Planning Act 1990. Note: development seaward of mean low water mark is not within the jurisdiction of the Town and Country Planning Acts.

If the construction requires the placing of material seaward of the Mean High Water Mark Spring Tides, a licence from MAFF will be required under the Food and Environmental Protection Act 1985.

Under the Habitats Regulations 1994, the construction of ports, harbours, marinas and slipways constitutes a plan or project and therefore is subject to the provisions of Regulations 48-53 (see Appendix 5.1). Under the Habitats Regulations, competent authorities are required to ensure that the potential impacts of any shoreline defence works on the reefs or estuaries of the cSAC are fully addressed.

The Environment Agency implements flood defence schemes under the Environment Act 1995 and the Land Drainage Act 1994. Additional consents may be required depending on the location of the defence works, e.g. within an estuary where there is a river/watercourse involved..

Management response

Type of response

F2: There is a known mechanism for the operation to have an effect, but no evidence to suggest that it is having a significant effect at present.

F6: The activity constitutes a plan or a project and is subject to the provisions under the Habitats Regulations 48-53.

Rationale

The construction of shoreline defence structures and associated works have the potential to affect the reef and estuary features of the cSAC, depending on the location and scale of the works. Assessment of the potential impact of such structures and works is addressed by existing legislative requirements and the procedures that planning authorities (as Competent Authorities) are required to undertake in order to fulfill, in part, the requirements of the Habitats Regulations.

During the construction process it may be possible to mitigate many of the potential impacts by ensuring that there is a comprehensive specification for the work, that the contractor uses good working practices and that there is good site supervision by the client.

Management actions required (including links to other policies/plans/measures)

i Actions:

· Review extant planning permissions for coastal defence works (Competent authorities)

· Review the extent of unauthorised slipway developments and take enforcement action where appropriate (Competent authorities).

· Treat shoreline defence works as a Plan or Project (Competent authorities).

· Encourage the use of more modern, holistic approaches to the future design of coastal defence in the cSAC (Gwynedd Council, Ceredigion County Council, Snowdonia National Park Authority, Environment Agency Wales)

· Continue the programme of monitoring of coastal processes which has been set up as part of the work for Shoreline Management Planning to provide advice on best coastal defence options. Keep this programme under review and identify any new requirements as appropriate. (Gwynedd Council, Ceredigion County Council, Ynys Enlli to Llandudno Coastal Group).

· Ensure that the implications of possible alterations to sea level, wave exposure and other physical processes as a result of climate change are fully considered in the development and maintenance of new and existing coastal defence works. (Gwynedd Council, Ceredigion County Council, Ynys Enlli to Llandudno Coastal Group).

ii Links:

· Ensure that the cSAC is taken fully into account in the preparation and review of the relevant Shoreline Management Plans.

· Local Authority Unitary Development Plans

5.4.1.3 Land reclamation

Extent of the activity

The majority of land-claim currently occurring in the cSAC is located within the estuaries and is associated with agricultural activities. Flood banks have been constructed in the Mawddach to reclaim land for agricultural purposes. On the southern side of the Dyfi, approximately 3200 acres of tidal marsh and 1600 acres of raised mire (i.e. about 80% of the original floodplain wetland vegetation) has been reclaimed for agricultural purposes. In addition, a high percentage of the current saltmarsh acreage has developed since the introduction of *Spartina* in 1920 (see section 5.4.7.8). The construction of the Cambrian coast line also resulted in land reclamation in parts of the Dyfi. There is currently no active land reclamation being pursued in the part of the cSAC within Ceredigion.

In the other coastal areas of the site, there is currently little land-claim activity being undertaken although land reclamation in or adjacent to the intertidal zone has occurred in association with marine dredging within harbours, e.g Pwllheli. In this sort of situation, land reclamation associated with dredging of material unsuitable for recycling as beach nourishment presents the cheapest and most energy efficient method of disposal which also has the potential to benefit the local community. It has been suggested that changes to the beach that have been observed at Gimlet Rock, Pwllheli, may be related to the land reclamation works carried out in the vicinity of the harbour, although there is no evidence to support such a link. If land reclamation is not available, the material, in a slurry state, has to be shipped to a sea disposal site (the nearest site to the cSAC is at Holyhead Deep). There may be land reclamation requirements in the future associated with marine dredging in the harbours of Aberdyfi, Barmouth, Porthmadog and Pwllheli.

How the activity may affect the features

Land-claim on estuaries and coasts results in the destruction and loss of the existing habitat and its associated species. In estuaries, land-claim may also result in an overall reduction of estuarine biomass and production. There may also be effects on coastal processes caused by direct loss or extension of the intertidal, and the impact of this on the estuary dynamics. There is the possibility of fine material and/or pollutants being released as a result of works associated with the land reclamation (e.g. fuel oil spillage from machines engaged in the reclamation work, increased turbidity caused by decanting slurry water associated with suction dredging).

The influence of sea level rise may exacerbate estuary habitat loss caused by other activities such as land claim.

Organisation(s) responsible for management

Gwynedd Council
Snowdonia National Park Authority
Ceredigion County Council
Owners & occupiers of land
MAFF (if works involve depositing of material on the seashore or seabed)
Environment Agency Wales
Crown Estate (as landowner)

Existing management

Planning permission[5] may be required for land reclamation works depending on the specific situation. For example, land reclamation on agricultural land that is necessary for agricultural purposes may be permitted development[6] (i.e. not requiring the specific grant of planning permission) in circumstances where the material is derived from that holding. Land reclamation works requiring the specific granting of planning permission would be subject to statutory consultation and notification requirements.

Depending on the scale and location of the proposed development, an Environmental Assessment may be required under the Environment Impact Assessment Regulations 1999 (see Appendix 5.1).

If the land reclamation requires the placing of material seaward of the Mean High Water Mark Spring Tides, a licence from MAFF will be required under the Food and Environmental Protection Act 1985.

If the material is to be deposited below MHWM, samples of the fill material must be collected at locations specified by CEFAS (Centre for Environment, Fisheries and Aquaculture Science) which they will test for pollutants, heavy metals etc. Under the Environmental Protection Act 1990 the Environment Agency will also require samples of the fill material to be collected and tested by an independent laboratory. CEFAS would consult the Environment Agency if placement of the material was to take place at sea and the Agency could recommend the sort of monitoring that would need to be undertaken under the CEFAS remit. For material to be deposited on land, an Environment Agency Waste Management Licence or an exemption from the Waste Management Licensing Regulations would be required.

Under the Habitats Regulations 1994, land reclamation constitutes a plan or project and therefore is subject to the provisions of Regulations 48-53 (see Appendix 5.1). Under the Habitats Regulations, competent authorities are required to ensure that the potential impacts of any land reclamation on the reefs or estuaries of the cSAC are fully addressed.

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5 Town and Country Planning Act 1990. Note: development seaward of mean low water mark is not within the jurisdiction of the Town and Country Planning Acts.

6 **The Town and Country Planning (General Permitted Development) Order 1995**

Management response

Type of response

Outside of the estuaries: F2: There is a known mechanism for land reclamation to have an effect on the cSAC features, but there no evidence to suggest that it is having a significant effect at present.

Within the estuaries: F5: There is evidence to suggest that land reclamation is having a significant affect on the estuaries of the cSAC.

F6: The activity may constitute a plan or a project and is subject to the provisions under the Habitats Regulations 48-53.

Rationale

Land reclamation has the potential to affect the estuary features in particular and, to a lesser degree, the reef features of the cSAC, depending on the location and scale of the works. At present, it is not considered that land reclamation is having a negative impact on that part of the cSAC outside of the estuaries.

Within the estuaries, although no new current land reclamation work is being carried out, there is evidence to suggest that previous reclamation is having an impact on these features of the cSAC, e.g. the building of the Cob and its subsequent, and ongoing, impact on the equilibrium relationship between the tidal prism and the mouth of the estuary (see section 5.3.1). Any additional land claim in the estuaries (including restoration of old flood banks) has the potential to affect the estuary dynamics and this may to lead to siltation and/or erosion of other parts of the estuary. Because of this, different management response categories have been applied to the estuaries and the part of the cSAC outside of the estuaries.

As explained above, in certain situations land reclamation constitutes a 'permitted development'. Although activities which are permitted developments are referred to in the sections of the Habitats Regulations dealing with plans and projects, it is not clear how the procedures relating plans and projects should be implemented in these cases. As a result, activities which are permitted developments are currently falling outside of the Habitats Regulations procedures for plans and projects. This situation requires clarification from government. There is also a need for greater awareness about the relationship between 'permitted developments' and the cSAC procedures amongst those undertaking these activities/works.

Current proposals for land reclamation associated with maintenance dredging in Pwllheli harbour are being assessed as part of the existing management process described in the sections above.

Management actions required (including links to other policies/plans/measures)

i Actions:

· Review extant planning permissions for land reclamation works (Competent authorities.)
· Treat land reclamation works as a Plan or Project . (Competent authorities)

- Review the Habitats Regulations (Plans and Projects) with respect to permitted developments which may affect an SAC. (UK Government / National Assembly of Wales)

- Carry out an appropriate screening assessment for land reclamation proposals likely to affect the Pen Ll_n a'r Sarnau cSAC (Gwynedd Council, Ceredigion County Council, Snowdonia National Park Authority)

- Develop an overview of land reclamation proposals for each of the cSAC estuaries in order to enable a strategic consideration of the potential overall impact of these works on the estuary features and to identify requirements and opportunities to reverse previous land claim. (Countryside Council for Wales)

- Raise awareness of the potential implications of land reclamation for the cSAC amongst those responsible for managing and undertaking such work. (Gwynedd Council, Ceredigion County Council, Snowdonia National Park Authority, Countryside Council for Wales, Environment Agency Wales).

ii Links:

- Eryri/Ll_n Local Environment Agency Plan (LEAP)

- Meirionnydd LEAP

- Shoreline management plans

- Unitary Development Plans - see Appendix 5.2 (Gwynedd Council, Ceredigion County Council, Snowdonia National Park Authority (in preparation))

- Snowdonia National Park Authority Eryri Local Plan (see Appendix 5.2)

- Dyfi SSSI/National Nature Reserve (NNR) plan

5.4.2 Dredging, dumping and depositing of material

5.4.2.1 Aggregates dredging (for capital & maintenance dredging, see 5.4.2.2)

Extent of the activity

There is currently no marine aggregate extraction occurring within the cSAC. At present there are no known plans for marine aggregate extraction within or adjacent to the cSAC, although the presence of huge volumes of sandy sediments within the cSAC mean that the possibility of future interest in this resource cannot be dismissed.

How the activity may affect the features

i Seabed effects

The extraction of seabed material results in the localised destruction of seabed habitats and species. Fine particles are released during the dredging operations and these become resuspended in the water and later settle out on the seabed, possibly some distance away from the dredge site. This may smother and kill seabed animals and plants. The scale of these effects depends on a number of factors including the dredging operation, the type of dredged material and the hydrology of the dredge site.

ii Pollution

There may be pollutants bound within the dredged sediments and these may be released into the water column either in solution or bound to fine particles. These may be taken up by marine organisms and so enter the food chain. Pollutants may also be released from the works machinery.

iii Physical processes

Aggregate dredging operations may cause a change in the topography and characteristics of the seabed which may affect the physical processes in and around the dredged area. The reduction and/or removal of sand supply may have an impact on coastal areas (e.g. sand dune systems).

Organisation(s) responsible for management

Crown Estate
DETR / National Assembly for Wales
MAFF

Existing management

Marine aggregates dredging is authorised by licences issued by the Crown Estate which are supported by a Government View (GV) issued by the DETR, in Wales acting on behalf of the NAW. The process of issuing a GV is currently informal (non-statutory) but Government has publicised its intention to introduce a statutory authorisation system, based on the Town and Country Planning Act procedures, when a legislative opportunity arises. At present the criteria to be satisfied for an applicant to obtain a

favourable GV are set by individual departments consulted by DETR during the process of consulting on the application - particularly MAFF who have responsibility for marine environmental protection, fishing policy and coastal protection. DETR intend publishing formalised planning guidance for dredging to accompany the new statutory procedures so that all involved in the process understand the Government's policy and criteria.

The scope of the research will be framed in more detail as development of the guidance proceeds. It is likely to require the provision of information on a wide range of topics such as the extent of the potential resource and existing reserve, and assessment of the potential effects of dredging on the marine environment and on coastal protection.

Management response

Type of response

F2: There is a known mechanism for this activity to have an effect on the reefs and estuaries, but this activity does not occur at present within or adjacent to the cSAC.

F6: The activity constitutes a plan or a project and is subject to the provisions under the Habitats Regulations 48-53.

Rationale

Marine aggregate dredging activity is not at present a concern to the Pen Ll_n a'r Sarnau cSAC as there is currently no aggregate or sand dredging occurring within or adjacent to the cSAC. There are, however, potential resources available within Cardigan and Caernarfon Bays and there are known mechanism by which this activity may affect the features of the cSAC

Any new developments would almost certainly constitute plans and projects and competent authorities (in this case DETR and MAFF) should therefore ensure that the potential impacts on the reefs and estuaries are fully addressed in any assessments.

Management actions required (including links to other policies/plans/measures)

i Actions:

· Treat marine aggregate dredging as a plan or project (Competent authorities)

ii Links

· Cardigan Bay cSAC management plan

5.4.2.2 Capital and maintenance dredging

Extent of the activity

There is currently no capital dredging being undertaken with the cSAC. Capital dredge works may be required to develop and extension to the existing marina at Pwllheli but there are no definite proposals at the present time.

A Harbour Revision Order is being promoted for Barmouth, but has not yet been secured. This may involve some capital dredging work. Current proposals for developments at Aberdyfi do not involve any dredging.

Maintenance dredging primarily to maintain navigable depths occurs both within and in the approaches to Pwllheli marina and periodically to Porthmadog, Barmouth and Aberdyfi harbours. The scale of the dredging works is variable.

It is proposed to use suitable dredged material from Pwllheli harbour to be used for beach feeding as part of coastal defence at Traeth Crugan and Traeth Abererch. It is proposed that finer dredged material will be used in a small area of land reclamation behind the harbour wall.

It is also relevant to consider the maintenance dredging carried out at Aberystwyth harbour. Here, dredging of the harbour channel is carried out every 2 years whilst the inner harbour (including the marina) is dredged approximately every 4 years. Selected suitable dredged material has been used to replenish South Beach, Aberystwyth.

How the activity may affect the features

(See Chapter 5 of: ABP Research, 1999. *Good practice guidelines for ports and harbours operating within or near UK European marine sites.* English Nature, UK Marine SACs Project, 120pp).

Capital dredging involves the removal of material from the seabed in areas that have either not been dredged at all before, or from previously dredged areas that have not been disturbed by further dredging over a period of time. The material removed during capital dredging operations is generally relatively stable and consolidated and may include any mixture of boulders, cobble, pebble, sand, silt and clay. The material removed during maintenance dredging is generally composed of sands and silts that have been relatively recently deposited by siltation.

i Seabed effects

The dredging operations will result in the removal of animals and plants living on and in the sediment and cause disturbance to the seabed habitat. With capital dredging operations this is often likely to result in a complete loss of the existing habitat in the dredged area.

ii Water quality effects

There will be increases in the level of suspended sediment which may affect water quality as a result of changes in turbidity and the possible release of organic matter, nutrients or contaminants. The release of

organic rich sediments may result in the temporary localised depletion of oxygen in the surrounding water and, in certain situations, may influence benthic productivity and the occupance of eutrophication and algal blooms.

Fine particles in the dredge sediments may be resuspended into the water column and then settle on the seabed surface, maybe some distance from the dredge site. This may smother seabed organisms and clog up the feeding and breathing structures of marine animals. Resuspension of fine particles may also result in increased turbidity of the water which may affect marine plants by causing a reduction the amount of light penetrating through the water column to the seabed. These possible impacts are likely to be greater in areas with low background levels of suspended solids in the water.

The scale of all of these effects will depend on the nature of the dredged material (e.g. particle size), the scale and nature of the dredging operation and the hydrodynamics of the dredge site and the existing background water quality and characteristics.

iii Changes to physical processes

The dredging may cause physical changes to bathymetry and hydrodynamic processes at the dredge site and in the surrounding area. These changes may affect marine and coastal habitats and species as a result of:

- alterations to coastal or estuary morphology by, for example, altering siltation patterns and sediment pathways;
- alterations to water currents and wave climates;
- alterations to water quality.

The type and scale of any impacts will be related to the overall size of the excavation and the overall size of the system/site. However, removal of sediment from a site may deprive other coastal areas of sediment and so affect coastal stability. Increased erosion of, for example, mud and sand flats will have implications on the ecology of marine habitats and species; this may result in the loss of particular habitats and/or species. Even if the dredged sediment is placed back within the same system, this may cause changes to the sediment patterns of the system and promote siltation or erosion in specific areas.

The impacts of maintenance dredging on the hydrodynamics and geomorphology of a site are generally much smaller than for capital dredging (depending on the scale of the operation), although the overall effects are as equally complex.

iv Pollution

Sediments in ports and harbours may contain contaminants such as heavy metals, oil, TBT, PCBs and pesticides; these are effectively 'locked into' the seabed sediments and may be released into the water column as a result of dredging and potentially cause contamination and/or poisoning of animals and plants. The likelihood of this occurring depends on the on the type and degree of sediment contamination. Pollutants may also be released from the works machinery/vessels.

Organisation(s) involved in management

There are a number of organisations that may be involved, depending on the location of the dredging. The main organisations are:

Crown Estate (issuing licenses for seabed areas they own)
DETR (Consent for dredging in navigable waters, under Coast Protection Act 1949)
MAFF (FEPA for removal and depositing of material below high water)
Environment Agency Wales
Gwynedd Council and Ceredigion County Council (Authorisation under Harbours Act 1964 and Transport & Works Act 1992
Marina owners/operators

Existing management

The majority of port undertakings, including maintenance dredging, are administered by the statutory harbour authorities which, for the harbours/marinas within Pen Ll_n a'r Sarnau cSAC are Gwynedd Council and Ceredigion County Council.

Removal or depositing of material below Mean High Water Mark Spring Tides requires a license from MAFF under the Food and Environmental Protection Act 1995 (except within designated harbour areas where dredging powers exist (i.e. 'permitted development').

Under the Habitats Regulations 1994, capital and maintenance dredging constitute a plan or project and therefore are subject to the provisions of Regulations 48-53 (see Appendix 5.1). Under the Habitats Regulations, competent authorities are required to ensure that the potential impacts of any land reclamation on the reefs or estuaries of the cSAC are fully addressed. Although activities which are permitted developments are referred to in the sections of the Habitats Regulations dealing with plans and projects, it is not clear how the procedures relating plans and projects should be implemented in these cases.

Consent may also be required from DETR Ports Division if the dredging has implications on the provision of safety of navigation, under the Coast Protection Act 1949. A license may need to be obtained from the Crown Estate as owners of the seabed.

The Environment Agency Wales (EAW) may issue a temporary consent to limit any environmental impact when dredging works are undertaken. The EAW would be involved in final disposal of the material was to land as it would have to be disposed of to a licensed site or be controlled as an exemption under the Waste Management Regulations. An exempt activity should not have a detrimental impact otherwise the activity requires a licence.

There are several other different pieces of legislation in addition to those mentioned above which may have a bearing on proposals for dredging and disposal:

· Deposits in the Sea (exemptions) Order 1985;
· Environment Act 1995;
· Environmental Protection Act 1990;
· Harbour Act 1964;

· Harbour Works (Assessment of Environmental Effects) Regulations 1988;
· Harbour Works (Assessment of Environmental Effects) (Amendment) 1996;
· Landfill Tax Regulations 1996;
· Waste Management Licensing Regulations 1994;
· Town and Country Planning Act 1990
· Various local harbour powers
· Food and Environmental Protection Act 1985

Management response

Type of response

F2: Whilst there is a known mechanism for capital dredging to affect the reefs and estuaries there is currently no capital dredging being undertaken within or adjacent to the site. Whilst there is a known mechanism for maintenance dredging to affect the reefs and estuaries there is no evidence to suggest that it is having a significant effect at present.

F6: The activity constitutes a plan or a project and is subject to the provisions under the Habitats Regulations 48-53.

Rationale

Depending on the location and scale of the works, capital and maintenance dredging have the potential to affect both the reef and estuary features of the cSAC. At present there are no applications for capital dredge works within or adjacent to the cSAC. Maintenance dredging operations have been undertaken at Pwllheli harbour and marina, Porthmadog, Barmouth and Aberdyfi harbours, and there will be a requirement for dredging works in the future in order to maintain navigable channels to these facilities.

All existing FEPA licences will be subject to review under the Habitats Regulations. Any new developments would almost certainly constitute plans and projects and be subject to the test of significance/appropriate assessment for the purposes of the Habitats Directive. Competent authorities should ensure that the potential impacts on the reefs and estuaries are fully addressed in such assessments. The relationship between Harbour Empowerment Orders and Harbour Revision Orders and the Habitats Regulations requires clarification as do the procedures for considering 'permitted developments' within the context of plans and projects.

Management actions required (including links to other policies/plans/measures)

i Actions:

· Review extant planning permissions for capital and maintenance dredging works (competent authorities)

· Seek clarification of the relationship between Harbour Revision Orders and Harbour Empowerment Orders and the Habitats Regulations. Assess the implications of existing and proposed HRO's and HEO's for the cSAC features.

· Treat capital and maintenance dredging as a Plan or Project. (Competent authorities)

· Produce Dredging Plans for the area within and immediately adjacent to the cSAC to clarify the future dredging requirements within the area and consider disposal options. Link to those being produced as part of the Cardigan Bay cSAC management plan. (Gwynedd Council)

· Ensure that the cSAC is taken fully into account in the preparation and review of Harbour Revision Orders and Harbour Empowerment Orders. (Gwynedd Council).

· Ensure the cSAC is taken fully into account in the preparation of any regional development proposals (e.g. in relation to European or other funding). (Gwynedd Council, Ceredigion County Council).

ii Links:

· Cardigan Bay cSAC management plan

· Dyfi SSSI/NNR management plan

5.4.2.3 Disposal/dumping of sediment / material

Extent of the activity

There are currently no licensed offshore disposal sites within or adjacent to the cSAC. The nearest offshore disposal site is at Holyhead Deep near Anglesey. A site located in Tremadoc Bay was granted a disposal licence for capital dredge material in 1979, but was never used. The licence for this site has now expired. There have been preliminary discussions about the possibility of establishing a licensed disposal site closer to Cardigan Bay.

Sediment arising from other dredging operations that has not been transported to the Holyhead Deep disposal site has either been removed to landfill (Pwllheli marina, see 5.4.1.3 above), used for beach nourishment schemes (see 5.4.1.2 above) or deposited on adjacent land (e.g. Aberdyfi, on dunes to north of the town).

How the activity may affect the features

(See Chapter 5 of: ABP Research, 1999. *Good practice guidelines for ports and harbours operating within or near UK European marine sites.* English Nature, UK Marine SACs Project, 120pp.)

i Licensed disposal site at sea

Dredged material will blanket and smother the benthic organisms in the immediate vicinity of the disposal site, so altering the seabed and habitat type, and may prevent the development of stable seabed communities.

Depending on the hydrodynamic conditions at the disposal site and the characteristics of the dredged material, the finer parts of the disposed material may be resuspended and carried further afield, potentially increasing turbidity and settling out and smothering benthic communities at some distance from the disposal site.

ii Deposit of materials within the system/adjacent land

Redepositing dredged material within the same system, even if the net change in sediment is minimal, may alter where sites of maximum sediment concentration occur and so cause siltation in other areas.

Disposal of dredgings in intertidal areas may cause smothering of marine animals and plants and problems with resuspension of sediments into the water. Depending on the nature of the material, it may cause temporary or permanent habitat changes, particularly if the material is placed within bunded areas which are then used to expand adjacent land areas.

iii Intertidal recharge

The recharge of intertidal areas with dredged materials may be used to protect beach areas from erosion. Depending on the type of material used, this may cause a change to the type of habitat and the animals and plant communities present; benthic animals and plants may be smothered during the initial placement of the recharge material, or as a result of more gradual accumulation. Particles in the deposited material may be resuspended leading to redistribution of sediments and the smothering of nearby communities.

Organisation(s) involved in management

Depending on the method of disposal:

Gwynedd Council
Ceredigion County Council
Snowdonia National Park Authority (if disposal of material within the Park boundaries)
MAFF
EA

Existing management

Disposal of dredged material to a designated site at sea requires a disposal licence from MAFF.
The deposit of dredged material to adjacent land areas will require planning permission from the local planning authority and/or permission from the landowner and may require a licence under the Food and Environmental Protection Act (FEPA) 1985 if the site is below the high water mark spring tides, and may require a consent from the Environment Agency (under the Environmental Protection Act 1990). Dredged material needs to be tested for potential contaminants or toxic material. The sampling method, testing, location etc will be specified by CEFAS or the Environment Agency prior to any work being undertaken. The results of the testing will determine how the material can be disposed of.

If the material is redeposited within the hydrographic system, a FEPA licence is likely to be required, depending on the method of dredging and disposal. The material will need to be analysed for any potential contaminants prior to dredging commencing

Management response

Type of response

F2: There is a known mechanism for the disposal of dredged material to affect the reefs and estuaries of the cSAC, although there is currently no evidence that this activity is having an effect on the features.

F6: The activity constitutes a plan or a project and is subject to the provisions under the Habitats Regulations 48-53.

Rationale

Dredged material has been disposed of in a number of ways either within or adjacent to the cSAC or by removal to a disposal site further afield. As long as there is a need to undertake maintenance dredging works or capital dredging schemes, there will be an ongoing requirement to dispose of dredged material. The disposal of dredgings has the potential to affect both the reef and estuaries of the cSAC, depending on the scale and location of the operation.

All existing FEPA licences will be subject to review under the Habitats Regulations. Under most circumstances, disposal or dumping of sediments constitutes a plan or project and would be subject to the tests of significance/appropriate assessment for the purposes of the Habitats Directive. Competent authorities (including MAFF, DETR, local authorities and the Environment Agency) should ensure that the potential impacts on the reefs and estuaries are fully addressed in such assessments.

Management actions required (including links to other policies/plans/measures)

i Actions:

· Review any extant authorisations for sediment disposal/dumping (Competent authorities)

· Treat sediment disposal/dumping as a Plan or Project (Competent authorities).

· Produce Dredging Plans to clarify future requirements for sediment disposal (Gwynedd Council, Ceredigion County Council).

· If new sea disposal site closer to the cSAC is considered, the assessment for this will need to include appropriate monitoring and surveillance to ensure the requirements of the cSAC features are taken fully into account. (MAFF &/or National Assembly of Wales)

· Ensure the cSAC is taken fully into account in the preparation of any regional development proposals (e.g. in relation to European or other funding) that may involve requirements for sediment disposal/dumping. (Local authorities and others).

· Ensure that any proposals for sediment disposal/dumping (in particular in coastal/intertidal areas) are assessed in the context of the relevant Shoreline Management Plans. (Local authorities and other competent authorities)

· Ensure that any proposals for sediment disposal/dumping (in particular within and adjacent to the estuaries) are assessed in the context of the relevant Local Environment Agency Plans (LEAPs). (Environment Agency and other competent authorities)

ii Links:

· Cardigan Bay cSAC Management Plan

5.4.2.4 Mineral / ore extraction

Extent of the activity

No mineral extraction activity is currently occurring within or adjacent to the cSAC. In the past there have been proposals to dredge for gold in the Mawddach Estuary in the early 1970's but no planning permission was granted. These proposals were for the dredging of large quantities of sand within the estuary and its removal for processing many of the possible affects of this kind of operation are similar to nature to capital and maintenance dredging. There may be future applications for mineral and/or ore extraction from locations within or adjacent to the cSAC.

Historical mineral and ore extraction activities, in particular within the catchment areas surrounding the three estuaries, have left a legacy of potential pollution problems arising from discharges from the old works. This issue is considered further under 5.4.4.4.

How the activity may affect the features

i Seabed effects

Depending on the type of operation and its location, there may be a loss of the animals and plants living on and in the sediment and disturbance to the seabed habitat.

ii Water quality effects

There may be increased in the level of suspended sediment and the possible release of organic matter, nutrients or contaminants. See also 'capital and maintenance dredging' above

iii Changes to physical processes

Depending on the type of operation and its location, there may be physical changes to bathymetry and hydrodynamic processes at the extraction site and in the surrounding area. See also 'capital and maintenance dredging' above.

iv Pollution

There may be pollutants that are bound within the excavated material, and these may be released into the water in solution or bound to fines. Pollutants may also be released from the works machinery.

Organisation(s) involved in management

Gwynedd Council (as Mineral Planning Authority)
Ceredigion County Council (as Mineral Planning Authority)
Snowdonia National Park Authority (as Mineral Planning Authority)
Environment Agency Wales (in respect of control of pollution from any individual workings and as consultee to)
MAFF (if FEPA licence required)

DETR (mineral extraction licence)
Crown Estate Commissioners (as land owner)

Existing management

This activity is not currently occurring within the cSAC, consequently there is no active management of this activity at the present time. First point of contact for this activity would be the appropriate Mineral Planning Authority.

Management response

Type of response

F2: Depending on the location, scale and type of operation, there are known mechanisms for the activity to affect the features of the cSAC, but no evidence to suggest that it is having a significant affect at present.

F6: The activity constitutes a plan or a project and is subject to the provisions under the Habitats Regulations 48-53

Rationale

Although there is no mineral extraction currently being carried out within or adjacent to the cSAC this does not exclude the possibility of future applications being made. There a number of possible mechanisms by which this activity could affect the features of the cSAC. On the basis of past proposals, this activity is most likely to focused within the estuaries and therefore have minimal potential impact on the reef features.

Management actions required (including links to other policies/plans/measures)

i Actions:

· Competent authorities to review any extant authorisations for mineral extraction

· Treat mineral extraction operations as a Plan or Project

· Ensure that any proposals for mineral extraction are assessed in the context of the relevant Local Environment Agency Plans (LEAPs).

5.4.2.5 Artificial reefs (excluding offshore coastal defence structures)

Extent of the activity

There are currently no formal artificial reef structures within the cSAC, although remains of wrecks within the area could be consider to function in a similar way to an artificial reef by providing a hard substratum for colonisation and as a fish refuge. There may be proposals in the future for artificial reef structures to be established for habitat enhancement in relation to the lobster fishery. Although not established as such, offshore breakwaters may act as artificial reefs.

How the activity may affect the features

Artificial reefs may affect the features of the cSAC through several mechanisms:

i Physical damage

There may be loss, alteration of, or damage to habitats at the location where the artificial reef is established and in the area surrounding it. The significance of this impact would depend largely on the scale and location of the structure. The presence of an artificial reef structure may have a potential impact on hydrography or sediment movement in the surrounding area which may affect the reef or estuary features, depending on the location, scale and nature of the artificial reef.

Artificial reefs may also have beneficial implications. There has been a trend abroad to sink wrecks as recreational facilities, to reduce pressure from diving on reefs elsewhere.

ii Pollution

The materials used in the construction of any artificial reefs need to be carefully selected to ensure that they will not be released any harmful and polluting substances into the cSAC.

Organisation(s) involved in management

MAFF (FEPA licence)
National Assembly of Wales
Crown Estate
DETR Ports Division

Existing management

The placement of an artificial reef structure would constitute a plan or project and would be subject to the test of significance/appropriate assessment for the purposes of the Habitats Directive. Competent authorities (in this case MAFF, Crown Estate and DETR should ensure that the potential impacts on the reefs and estuaries are fully addressed in such assessments. A licence under the Food and Environmental Protection Act 1985 would be required.

Management response

Type of response

F2: Depending on the location, scale and type of structure, there are known mechanisms for the activity to affect the features of the cSAC, but no evidence to suggest that it is having a significant affect at present.

F6: The activity constitutes a plan or a project and is subject to the provisions under the Habitats Regulations 48-53

Rationale

There are currently no applications for artificial reef structures within the cSAC. Should there be applications in the future, these would constitute a plan or project and be subject to the test of significance/appropriate assessment of the purposes of the Habitats Directive.

Management actions required (including links to other policies/plans/measures)

i Actions:

· Treat the construction of artificial reefs as a Plan or Project (Competent authorities)

· If the artificial reef is associated with habitat enhancement for the local fishery, ensure that the need for and suitability of an artificial reef has been considered in relation to the existing availability of habitat and whether this is a limiting factor for the fishery stock. (Competent authorities)

· Ensure the cSAC is taken fully into account in the preparation of any regional development proposals (e.g. in relation to European or other funding) that may involve requirements for artificial reef construction. (Local authorities and others).

· Ensure that any proposals for artificial reef structures (in particular in shallow coastal areas) are considered in the context of the relevant Shoreline Management Plans. (Local authorities).

5.4.3 Offshore activities

5.4.3.1 Oil and gas exploration and development

Extent of the activity

With the exception of the gas fields in Liverpool Bay, all activity relating to offshore oil and gas in the Irish sea has been currently limited to exploration, rather than exploitation. Factors that could influence features of the cSAC in both the exploratory and exploitation phases are considered here, although the latter is a wholly unknown area at present.

i. Extent within the site

There are no blocks that are currently licenced for exploration for oil and gas within the boundaries of the cSAC. One block has previously been under licence. There is currently no exploitation of oil and gas resources in the southern Irish Sea.

ii. Extent adjacent to the site

All exploration activity has been undertaken in blocks that lie outside the cSAC. Current levels of exploratory activity in areas adjacent to the cSAC, ranging from seismic "shooting" (see below) to drilling, are low. Recently several oil companies holding exploration licenses for blocks in the vicinity of Cardigan Bay have sought to surrender these. In particular this means that whereas oil companies were previously required to conduct exploration drills as a condition of their license they are no longer required to do so where there are sufficient economic and geological reasons not to. One block is currently under licence in the quadrant containing the cSAC and four blocks have been previously under licence. To date, three exploration wells have been drilled and abandoned in blocks 107/1, 107/16 and 107/21. No wells have been drilled in the block that is included within the cSAC.

How the activity may affect the feature

i. Seismic survey of the sea bed.

Seismic survey essentially involves the use of compressed air to generate high energy sounds, typically ranging between 10 and 200 Hz. Seismic shooting takes place via an array of air guns aimed at the sea bed. Intensive low frequency sounds penetrate the sea bed and are reflected back by different rock-types. The reflected sound waves are received by arrays of hydrophones, and reveal subsurface geological formations. During shooting, high amplitude pulses lasting for about one second are emitted every 5-15 seconds. Water is an excellent conductor of sound, and sound (from man-made and natural sources) travels considerable distances through the water column. Seismic pulses travel large distances, beyond the area targeted for seismic survey.

The shock waves created by powerful underwater explosions can contain sufficient energy to disturb, injure or even kill fish and other animals within very localised areas. However, little is known of the long term or cumulative effects on marine faunal populations, of lower intensity but more persistent sources of artificial noise.

ii. Construction works

The construction and placement of the platforms, pipelines and other infrastructure (including shore-based facilities) associated with offshore oil and gas development, can impact in a number of ways. The construction phase itself is likely to cause short term increases in turbidity and sediment load in the water column. The longevity and spatial extent of this effect will depend on the scale and duration of the construction operations, the characteristics of the disturbed sediments and their mobility.

The presence of the structures themselves can also impact significantly on benthic and intertidal communities and species. In addition to the direct impact (usually gross modification or even total loss) of habitat in the immediate vicinity of the structures, the presence of structures on the seabed can alter physical processes, for example altering water currents and causing localised scouring or deposition of the seabed or seashore. This will affect the biological composition of benthic communities which are sensitive to alterations in substrate type and degree of exposure to scouring or sediment deposition. These effects can be quite far-reaching where sedimentary processes are sufficiently disrupted. Biological changes can also occur as a direct result of the presence of artificial structures, for example where the structures themselves attract mobile species or provide substrate for colonisation by plants and encrusting fauna.

iii. Shipping movements

In any offshore oil and gas activity which moves beyond seismic exploration (i.e. drilling), there is likely to be an increased level of localised shipping movements, associated with supplying the drilling rig. Such shipping activity may be highly localised, and of a temporary nature (e.g. for exploratory drilling) or much longer term. The main potential source of impact on the cSAC features would be from ship-source pollution, i.e. accidental or deliberate discharges of fuel, rubbish and sewage.

iv. Drilling and transporting operations

Exploratory drilling has only been carried out in areas outside the cSAC boundary. Influences on the SAC features could arise from pollution, for example oily water discharges, oil or fuel discharges/spillages from rigs, well-heads or pipelines, or during tanker loading operations (where the oil is transported away from the well-head by vessel). There may also be localised contamination of the sea bed as a result of disposal of drill cuttings and muds. Sustained noise pollution from drilling and related activities could possibly induce changes in the behaviour of fish populations and other mobile species, but as stated above in relation to seismic exploration, this is a poorly researched area.

Organisation(s) involved in management

Department of Trade and Industry
DETR
Petroleum producers
Local planning authorities

Existing management

(See the DTI Oil and Gas Directorate website (http://www.og.dti.gov.uk/)

Under the Petroleum Act 1998 (which consolidates much earlier legislation), ownership of oil and gas resources within Great Britain, its territorial sea and continental shelf (UKCS), is vested in the Crown. A licence is required from the UK Government to explore for and exploit these resources. The exploitation of offshore oil and gas is primarily regulated by the DTI who award two types of licences for sea areas: exploration licences and production licences. Exploration licences are issued at any time and permit the licence holder to undertake seismic surveys and exploratory drilling anywhere on the UK continental shelf except where production licences are in effect. Production licences are issued for specific areas (usually standard "blocks" of 250 sq km), in application "rounds" for groups of blocks, which take place roughly every two years.

Licence applications must be accompanied by Environmental Assessments of the blocks to which they apply and the potential effects of the development. In addition, EIA is required for all production developments. Licences have a range of conditions attached to them, and the DTI can require the operators to comply with various statutory provisions through a consenting process. Consents from DETR Ports Division are required for the placement of offshore installations to the extent that they may interfere with navigation (Coast Protection Act 1949). Planning permission under Town & Country planning legislation may also be required for associated onshore developments.

Vessels servicing offshore oil and gas structures and/or involved in their construction are subject to the same national and international regulations regarding safety, disposal of waste etc, as any other commercial vessels.

Management response

Type of response

F2: Depending on the location, scale and type of operation, there are known mechanisms for the activity to affect the features of the cSAC, but no evidence to suggest that it is having a significant affect at present, largely because operations are not currently taking place.

F6: The activity constitutes a plan or a project and is subject to the provisions under the Habitats Regulations 48-53
Rationale

The absence of oil and gas exploration within the cSAC, together with the relatively low levels of activity in neighbouring "blocks" that have been licensed by the DTI for exploration suggest that, at present, this is not a significant factor influencing the features of the cSAC. Furthermore, the immediate risk would appear likely to have decreased following recent decisions by Marathon and Chevron - the two companies with the largest interests in the southern Irish Sea - to withdraw from exploration activities.

However, the cSAC would potentially be "at risk" from any of the impacts described above, from operations occurring within or adjacent to the boundary. Future licensing rounds and seismic survey proposals should be monitored, and the competent authorities should ensure that all potential impacts on the feature and the habitat within the cSAC are properly addressed in EIAs and via the significance/appropriate assessment provisions in the 1994 Conservation Regulations (see 'Plans and Projects', Appendix 5.1). Competent Authorities should also satisfy themselves that oil spill and other

emergency contingency plans adequately address the protection of the cSAC features. Surveillance and/or monitoring of the various potential effects of this type of operation can only be carried out on a reactive basis, i.e. when exploratory or exploitative activities are notified/planned and then carried out.

Management actions required (including links to other policies/plans/measures)

i. Actions:

· Ensure that EIAs and appropriate assessments under the 1994 Habitats Regulations, where required, are carried out on all operations associated with offshore oil or gas developments within the UK sector of the southern Irish Sea. (DTI)

· Ensure that oil spill and other emergency continency plans adequately address the requirements of the cSAC features. (Gwynedd Council, Ceredigion County Council, Snowdonia National Park Authority, Environment Agency Wales, Countryside Council for Wales, MAFF, Maritime and Coastguard Agency).

5.4.3.2 Offshore windfarms and other alternative energy structures

This section covers the construction and operation of structures seaward of low water mark, for generating electricity from wind, wave or tidal power.

Extent of the activity

A variety of structures such as wind and current turbines typically make use of wind, wave and tidal movement. There are presently no such structures either within the cSAC or elsewhere in Cardigan Bay or around the Ll_n Peninsula. However, alternative energy sources are being promoted by the UK government as part of its commitment to reduce carbon dioxide emissions and reach a target of 10% of electricity supply being met from renewable sources.

Little is known by the authors of this management plan about the suitability or otherwise of the cSAC or its vicinity for these structures, but offshore renewable energy is clearly a developing field which may become more significant in the near future. Aside from any developments needing to comply with any requirements regarding nature conservation, environmental protection, or landscape/seascape impact, the constraints on development are principally suitable physical environmental conditions, the logistics of transport of the structures to the site, and costs of connection to the national grid.

How the activity may affect the feature

The types of structures may vary enormously. Wind-powered systems can vary from single turbines or "farms" of many tens or hundreds of turbines, placed anywhere from just offshore or in waters up to 20 m deep, although 5-10 metres is more likely.

Tidal structures usually make use of areas with high rates of tidal flow such as narrows, headlands and estuaries. Wave power generators require a good sea swell. Structures may be floating, self supporting or anchored in or placed on the seabed.

Therefore, although the type of effects would vary greatly according to individual circumstances, it is possible to make some general observations:

- The construction/placement of structures may have many of the same types of effect as offshore oil and gas facilities (see section 5.4.3.1).

- Any offshore electricity generating structure would require cabling to some form of onshore facility, both of which may have impacts themselves (see section 5.4.3.3).

- Another potential impact might be from contamination of water and/or sediments by chemicals used on or within the structures, e.g. grouting, antifouling coatings.

- Any structures with moving parts (e.g. wind or tide-driven turbines, wave-riding buoys) are liable to generate persistent, if low-level, noise, which in the long term may affect fish and other wildlife populations. This is a very little-researched area, although there are ongoing studies in the USA which suggest that the underwater noise from offshore windfarms may affect the migratory behaviour of salmon populations.

Organisation(s) involved in management

DETR Ports Division
National Assembly for Wales
Department of Trade and Industry
Local planning authorities

Existing management

This type of operation would require a number of statutory consents (see also section 5.4.3.3 relating to cables and pipelines):

1. A consent from DETR Ports Division is required under Section 34 of the Coast Protection Act 1949 (works likely to interfere with navigation).

2. A licence under section 5 of the Food and Environment Protection Act 1985 (deposit of articles on the seabed). The licensing authority is the National Assembly for Wales, although the licensing system is operated on behalf of the NAW by MAFF.

3. A consent from DTI under section 36 of the Electricity Act 1989 (if more than 50 megawatts will be generated).

4. Planning permission under town and country planning legislation may also be required for associated onshore developments.

In addition, a lease from the Crown Estate Commissioners, as owners of the seabed, would probably be required.

Management response

Type of response and rationale

F6: The construction/placement of offshore energy structures such as wind turbines would clearly constitute a plan or project, and therefore the consents above could not be given until the operation had been subject to the process of assessment set out in Regulation 48 of the Habitats Regulations. Many schemes would also be subject to Environment Impact Assessment (EIA) under separate legislation (see Appendix 5.1).

Management actions required (including links to other policies/plans/measures)

***i. Actions*:**

· Treat such developments as a Plan or Project. (Competent authorities)

· Monitor the development of UK government policy/strategy with respect to the development of offshore alternative energy generation, and ensure that the SAC is appropriately considered in the development of such a policy, e.g. in any consultation exercises. (Countryside Council for Wales, Gwynedd Council, Ceredigion County Council, Snowdonia National Park Authority).

5.4.3.3 Cables & pipelines

Extent of the activity

Around the UK, submarine cables have been installed for many years for the transmission of electrical power and for telecommunications. There are electricity and telecommunications cables running across the Mawddach and Dyfi estuaries; there are 6 telecommunications cables and 2 power cables in the Mawddach (not all are operational) and there are 3 power cables across the Dyfi, with a recent proposal from Manweb to put in a new cable to replace the existing operational one. There are no other power or telecommunications submarine cables in the Pen Ll_n a'r Sarnau cSAC. There are disused submarine cables marked on the Admiralty charts as being present west of Porth Dinllaen on the north Ll_n coast. Disused cables are generally left on the seabed because of the cost of recovery.

Most submarine pipelines around the UK have been laid for the transport of oil and gas from offshore well heads to the coast, although there are no such pipelines in the Pen Ll_n a'r Sarnau cSAC. Other pipelines in area are limited to outfalls for effluent discharges.

It seems likely that the future potential for installation of submarine cables and pipelines lies with the potential development of offshore energy structures (see section 5.4.3.2) which would probably require cabling to convey the energy ashore, or oil and gas fields where the products are to be brought ashore by pipeline (see section 5.4.3.1).

How the activity may affect the features

Cables and pipelines may be laid across the surface of the seabed, but the common practice these days is to bury them in trenches, particularly in shallower waters, to minimise the risk of entanglement with or damage from fishing gear and anchors. The excavation of trenches would result in damage to benthic habitats at the site of excavation, and would also be likely to result in temporary increases in turbidity and sediment load in the water column, with the extent, severity and longevity of the effect depending on the nature and scale of the operations and the type of seabed being affected.

Fractures to pipelines can occur, leading to leakage into the surrounding seabed and water column of the material being transported.

Organisation(s) involved in management

DTI
DETR Ports Division
Local planning authorities
Crown Estate Commissioners
National Assembly for Wales

Existing management

Table 5.2 below lists the legislation governing the installation of submarine cables and pipelines in Wales.

The installation of both cables and pipelines are subject to environmental impact assessment (EIA) legislation. This requires that an environmental statement should be prepared that looks at the impacts an installation will have, considers alternative proposals, and identifies the least damaging option.

The EIA process is open to public scrutiny, and places certain obligations on developers to publicise their proposals. The process places a formal obligation upon developers to consider the impacts that a proposal would have upon wildlife, and to minimise this. The environmental statement also ensures that the consenting authority has all the available environmental, social and economic information concerning a development at its disposal when it takes decisions.

Table 5.2: Regulation of marine (including intertidal) cables and pipelines in Wales

Activity	Type of consent required	Competent authority
All cables and pipelines	**easement from landowner (incl. lease from Crown Estate if applicable**	**Crown Estate/other landowner**
	Planning Permission under Town & Country Planning Act 1990	**Local Planning Authority**
	Navigational Consent under s.34 Coast Protection Act 1949	**DETR Ports Division**
	Environmental Statement under Electricity and Pipeline Works (Assessment of Environmental Effects) Regulations 1990	**DTI**
pipelines only	**Licence under s.5 Food and Environment Protection Act 1985**	**NAW (MAFF)**
oil and gas pipelines only	**Pipeline authorisation under s.1 Pipe-lines Act 1962.**	**DTI**
	Pipeline authorisation under s.20 Petroleum and Submarine Pipelines Act 1975	
	Environmental Statement under Offshore Petroleum Production and Pipe-lines (Assessment of Environmental Effects) Regulations 1998	

Management response

Type of response

F6: The activity constitutes a plan or project.

Rationale

Although there are currently only a few 'active' cables or pipelines in the area, there is always the potential for new pipelines or cables to be installed in the future. Whilst the likelihood of oil or gas pipelines appears to be diminishing (see section 5.4.3.1), the current promotion of offshore energy structures development may result in a need for submarine cables within the cSAC.

The installation of a submarine cable or pipeline requires the consent of a range of statutory bodies. The main consents needed, and the bodies involved, are summarised in Table 5.2 above. The installation of a submarine cable or pipeline would constitute a plan or project (see 'Plans or Projects', Appendix 5.1), and therefore consideration of the likely significance of such operations on the cSAC would need to be taken into account in determining whether or not a consent is issued.

Management actions required (including links to other policies/plans/measures)

i. Actions:

· Ensure the competent authorities are aware of their responsibilities with respect to the cSAC (includes Manweb, British Telecom, National Grid and others listed in table above).

· Treat the installation of submarine pipelines or cables as a plan or project (competent authorities)

· Ensure Environmental Impact Assessment legislation is followed (competent authorities)

5.4.4 Discharges from land and shipping

5.4.4.1 Discharges: sewage, stormwater, industrial etc

Extent of the activity

There are a number of discharges both throughout the catchment of the cSAC and directly to the waters of the cSAC; the location of these together with the type of discharge is available on the Public Registers maintained by the Environment Agency Wales or pictorially on the 'Liquid Waste Disposal' Maps within the Eryri/Ll_n and Meirionnydd Local Environment Agency Plans (LEAPs).

Most of the sewage is discharged by pipelines into an open water situation. Many of the coastal and inland discharges have been, or are being, upgraded to comply with the EEC Bathing Water Directive (76/160/EEC) and Urban Waste Water Treatment Directive (91/271/EEC).

How the activity may affect the features

Discharges, including rivers, contain a variety of materials that may affect the water quality. These include inorganic nutrients such as nitrogen and phosphorus that may contribute towards eutrophication and reduce the levels of dissolved oxygen present, heavy metals such as lead and copper which are toxic and may accumulate in the food chain, and synthetic organic compounds which may also accumulate in the food chain. All these may affect species abundance and diversity in affected areas.

Due to the mainly rural character of the coastline and catchment area, the majority of the discharges into the cSAC and its surrounding catchment area are domestic discharges. In areas where there is reduced water movement, untreated sewage effluent may lead to a reduced level of dissolved oxygen in the water, as the oxygen that is present is used up in trying to break down the material in the discharge.

Discharges with a high content of suspended material may affect the water clarity (turbidity) in the vicinity of the discharge and adjacent areas and this may affect marine communities in the same way as increased turbidity due to, for example, capital dredging and disposal (see section 5.4.2.2 and 5.4.2.3).

Organisation(s) involved in management

Environment Agency
D_r Cymru/Welsh Water
Severn Trent Water

Existing management

The Environment Agency Wales (EAW) are responsible for authorising discharges of effluent to watercourses, the sea and land through a system of consents which are issued on a discharge by discharge basis and these take account of uses and Directives applicable in the vicinity of the discharge. Routine sampling and inspections of effluent discharges to watercourses and the sea are undertaken to ensure compliance with the consent conditions. The EAW are also responsible for monitoring of river water quality to ensure that rivers are meeting water quality standards, and they also undertake some monitoring of marine water quality.

D_r Cymru/Welsh Water is the company responsible for the disposal of sewage waste from their customers connected to public sewerage systems in the area. These constitute the majority of the domestic discharges into the cSAC, although there are still some privately owned discharges.

The EC Urban Waste Water Treatment Directive (91/271/EEC) and the EC Bathing Water Directive (76/160/EEC) respectively set standards for the treatment of waste and standards for the microbiological quality of bathing waters.

Management response

Type of response

F2: This activity has an obvious potential to affect the features, but there is no evidence to suggest that this is happening. Operational limits have been put in place and monitoring is taking place.

Rationale

In general, there is no evidence to suggest that the existing discharges are having a significant affect on the features of the cSAC. There is, however, some indication that waste dispersal is poor in the north east corner of Cardigan Bay, around Porthmadog, due to shallow slow moving water in Tremadoc Bay. From time to time algal blooms are observed in the coastal waters of Cardigan Bay when conditions are right. An increase in the nutrient levels in the three estuaries, which are typically nutrient poor, would also be of concern.

Management actions required (including links to other policies/plans/measures)

i Actions:

· Continue to influence investment on maintenance and improvement in D_r Cymru's sewage treatment works and outfalls through the Asset Management Plan (AMP) process, for example the recent upgrading of treatment at Porthmadog STW (EAW, D_r Cymru)

· EAW continue water quality monitoring and implement appropriate actions from the Eryri/Ll_n and Meirionnydd LEAPs.

· EAW to review existing discharge consents.

· Work towards defining water quality requirements for the estuarine communities (CCW)

· Surveillance on coastal water quality and occupance of algal blooms etc (CCW in conjunction with EAW)
· Document/clarify industrial discharges into the cSAC and its catchment and the effect of any known defunct industries that could still have discharges occurring.

ii Links:

· Asset Management Plan (AMP) 3 process

5.4.4.2 Agricultural run-off and other diffuse inputs

Extent of the activity

Much of the catchment area around the cSAC is farmed (some parts of the Ll_n peninsula are intensively farmed), primarily for sheep, although the more fertile lowlands support a number of dairy units. The operation of these units, including mixed beef farms, has intensified in the past 20 years. Although in the area of the National Park the agricultural production systems are extensive, in Meirionnydd there is comparatively intensified agricultural use of land on the coastal areas. For example, the flood plains of the Dyfi, Dysynni, Mawddach and Dwyryd are examples of areas where the use of agricultural inorganic fertilisers, insecticides and herbicides are comparatively intensive. Due to the nature of the land, farmers tend to develop their modern farm complexes in such areas.

There will be diffuse inputs from this into the cSAC, e.g. in the form of nutrient run-off, and possible releases of silage effluent, slurry etc. Although pollution risks from sheep farms are minimal - due to the dispersed husbandry - there remains a very real risk when dipping takes place.

There are a number of forestry plantations within the catchment area and the potential exists for increased inputs from gold and copper mine waste upstream in the Mawddach estuary and the possibility of discharges from abandoned lead mines upstream in the Dwyryd if large-scale deforestation were to occur.

In general, the extent of run-off and other diffuse inputs into the cSAC and its catchment area are poorly known.

How the activity may affect the features

As with more managed discharges, run-off and diffuse waste inputs may contain a variety of organic and inorganic materials that may affect the water quality of the cSAC and its marine communities (see section 5.4.4.1).

Organisation(s) involved in management

Environment Agency Wales
D_r Cymru/Welsh Walter
Severn Trent Water

Existing management

The Environment Agency Wales (EAW) controls and regulates discharges from agriculture and some disposal on land. There are also Codes of Practice in place to reduce the impact of farming activities on the environment. Farm catchment inspections have been and will continue to be carried out in the area. The advice and actions arising from these, together with existing measures should further minimise the risk of harm to the site.
No regulation of diffuse sources takes place, e.g. mine waste. Where a mine has been abandoned before December 31st 1999 it is not consented or regulated (see contaminated land comments in Section 5.4.4.4).

Management response

Type of response

F2: This activity has an obvious potential to affect the features, but there is no evidence to suggest that this is happening.

Rationale

There is no evidence to suggest that existing agricultural run-off or other diffuse inputs into the cSAC and its catchment are having a significant affect on the features of the cSAC. However, there is only a limited amount of information available about the extent and nature of these kinds of inputs and consequently the importance of these in terms of the possible impact on the cSAC features and the site management is not well understood.

Management actions required (including links to other policies/plans/measures)

***i Actions*:**

· EAW to continue monitoring agricultural discharges.

· EAW to provide available information via public register on diffuse agricultural inputs, e.g. details of groundwater authorisations for disposal of sheep dip

· Clarify the nature and scale of diffuse inputs going into the cSAC, and assess their significance in terms of their possible effect on the features (singly or in combination with other inputs). As part of this, clarify which organisations collect data relevant to this issue (Countryside Council for Wales, EAW, Local authorities)

· EAW to implement appropriate actions from the Eryri/Ll_n and Meirionnydd LEAPs, for example with regard to sheep dip, acidification and metal levels.

· Raise awareness about water quality issues in the catchment areas around the estuaries and other parts of the cSAC (e.g. through production and distribution of a leaflet).

ii Links:

· Eryri/Ll_n and Meirionnydd Local Environment Agency Plans (LEAPs).

5.4.4.3 Accidental, unlicensed, unregulated discharge from land or shipping (including oil pollution and use of anti-fouling)

Extent of the activity

Potential sources of pollution considered in this section fall into a number of different categories:

i Oils and fuels

Oil and other pollution incidents within or adjacent to the cSAC have been infrequent. Major shipping lanes pass offshore to the west and north west of the site as a whole, so there is the potential for the cSAC to be affected by a major oil pollution incident.. There have been incidents of tar balls being washed up on beaches of the area in past years - in Gwynedd there were two reported incidents in 1989-1999 - and incidences of oiled bird casualties being washed on to the shore. There is a continuing problem with tankers washing their tanks at sea and often these incidents are the result of illegal tanker hold washing at sea. Following the Sea Empress oil spill, oiled birds were also washed onto Ceredigion beaches.

There are also many other materials, other than oil products, that are transported by land and sea.

The popularity of the cSAC as a location for motorised water sports as well as the presence of commercial vessels within the site means that there is the potential for small scale fuel spillages associated with the use of recreational and commercial craft operated within the cSAC as well as emissions from petrol and diesel engines directly into the water. There are unconfirmed reports of petrol spillages at Black Rock Sands as a result of refueling of personal water craft but, other than these, there is no data on small-scale fuel spills within the cSAC.

ii Anti-fouling

The majority of commercial and recreational craft use some form of biocidal paint to prevent or reduce the fouling of boat hulls by plants and animals. Antifoulant paints are also often applied to other underwater structures. Tributyltin (TBT) used to be the favoured biocide for us in antifouling paints, but studies in the 1980's showed that its continued use was causing severe damage to shellfish communities and, in particular, dog whelk populations. In 1987 a UK ban was introduced on the application of TBT on boats under 25 meters in length and on nets and cages in used in fish farming. Vessels under 25 meters length now have to use non-TBT based antifoulants. Many of the non-TBT paints use copper as the main biocide (most commonly as cuprous oxide, but also as cuprous thiocyanate and metallic copper powder), although some manufacturers have introduced additional biocides.

The majority of vessels using the Pen Ll_n a'r Sarnau cSAC are less than 25 m in length and those that spend a significant proportion of their time in the water will almost certainly be using an antifoulant which is likely to be copper-based..

iii Sewage from small boats

Most sailing vessels and motorised craft above a certain size will have some form of in-board toilet. The majority of sewage waste is pumped directly into the sea. There is an increasing trend for craft to be built with holding facilities so that sewage waste is not pumped directly into the sea but is held in a compartment within the vessel's hull until it can be pumped into a purpose-built reception facility in a harbour or marina. Many harbours and marinas promote a policy of no boat sewage discharge directly into the harbour/marina water.

How the activity may affect the feature

i Oils and fuels

Oil and fuel pollution may affect the wildlife and habitats of the reefs and estuaries in a number of ways:

· toxic effects on marine communities
· smothering (particularly in the case of oil)
· the use of damaging or toxic techniques to clean up spills (e.g. heavy machinery in the intertidal, use of dispersants).

Specific components of the reef communities may be impacted and commercially important species of fish and shellfish may become contaminated. Sediment areas both offshore, inshore and intertidally, may act as sinks for oil residues which may then continue to release materials over an extended period of time.

Land-based incidents may release contaminants into the cSAC through watercourses discharging to the estuaries or directly to the sea. Materials other than oil products may also be released into the sea from shipping. It is not possible to cover all the likely contaminants and their possible effects on the cSAC; as with oil pollution, the impact is likely to be from toxic or smothering effects of the contaminant itself or from clean-up techniques and any chemicals that may be used in the clean-up.

Various substances are emitted by marine engines as a result of the combustion process (e.g oxides of nitrogen and carbon, sulphur dioxide and particulate matter). In terms of marine communities, it is the potential toxic effect of hydrocarbons and lead in the water column and sediment that are of key significance. While the inputs from marine engines may by relatively small in comparison of the input of these materials into the marine environment from other sources, they do, inevitably, add to the hydrocarbon and lead loading in the marine environment. Hydrocarbons and lead may accumulate in sediments or through the food chain.

ii Anti-fouling

By their very nature, antifoulant materials are toxic to marine life. The biocides in antifoulants can have harmful effects on the fouling organisms they are designed to deter and also other marine life unconnected with fouling activity. Although copper is a naturally occurring element and is essential as a trace element for metabolic processes in living organisms, it can also be extremely toxic in high concentrations. There is evidence to show that certain species of fish and other marine organisms are sensitive to quite low levels of copper even though other species are relatively tolerant of much higher levels. Marine invertebrates are thought to be more sensitive to copper than fish.

Significant copper accumulation is unlikely to occur in fast flushing open coastal areas, but can accumulate in sediments where flushing times are slow, such as enclosed bays.

iii Sewage from small vessels

Inputs of sewage from small vessels are, in most open coast situations, likely to be quickly dispersed and therefore unlikely to have a significant impact on the reef and estuary communities. Such additions of organic matter can, however, become problematic in more enclosed water bodies where they can contribute to the creation of eutrophic conditions and reduction of dissolved oxygen in the water.

Organisation(s) involved in management

Oil and fuel, antifouling, sewage from small boats

There are a number of different organisations involved in different aspects of pollution prevention and response. These include:

DETR (Several different departments)
Maritime and Coastguard Agency (executive agency of DETR)
MAFF
Environment Agency
Gwynedd Council
Ceredigion County Council
Snowdonia National Park Authority
Countryside Council for Wales
Harbour / marina owners and operators
International Maritime Organisation (IMO)
RSPB
RSPCA

Existing management

i Oil and fuel

As a Party to the UN Convention on the Law of the Sea (UNCLOS), the UK has an obligation to protect and preserve the marine environment. The National Contingency Plan is one of the measures that the UK has taken to meet this obligation and to deal with pollution response in the marine environment. After saving human life, the key purpose of responding to a maritime incident is to protect human health, and the marine and terrestrial environment. A range of national and local agencies (some of whom are listed above) have specific statutory duties for certain aspects of pollution contingency planning and response. The roles and responsibilities of the organisations that may become involved are outlined in the UK's National Contingency Plan[7] (Appendix A).The aim of the plan is to ensure that there is a timely, measured and effective response to incidents.

Local plans are prepared by a number of different organisations (including the local authorities, the Environment Agency, the Countryside Council for Wales, harbour authorities and others) to provide detailed information on the local response to marine incidents; these underlie the National Contingency Plan.

The nature of the response to a pollution incident is very dependent on its scale. Although local authorities have no statutory duty to plan for, or carry out, shoreline clean up, they have accepted a voluntary commitment to do so. They are supported in this by the Maritime and Coastguard Agency (MCA) who maintain stockpiles of beach cleaning equipment, provide training courses on oil spill response and contingency planning, and organise practical training exercises.

To assist with pollution contingency planning and response in North Wales, a Maritime and Hazardous Spillages Sub-Group has been established. The membership of this group includes those organisations who are directly involved in different aspects of pollution response work and they meet regularly to

[7] **Maritime and Coastguard Agency. 2000. National Contingency Plan for Marine Pollution from Shipping and Offshore Installations**

address a range of issues concerning pollution contingency planning and response for the North Wales area.

In addition to this, a Shadow Environment Group for north Wales has recently been established to discuss and prepare for the work that would need to be undertaken by the Environment Group (explained in the National Contingency Plan) in the event of an incident.

Under the Merchant Shipping (Oil Pollution Preparedness, Response and Co-operation Convention (OPRC)) Regulations 1998, ports, harbours (of a certain size) and oil handling facilities are required to have an oil pollution emergency plan in accordance with the regulations.

In the case of small-scale pollution incidents, such a minor spillages of fuel in harbours or marinas or on a beach, in many instances it will not be possible to contain the spill before it has dispersed into the marine environment. There are, however, measures or policies in place in some locations to prevent such spillages occurring, or to contain them for proper disposal. The Environment Agency Wales (EAW) has produced Pollution Prevention Guidelines for Marinas and Craft (PPG14). A system for dealing with spillages and refueling is available at Pwllheli marina. Also, smaller, private refueling facilities are provided at Pwllheli (Gimblet Rock), Porthmadog and Abersoch.

There are two Interreg projects (ERIS and RACER) that are dealing with issues related to sensitivity and emergency response with respect to pollution incidents.

In the case of terrestrial-based pollution incidents, the lead organisation is the Environment Agency Wales.

Control of specific pollution incidents will be on a reactive basis. However, national and local policies and contingency planning are vital in helping minimise the likelihood and impact of pollution incidents.

ii Antifouling

Legislation prohibits the use of TBT on private vessels of less than 25 metres in length. For larger vessels the use of TBT requires an authorisation from the Environment Agency. There are good practice guidelines that have been produced by EAW (guidance series PPG14, see above), the Royal Yachting Association (Tidelines - dealing with wastes, shore side waste management and protecting wildlife habitats and species) and the British Marine Industries Federation (BMIF) as part of the 'Navigate with Nature'series.

iii Sewage from small boats

Sewage collection facilities are provided at Pwllheli Marina and at Aberystwyth harbour/marina. A new EAW leaflet 'Boats and the Coastal Environment' has recently been launched. This initiative was to raise awareness of and give advice to boat users on how to minimise the impact of their activities, including the disposal of sewage, on the coastal environment. Publications by the RYA (see above) and BMIF have also been produced about waste management.

Management response

Type of response

F2 : Accidental, unregulated and unlicenced discharges have the potential to affect the features of the cSAC, but there is no evidence to suggest that these (in the absence of a significant pollution incident) are currently having any impact.

Rationale

There is legislation and a number of policy initiatives in place to try and prevent the deliberate or accidental loss of oil, fuel and other potential pollutants at sea and on land, and to ensure safe and effective clean-up in the event of an incident. Other than these, management of pollution incidents within and adjacent to the cSAC can only occur on a reactive basis. In order to assist this, the main organisations involved in dealing with pollution incidents have contingency plans to help organise and coordinate any clean-up response.

The rate of incidence of minor pollution incidents involving oil and fuel within the cSAC is not known, and it is not clear whether these represent a significant chronic level of pollution at certain localities within the cSAC. Further work is required to clarify this situation and to assess the scale of inputs.

Small spillages of fuel or the input from antifoulants often, on when viewed in isolation, appears insignificant, but these inputs provide an additional contribution to the pollutant levels within the site. Measures to reduce the input of such material, whether these are based in statute or as policy initiatives, should be promote through the cSAC management.

Although the discharge of sewage from small vessels is not considered to be having a significant effect on the cSAC, promotion of good practice with respect to its disposal should nevertheless be pursued.

Management actions required (including links to other policies/plans/measures)

***i Actions*:**

· Clarify existing contingency plans and ensure that they are up to date. (Gwynedd Council, Ceredigion County Council, Environment Agency Wales, Countryside Council for Wales, Port/Harbour authorities).

· Ensure the cSAC is addressed through the setting up and running of a Shadow Environment Group for North Wales (Environment Agency Wales, MAFF, Countryside Council for Wales).

· Clarify regulatory mechanisms and policies with respect to re-fueling of vessels in harbours, marinas and on beaches (Local authorities, port/harbour/marina authorities and operators).

· Promote good practice with respect to re-fueling operations at all locations around the cSAC. (Local authorities, port/harbour/marina authorities and operators.

· Carry out further work to clarify the rate of incidence of minor fuel and oil spills within the cSAC including re-fueling on beaches. (Local authorities, port/harbour/marina authorities and operators, Environment Agency Wales).

· Promote codes of conduct and good practice guidelines for use and disposal of antifoulants and disposal of sewage from small vessels. (Local authorities, port/harbour/marina authorities and operators, Welsh Yachting Association, DETR, Environment Agency Wales.)

· Continue to be vigilant over activities and pollutant sources which might threaten the integrity of the cSAC and take action based on a realistic assessment of risk. (Everybody)

ii Links:

· Port Waste Management Plans.

5.4.4.4 Discharges from mineral, ore extraction and quarrying activities

Extent of the activity

A considerable amount of mining activity has occurred within the Area adjacent to the site, with some of the mines dating back to Roman times and possibly earlier. Literature on past mining activities suggests that the area yielded lead, copper, zinc, manganese, iron, silver and gold. Very little is known about the effect of the drainage from the historical mines, indeed dense conifer plantations have now effectively obscured many of the mining areas.

One mining site, Dylife, located on the upper Twymyn is reported to have had an output of 35,505 tons of lead ore, 1,342 tons of copper ore and 391 tons of zinc ore between 1845 and 1901. Surveys of sites along the length of the upper Twymyn and its tributaries indicate that the Dylife site is likely to be the major source of metals in the river. However, indications are that there may be many diffuse sources within the complex as opposed to major inputs via obvious adits.

Significant quantities of slate were historically produced in the area, particularly in the Blaenau Ffestiniog and Dulas (north) valley. As a result there are a number of abandoned slate quarries across the Area. All the quarries have settlement/treatment tanks to deal with the fine particles and solids arising during the cutting or crushing processes. Despite this, there are still significant intermittent problems with fines being washed off the haul roads during heavy rainfall. A number of companies have implemented schemes to further reduce the solids loadings in their discharges to the aquatic environment

At Tonfannau, north of the Dysynni estuary, is a granite quarry that mainly produces material for the road construction industry. Process water and road drainage is directed to settlement lagoons and oil-interceptors prior to discharge to a minor tributary of the lower Dysynni.

There are a number of old mineral planning permissions[8] for coastal quarries around the Ll_n coastal area of outstanding natural beauty dating back to the early 1950s. The majority of these schemes are currently dormant (see 'existing management' below). There may in the future be renewed commercial interest in coastal quarries generated by the need for coastal defence and beach replenishment schemes.

How the activity may affect the features

Waste or run-off from historic quarries and mines can contain materials that may affect the water quality or harm the cSAC and its marine communities, depending on the type of pollutants present, the volumes or concentrations of discharges and the dispersal capacity of the receiving waters.

[8] Planning permission may be express (i.e. granted on application) or may be deemed under Part 17 of the Town and Country Planning (General Permitted Development) Order 1995 if it is on 'operational land'

Re-opening of old mines, or establishment of new sites may involve the development of associated infrastructure, e.g. loading jetties, piers, which may affect the features of the cSAC (see sections 5.4.1.1, 5.4.2.2 and 5.4.2.3).

Organisation(s) involved in management

Gwynedd Council
Environment Agency Wales (EAW)
Snowdonia National Park Authority
Ceredigion County Council

Existing management

With respect to old mineral planning permissions for coastal quarries, the Government enacted the legislation[9] necessary to formally acknowledge their existence and then to require retrospective schemes of planning conditions to be submitted for approval by mineral planning authorities. Active sites are required to submit schemes in accordance with a set timetable. Sites classified as 'Dormant' under the review legislation may not be reopened without the approval of a full scheme of planning conditions. The Ll_n coastal review sites are:

Operation	Review & Status	Need for Environmental Statement?
1. Carreg y Llam, Llithfaen	**IDO*; Dormant**	**Yes**
2. Porth y nant, Llithfaen	**IDO*, Dormant**	**Yes**
3. Tyddyn Hywel & Tan y Graig	**IDO*; Dormant**	**Yes**
4. Yr Eifl, Llithfaen	**IDO*; Dormant**	**Yes**
5. Chwarel Trefor, Trefor	**R**; Active; to be submitted**	**Yes**
6. St. Pedrog, Llanbedrog	**R**, Dormant**	**Yes**

*IDO - Planning and Compensation Act 1991 review site (planning permission granted by Interim Development Order before 01/07/1948)
**R - Environment Act 1995 Review site (planning permission granted between 01/07/1948 and 22/02/1982)

There are no old mineral planning permissions relevant to the cSAC in Ceredigion and the National Park and no sites with extant planning permission for mineral extractions in the area.

EAW has some baseline data on location and history of mines in the area but does not have the resources available to implement wide scale remediation. Due to the recent advent of the "Abandoned Mine Regulations" EAW are involved in monitoring the discharges from the former Gwynfynydd gold mine.

The Local Authorities in their capacity as Mineral Planning Authorities have responsibility for the granting of planning permission with regard to mineral sites.

[9] Planning and Compensation Act 1991 & Environment Act 1995

The contaminated land legislation due out shortly will clarify which areas come under Environment Agency Wales (EAW)/Local Authority control. The likelihood is that sites where it can be proved there is a source of pollution, a pathway and a receptor e.g. watercourse may well fall within EAW remit.

Management response

Type of response

F2: This activity has an obvious potential to affect the features, but there is no evidence to suggest that this is happening.

Rationale

There is no evidence to suggest that the mineral workings, ore and quarrying activities in the area adjacent to the cSAC, nor existing run-off into the cSAC and its catchment are having a significant affect on the features of the cSAC. However, there is only a limited amount of information available about the extent and nature of these kinds of inputs.

Management actions required (including links to other policies/plans/measures)

i Actions:

· Continue water quality monitoring and implement appropriate actions from the Eryri/Ll_n and Meirionnydd Local Environment Agency Plans (LEAPs), including continued monitoring of the discharges from the former Gwynfynydd gold mine (EAW).

· Assess the effects on the reefs and estuaries of diffuse inputs going into the cSAC, including from old mines (EAW, local authorities and CCW)

· Promote, in partnership with others, the reclamation of disused metal mines where there is significant environmental benefit. (Competent authorities)

ii Links:

· Local Authority Unitary Development Plans (UDPs) - see Appendix 5.2

· Eryri/Ll_n and Meirionnydd LEAPs.

· Gwynedd County Council - Supplementary Planning Guidance (SPG) on Minerals: adopted March 1996 - in force until UDP comes out, in which there will be a chapter on minerals issues.

5.4.5 Fishing activities

5.4.5.1 Towed bottom fishing gear: Scallop dredging and trawling

Extent of the activity

The main scallop dredging beds are located at Porth Ysgo and Porth Ysgaden in the north, and also off the Sarnau in the south of the site. Little fishing had taken place in the five years up to 1998, but interest in the fishery is now reviving. Scalloping does not take place in the estuaries.

Relatively little trawling occurs within the area. A small number of vessels (two or three) operate in the area, primarily in the Cilan Head trawling grounds. The main target species is thorn-backed ray, but sole, plaice and whiting are also caught. There are no trawlers based in the area, but visiting vessels occasionally fish out of Pwllheli.

How the activity may affect the features

(See: Gubbay, S. and Knapman, P.A. 1999. A review of the effects of fishing within UK European marine sites. English Nature, UK Marine SACs Project, 134pp.)

Scalloping can affect the seabed in a number of ways: by creating tracks in the sea bed, altering the physical characteristics and topography of the seabed surface, resuspending fine sediments into the water column and overturning rocks. There may be a decrease in species diversity in the fished area. The seabed effects are generally most significant and longer-lasting in sheltered areas where track marks may be persistent for many months.

Fragile and slow-growing species, such as the horse mussel Modiolus modiolus, have been shown to be particularly sensitive to scalloping and they are unlikely to recover to pre-dredging numbers or sizes, even in the absence of any dredging.

The possible affects of beam trawling on the reefs and estuaries of the cSAC are similar to scallop dredging. Although trawling is generally carried out on soft seabeds, the use of rock hopping gear enables this fishing activity to be carried out in reef areas.

Organisation(s) involved in management

North Western and North Wales Sea Fisheries Committee (NW&NWSFC)
MAFF (national legislation)

Existing management

<u>Scalloping</u>
Under national legislation, there is a closed season between 1st July to 31st October when scallops may not be taken.
Under NW&NWSFC byelaws, there are restrictions on vessel size within the 3 nautical mile (nm) limit, a closed season for scallops between 1st July and 31st December south of Braich y Pwll, and a minimum landing size of 110mm. Any fishing for shellfish out to 6nm other than by hand also requires an authorisation to fish from the NW&NWSFC.

Since 1998 scalloping off the north Ll n coast between Porth Dinllaen and Penrhyn Colmon has been restricted in order to protect the horse mussel bed located in this part of the site.

Trawling

Trawling is regulated by a range of EC, national and NW&NWSFC measures. These regulate the mesh size for nets, overall size of nets, quota allocations and other controls on fishing activity.

Under NW&NWSFC byelaws there is limit on the maximum length of vessels operating within the 3nm fishery limit.

Management response

Type of response

F2 (scalloping): There are known mechanisms for scallop dredging to have an effect on the features of the cSAC, but there is no evidence to suggest that it is having a significant effect at present.

F2 (trawling): There are possible mechanisms by which trawling could affect the reefs and estuaries of the cSAC but there is no evidence to suggest that it is having a significant effect at present.

Rationale

Although the traditional scalloping areas within the cSAC are quite small, scallop dredging may take place throughout the district except in the existing restriction area between Porth Dinllaen and Penrhyn Colmon. With the restriction area in place to prevent damage to the horse mussel reef, there is no evidence to suggest that the current level of scalloping is having a significant affect on the reef features of the cSAC. However scalloping is known to have adverse effects in some situations, so it will be important to observe levels and locations of fishing to ensure that the cSAC is not adversely affected.

The current level of trawling is very low, and is not currently undertaken in areas where it is likely to cause a significant affect to the features of the cSAC.

Management actions required (including links to other policies/plans/measures)

i *Actions:*

- NW&NWSFC to maintain restriction area to protect the horse mussel reef
- NW&NWSFC to continue to collate information on number of vessels and fishing locations to better understand where scalloping takes place within the cSAC
- Observe numbers of vessels using towed bottom gear. If a significant increase in fishing activity using towed bottom gear is observed, other management actions might be needed.

5.4.5.2 Suction and mechanised dredging for shellfish

Extent of the activity

Suction and mechanised dredges are relatively new and specialised methods of fishing for shellfish. Neither method has been used within or adjacent to the cSAC.

How the activity may affect the features

(See: Gubbay, S. and Knapman, P.A. 1999. A review of the effects of fishing within UK European marine sites. English Nature, UK Marine SACs Project, 134pp.)

Suction and mechanised dredging can have a number of effects on the seabed and benthic wildlife, such as:

- alteration of the food chain by the removal of the target species
- physical damage to communities and flora and fauna
- alteration of seabed topography and sediment structure by the creation of tracks, holes

The severity and longevity of such impacts depends on a whole range of factors, not least the gear type and the intensity of its use, and the sensitivity of the seabed to these effects. However, since neither activity takes place here at present, nor has in the past, this is not currently an issue for the management of the cSAC.

Organisation(s) responsible for management

North Western and North Wales Sea Fisheries Committee (NW&NWSFC)
MAFF / NAW(national legislation)

Existing management

An authorisation from the NW&NWSFC is required to gather shellfish other than by hand in the area out to 6nm offshore.

Management response

Type of response

F2: There are known mechanisms for this type of fishery to have an effect on the features of the cSAC, but the activity is not taking place at present.

Rationale

There is the potential for this activity to affect the site features but it is not currently taking place within the cSAC. An authorisation from the NW&NWSFC is required to undertake this type of fishing activity.

Management actions required (including links to other policies/plans/measures)
i Actions:

None necessary.

5.4.5.3 Netting (including tangle nets and other bottom set nets)

Extent of the activity

Tangle netting for bottom dwelling fish and crustacea occurs in Tremadoc Bay and in other bays around the coast of the Llŷn Peninsula. Some tangle netting is undertaken in the estuaries .

Drift and set gill nets are also used at a range of locations including Harlech and Barmouth and set nets are used on beaches around Llŷn. These fisheries tend to be quite variable, both in location and intensity..

How the activity may affect the features

(See: Gubbay, S. and Knapman, P.A. 1999. A review of the effects of fishing within UK European marine sites. English Nature, UK Marine SACs Project, 134pp.)

Netting may affect reef and estuary communities by the removal of mobile species that are considered to be part of those communities. Some types of net my cause physical damage to reef communities by entangling non-target species.

Lost nets which continue to ghost fish are of concern as these will catch both target and non-target species. The longevity of ghost nets depends on durability of the material from which they are made and the environmental conditions influencing their behaviour once lost (e.g. substrate type, exposure of the site).

Organisation(s) responsible for management

MAFF
North Western and North Wales Sea Fisheries Committee (NW&NWSFC)
Environment Agency (EA) (for migratory fish, i.e. salmon and sea trout)

Existing management

National legislation covers the mesh size of gill and enmeshing nets used from vessels. There are designated bass nursery areas in the Dyfi, Mawddach and Glaslyn/Dwyryd estuaries. These have been designated by MAFF/NAW and may be enforced by MAFF, Environment Agency or NW&NWSFC officers. There are restrictions within these areas to prohibit fishing for bass from boats between 1st May to 31st October. The nursery areas apply to all fishermen, irrespective of the fishing method or purpose (recreation or profit). Anglers are expected to respect these conservation areas and return any bass caught during the prohibited period.

There are NW&NWSFC bylaws covering the mesh size of nets and the way nets are set.

The NW&NWSFC have bylaws authorising the use of drift and set nets in certain areas at certain times of the year, and also prohibiting their use in other locations at other times. More information on these bylaws can be obtained from NW&NWSFC.

Management response

Type of response

F2: There is a possible mechanism for the activity to affect the features of the site but there is no evidence to suggest that it is having a significant effect at present.

Rationale

There is no evidence to show that netting is currently having an adverse effect on the reef or estuary features. It is possible that the removal of fish species by netting might affect the coastal ecosystem, but there is presently no information to suggest this is happening.

The precise amount of netting lost in the cSAC is not known but there is currently no evidence to suggest that the action of lost nets is adversely affecting the cSAC features.

Management actions required (including links to other policies/plans/measures)

i ***Actions*:**

- Watching brief on the extent of netting

5.4.5.4 Potting (crustacea and whelks)

Extent of the activity

Lobsters are the main target species for potting in the area, although the catches will also include brown (edible) crab, velvet crab and spider crab. About 70 lobster fishing boats operate within the cSAC. This is currently the most important fishery within the cSAC in terms of its benefits to the local economy and the number of people employed in the fishery. Potting takes place in rocky areas all along the coast around the Ll n Peninsula and along the edge of the Sarnau. A small amount of potting also takes place at Borth and Tywyn.

Potting for whelks also takes place in within the cSAC. This has mostly occurred in the area from Porth Dinllaen to Porth Ysgaden and in Tremadoc Bay. The intensity of the whelk fishery fluctuates from year to year is very much dictated by market demands.

How the activity may affect the feature

(See: Gubbay, S. and Knapman, P.A. 1999. A review of the effects of fishing within UK European marine sites. English Nature, UK Marine SACs Project, 134pp.)

There is only a limited amount of information available about the impacts of pot fisheries on reef habitats, communities and species. Studies that have been undertaken show that some species, such as Ross coral Pentapora foliacea can be sensitive to damage by potting. It is also possible that whelk potting could cause physical damage to Modiolus reefs.

There is the possibility that removal of top crustacean predators may affect the reef communities but there is no work that has been carried out on this.

It is possible that ghost potting by lost pots might adversely affect both the fishery and ecosystems.

Organisation(s) involved in management

MAFF
North Western and North Wales Sea Fisheries Committee (NW&NWSFC)

Existing management

EC, national and NW&NWSFC legislation regulates potting activities. The main regulations apply to the minimum sizes of species and must be observed by any person taking these species.

NW&NWSFC bylaws regulate lobster fishing by:

- setting a minimum size for lobsters fished within the district;
- protecting v-notched lobsters. This bylaw creates an offence of landing a lobster with a notch in its tail. A voluntary V notching programme has been established, aimed at protecting female

lobsters. Once a notch has been made in the tail it will take approximately 3 years to grow out, giving the lobster 3 opportunities to reproduce; and,

- requiring permits for any person wishing to gather more than 2 crabs, lobsters or crawfish per day, or more than 5kg of whelks and to file a monthly return of landings for these species.

Management response

Type of response

F2: There may be a mechanism for the activity to affect specific species of the reef communities, but there is no evidence to suggest that these species or the communities are currently being affected.

Rationale

The current level of potting undertaken within the cSAC is unlikely to cause a significant affect to the reef features of the cSAC.

Management actions required (including links to other policies/plans/measures)

i Actions:

- Watching brief on the extent/intensity of potting.
- Lobster stock assessments?

5.4.5.5 Fish/shellfish farming

Extent of the activity

Until recently, no mariculture occurred within or adjacent to the cSAC. However, there may be applications in the future to develop both land- and marine-based mariculture systems. During 1999 a land based fish farm has been developed at Afon Wen (outside the immediate cSAC area), using a recirculating water system to farm bass.

How the activity may affect the features

(See: Gubbay, S. and Knapman, P.A. 1999. A review of the effects of fishing within UK European marine sites. English Nature, UK Marine SACs Project, 134pp.)

Different aquaculture operations will give rise to different types of effects, with varying magnitude. Land based farms may discharge effluent to the sea, and sea based farms may also give rise to effluents. If non-native species were cultivated, there could be concerns about their escape into natural populations. Escape of farmed species native to an area can affect the genetic structure of local wild populations.

Organisation(s) involved in management

Gwynedd Council
Snowdonia National Park Authority
Ceredigion County Council
Crown Estate

Existing management

Land-based aquaculture systems will require planning permission under the Town & County Planning Act 1990. Depending on the scale of the development aquaculture facilities may require an Environmental Assessment. Consent for the discharge of waste material from the aquaculture systems will be required from the Environment Agency (under the Water Resources Act 1991). If the proposal involves construction seaward of Mean High Water then permission under the Food and Environmental Protection Act 1985 will be required.

Aquaculture at sea is only possible with the consent of the seabed / foreshore owner. Shellfish may be cultivated on the seabed if a Several Area is established under the Sea Fisheries (Shellfish) Act 1967. There are presently no Several Areas within the site.

Management response

Type of response

F2: There are known mechanisms for fish and shellfish cultivation to have effects on the features of the cSAC, but there are currently no sea-based fish farms within or adjacent to the cSAC, and there is no evidence to suggest that existing land-based farms are having an affect at present.

F6: The activity may constitute a plan or a project and therefore be subject to the provisions under the Habitats Regulations 48-53.

Rationale

This activity might affect the site, but presently takes place at such a low level that no effects are presently likely. Future applications for consents to construct aquaculture developments will need to comply with Part IV of the Habitats Regulations, which should ensure adequate protection of the site.

Management actions required (including links to other policies/plans/measures)

i Actions:

No action presently required.

5.4.5.6 Cockling (hand collection)

Extent of the activity

Cockles are harvested from the Dyfi, Dwyryd and Mawddach estuaries. Collection is by hand, using a spade or rake. The intensity of harvesting fluctuates depending on the availability stocks and the market price. Most cockling is carried out during the period August-March.

How the activity may affect the features

(See: Gubbay, S. and Knapman, P.A. 1999. A review of the effects of fishing within UK European marine sites. English Nature, UK Marine SACs Project, 134pp.)

Hand gathering of cockles may affect certain estuarine sediment communities as a result of trampling and physical disturbance, and the removal of the prey species however studies have revealed that impacts are slight and local. The collecting operation itself is only likely to cause a significant impact if it is carried out very intensively for extended periods of time. Damage to saltmarsh and muddy communities, in particular, may be caused by the use of ATV s (all terrain vehicles) to get to and from the cockle beds.

Organisation(s) involved in management

North Western and North Wales Sea Fisheries Committee

Existing management

There are NW&NWSFC bylaws restricting the methods of fishing and the minimum size for cockles. Cockle beds may be closed to exploitation by the NW&NWSFC in order to protect the cockle stock from over exploitation or to protect juvenile fish stocks.

Management response

Type of response

F2: There is a known mechanism for cockling to affect the estuarine features but there is no evidence to suggest that it is having a significant effect at present.

Rationale

The cockle beds in the area are relatively small and tend to be fished intermittently. The level of exploitation is such that there will be only local disturbance to the estuarine communities. The use of ATV s may require additional consideration (this is considered further in section 5.4.6.2).

Management actions required (including links to other policies/plans/measures)

i Actions:

- NW&NWSFC to continue to monitor the cockle stocks in the estuaries

- Promote the intertidal shell fisheries voluntary code of conduct to people undertaking shellfish collection

5.4.5.7 Bait collection

(Some of the following information is taken from Fowler S.L. (1999) Guidelines for managing collection of bait and other shoreline animals within UK European marine sites. English Nature, UK Marine SACs Project.)

Extent of the activity

Many species of animals are gathered from the shore for use as bait by anglers. These include worms (lugworms and ragworms), mussels and other molluscs, shore crabs (often referred to as peelers), and sand eels.

A variety of methods are used to gather different species:

- hand digging with fork or spade in sandy or muddy areas (lugworms, ragworms, burrowing bivalve molluscs)
- bait pumping (pump placed over faecal cast, using suction to extract individual worm)
- hand picking on rocky shores (either straightforward removal by hand, or involving stone turning, for crustaceans and molluscs)
- crab shelters (e.g. placing roofing tiles or tyres to attract moulting crabs)
- dragging and dredging (using gear towed from boats when the tide is in)

Overall, the level of collection is low. Lugworm (blow worm) and harbour rag as well as peeler crab and, occasionally razor fish, are collected. A very small number of crab tiles are used in the Pwllheli area.

How the activity may affect the features

The types of potential impact of collection of shoreline animals on marine habitats and other species are described in detail in Fowler (1999). The main types of impact of relevance to the features of the Pen Ll n a r Sarnau cSAC are:

- physical damage, caused by:
    - digging (especially in sheltered muddy or sandy habitats where sediments can persist in the disturbed state)
    - turning of rocks
    - placement of crab shelters - physical impacts not known
    - trampling
- Reduction of stocks of target species (especially significant for slow-reproducing species)
- Alteration of community structure (e.g. reduction in abundance of non-target species through damage/disturbance, removal of prey species of other animals)

- Water quality impacts (e.g. disturbance of fine sediments, or contaminants present in the sediments, too the surface or into suspension)

The severity of impact of all the above depends on a range of factors, in particular the intensity of the activity, and the type of species, substrate and method used.

Organisation(s) involved in management

Different sorts of bait have a different legal status, and are thus managed differently. In essence, all bait species other than worms are sea fish , and subject to management by sea fisheries legislation, where appropriate. Worms are not sea fish , and while there is a public right to gather worms for personal use as bait from the shore, their commercial collection is illegal without permission from the landowner.

As a consequence, responsibility for the management of bait collection is shared between many organisations, including:

- local authorities
- harbour authorities
- Environment Agency
- sea fisheries committees
- nature conservation agencies
- NAW and MAFF
- landowners (e.g. Crown Estate Commissioners)

Existing management

There are presently no management measures in force relating to the collection of worms from the shore, other than the common law described above. Other species of bait, which are sea fish are subject to the appropriate sea fisheries legislation.

Many sea angling clubs and associations develop and promote voluntary codes of conduct. These do not seek to control the numbers of people undertaking bait collection or the total quantities of animals removed, but rather focus on the methods employed and the steps that can be taken to minimise the impact of bait collecting on intertidal habitats and other species (e.g. backfilling holes when digging, replacing rocks after turning). A national code of conduct for anglers is currently being developed by the a group of organisations from Wales, England and Scotland. This will cover bait collection and other angling activities.

Management response

Type of response

F2 :There is a known mechanism for the activity to have an effect, but no evidence that it is having an effect at its present levels.

Rationale

Bait collection currently occurs at a very low level and is carried out primarily during the summer months (May - September). There is no evidence to show that the current level of bait collection is affecting either the estuary or reef features of the cSAC.

Management actions required (including links to other policies/plans/measures)

i Actions:

- Promote national code of conduct for anglers within the cSAC.

5.4.5.8 Angling

Extent of the activity

i. Definition

Angling is used here to apply to recreational fishing using rod and line. This may be carried out by individuals fishing from the shore or from boats, or on a more organised basis by commercial charter boat operators.

In legal terms, there is no distinction between sea fishing carried out for commercial sale of the catch, or for recreation. All fishing for sea fish is subject to the same body of legislation, which covers matters such as gear type, landing sizes, area and/or time restrictions. Therefore sea angling is not a legally distinct activity from commercial sea fishing.

ii. Extent within the cSAC

The estimated maximum annual number of anglers (boat- and shore-based) fishing in the cSAC is in the region of 10,000 - 10,500. Trefor, Morfa Nefyn, Abersoch, Pwllheli, Mochras/Shell Island, Barmouth and Aberdyfi are the main launch sites for boat-based anglers using the cSAC. Angling also takes place from Aberystwyth. Angling takes place throughout the site depending on the target species. Many anglers operate a catch and release approach to angling and the catch and keep levels are low.

How the activity may affect the features

The potential impacts of angling are similar in type, if not in scale or intensity, to the potential impacts of commercial fisheries (see sections 5.4.5.1 to 5.4.5.6):

- removal of the target species
- bycatch
- impacts associated with access to the foreshore (such as trampling)
- impacts from associated bait collecting activity (see section 5.
- impacts from use of boats, such as physical impact on seashore and seabed from launching and anchoring
- pollution by lost gear/litter

Organisation(s) involved in management

Sea fisheries authorities (NW&NWSFC and NAW/MAFF)
Welsh Federation of Sea Anlgers
Three Herrings Angling Club

Existing management

i. Statutory

As outlined above, sea angling is a public right which is subject to the relevant sea fisheries legislation. Restrictions such as minimum fish sizes, closed areas, closed seasons, and restrictions on fishing methods are most relevant to anglers in this area.

ii. Non-statutory

As with bait collecting, voluntary codes of conduct are widely used (and may cover both bait collecting and sea angling itself).

A national code of conduct for anglers is currently being developed by the a group of organisations from Wales, England and Scotland. This will cover bait collection and other angling activities and will incorporate angling associations and clubs existing codes of conduct.

Management response

Type of response

F2: There is a known mechanism for the activity to have an effect, but no evidence that it is having an effect at its present levels.

Rationale

It is unlikely that at current levels, sea angling itself is having or is likely to have an adverse effect on the features of the cSAC:

- The numbers of fish removed are generally small enough not to significantly affect abundance and hence community structure. There are exceptions to this with some rare or vulnerable species, where even small catches can represent a significant proportion of a population

- Many of the target species of sea anglers would not be considered integral parts of the reef and estuary features.

- The gear types, if used properly (i.e. not discarded) do not generally cause damage to the seabed or to non-target species.

In view of the above, it is not felt that there are major specific actions needing to be taken in relation to sea angling. There are various ways in which this activity is self-regulating , and unless and until it risks impinging on the conservation status of the cSAC features, there seems little reason to introduce major change. Instances of non-compliance by anglers with Bass nursery area regulations is generally as a result of lack of knowledge about the nursery areas and their regulations. It is worth noting that, although much of this self-regulation is in the interests of the sea anglers themselves - promoting good practice which protects the viability of the resource and quality of the recreational environment - it is also of benefit to nature conservation and wider environmental interests.

Management actions required (including links to other policies/plans/measures)

i Actions:

- Promote national code of conduct for anglers within the cSAC.
- Promote the adoption of catch and release as the basis for sea angling competitions within the cSAC, rather than bag sizes.
- Improve publicity to anglers about the cSAC and bass nursery areas.

5.4.5.9 Collection of marine plants (including macro-algae and glasswort)

Extent of the activity

In other parts of the world such as South East Asia, and to a lesser extent Ireland, large scale seaweed gathering (and even cultivation) takes place, for use as a foodstuff, soil fertiliser and in the manufacture of food additives, pharmaceuticals and industrial chemicals. However collection from the shorelines of Wales has historically taken place only on small non-commercial scales, mainly the collection of strandline algae for use as a fertiliser (or mulch) on agricultural land, the collection of Lava bread (Porphyra sp.) or the collection of glasswort (Salicornia spp., also known as samphire) as foodstuffs.

Strandline material may be removed during beach cleaning operations by local authorities. Within Ceredigion, the beaches at Borth and Clarach are cleaned by hand during the season. If large scale deposits of seaweed occur, then these are mechanically removed. However, on coastal SSSI areas, mechanical methods are not generally allowed.

How the activity may affect the features

Removal of live or dead plant material can have a number of types of impact:

- Complete loss of the habitat, if whole scale removal of plant material takes place. The effect can either be immediate if all plants and plant material are removed, or a longer term decline if sufficient plants are removed to expose the substrate and remaining plants to further erosion, or to prevent regrowth.

- Alteration of community structure by selective or wholesale removal of one component species or, in the case of strandline plant material, nutrient supply and habitat for other species.

- Acceleration of the erosion of sediment. For example glasswort is often regarded as pioneer saltmarsh , where it occurs along the seaward edge of saltmeadows. Excessive removal could prevent the development and stability of saltmarsh at its seaward edge. Similarly, seaweed strandlines on sandy shores are known to play a role in sand dune formation, by providing suitable conditions for pioneer dune flora. Removal will thus inhibit dune formation and stability.

Organisation(s) involved

Landowners
Local authorities
Individuals

Existing management

The legal regime concerning collection of marine plants from the foreshore is almost as complex as that relating to the gathering of shoreline animals (see section 5.4.5.7), only without the added complication of the question of whether or not it constitutes a fishery . In general the natural products of the seashore (excluding fish but including plants) belong to the landowner, and there is no general right to collect them, except for use as bait for fishing. In theory therefore, gathering of plants (dead or alive) from the

foreshore can only be undertaken by the landowner or someone acting with the landowner s permission. But as with most activities of third parties in the sea and intertidal areas, in practice it would be very difficult to prevent gathering of plants by third parties even if it were considered necessary to do so from a nature conservation viewpoint. Even without specific permission from landowners, the gathering of seaweeds or glasswort may be tolerated, along with other activities that are not public rights as such, but customary uses or tolerances on the foreshore, such as access and sea bathing.

Notification of areas of foreshore by CCW as SSSI can seek to prevent the removal of plants, but as with all SSSIs, such provisions only apply to landowners. It has not been legally established whether landowners can be held responsible for the actions of third parties, either generally or in specific circumstances. All of the SSSIs within or immediately adjacent to the cSAC list removal of vegetation as a notifiable operation , requiring the prior consent of CCW. Forthcoming changes to the statutory basis of SSSIs may enable some control of the actions of third parties.

Management response

Type of response

F2: There is a known mechanism for the activity to have an effect, but no evidence that it is having an effect at its present levels.

Rationale

There is virtually no documented information about the nature and scale of marine plant collection in the cSAC. It is believed that this only occurs at a very low level as described above. Although there are mechanisms by which this activity could have an affect on the cSAC features, there is no evidence to suggest that at current levels it is having a negative impact. It is possible that the scale of collection may increase in the future.

Management actions required (including links to other policies/plans/measures)

Actions:

- Collate any available information on nature and scale of marine plant collection within the cSAC. (Relevant authorities)

5.4.6 Recreational activities

5.4.6.1 Recreational boat use

The information in this section relates to a variety of recreational boat use: sailing, windsurfing and powered craft (including personal water craft (PWC) and the use of powered craft for other water sports activities such as water skiing and diving).

Extent of the activity

A wide range of recreational boat use is undertaken within the cSAC. Centres using cSAC waters include Porth Dinllaen and Nefyn (itself just outside the cSAC boundary) northeast of Bardsey Island, with the reminder in Cardigan Bay itself with a concentration of important facilities and anchorages in the northernmost part of the bay. Aberystwyth harbour and marina, an important sailing centre lies just outside the southern limit of the cSAC. There are moorings at Abersoch, Mochras/Shell Island and Aberdyfi and harbour or marina facilities at Pwllheli, Porthmadog, Barmouth and Aberdyfi.

There are sailing/boating clubs at Aberdyfi, Barmouth, Llanbedr, Pensarn, Porthmadog, Pwllheli, Abersoch and Nefyn from which both dinghies and large vessels set off, but a number of other locations serve as launching points for small craft, including Porth Ysgaden, Black Rock Sands, Mochras/Shell Island, Fairbourne and Borth-y-Gest and other beaches in the region.

All of the major centres mentioned above host watersports championships which attract visitors from around the British Isles and abroad. Pwllheli (the watersports venue for the Manchester bid for the 2000 Olympics) with its excellent facilities and its strong support from nearby clubs (at Abersoch and Porthmadog) is now well established as a location for international as well as national events including power boating events.

Although recreational boating is carried out throughout the year, the peak season for recreational boat use is May to September with, in some locations, a dramatic increase during the summer months July to September.

The region has a long history of trading/commercial boating and also, more recently, many years of recreational boating with some traditional mooring, anchoring and launching areas.

There are approximately 20 centres for watersports operating commercially that use part of the cSAC for different watersport activities. Also, the National Watersports Centre (SCW) is located at Plas Menai near Caernarfon not far from the northern boundary of the cSAC.

i. Sailing

Sailing (ranging from dinghy sailing to large yacht cruising and including windsurfing) is a very popular activity within the area of the cSAC. There are some 11 sailing clubs within the cSAC area and a number of others close to its boundaries. The membership include both local and distance members and also visiting members. The clubs promote a variety of activities which include racing, cruising and training. The number of people involved including children and teenagers is substantial.

In addition to the local clubs, there are two main outdoor activity centres that use the cSAC for sea sailing.

It is anticipated that there will be a steady increase in the number of people participating in sailing either through activity centres, clubs or independently.

ii. Canoeing and other paddle/board sports

Canoeing, kayaking, wave-skiing and surfing account for a significant proportion of the recreational boat use of the cSAC.

There are many Outdoor Activity Centres and licensed operators (by AALA (Adventure Activities Licensing Authority) and WCA (Welsh Canoeing Association)) which use sites which are tidal or neo-tidal for canoeing and kayaking. Many groups from outside the area visit the Tudwal Islands for sea kayaking trips, and the trips from Aberdaron to Bardsey and the north coast of Ll n are very well known advanced sea kayaking trips for experts.

The area has become increasingly popular, particularly in the last five years and since the publication of The Storm rider guide , for surfing (including body boarding, short board surfing, long board (malibu) surfing, wave skiing and kayak surfing). Favoured sites for surfing are Porth Oer (Whistling Sands), Porth Neigwl (Hell s Mouth), Porth Ceiriad, Black Rock Sands, Harlech, Barmouth, Fairbourne beach, Allens Sunbeach Llwyngwril and Tywyn beach. Surfing is an increasingly popular activity.

iii. Power boats/craft

Power boating and use of personal water craft (PWC) are becoming increasingly popular within the cSAC area, particularly around Tremadoc Bay.

Some powerboat activity is linked to water-skiing, diving and other watersports activities. Aberdyfi is a popular location for waterskiing.

How the activity may affect the features

Recreational boating activities have the potential to affect the reefs and estuaries in a number of ways:

i Physical disturbance

Launching:
Launching of craft from informal access points or intensive use of certain areas for access may result in compaction and erosion of features and possible damage to certain species in the intertidal area.

Anchoring and mooring:
Anchoring and moorings may cause physical damage to certain marine communities depending on the location and communities present. The scour caused by mooring chains may disturb sediment communities within a localised area.

Wash from craft:

In certain situations, the waves generated by powered craft may contribute to bank erosion in coastal and estuarine areas. The force of the wash is dependent on the speed, size and displacement of the craft. Soft or easily eroded shorelines, such as in estuaries, are more susceptible to erosion, although the scale of the impact will also depend on the type of sediment, the orientation of the shoreline and the profile of the shore. Increased erosion in, for example, estuarine locations, as a result of boat wash can lead to habitat loss and the resuspension of sediment and its impact on water quality.

ii Pollution

There is the potential for pollution caused by recreational boat use. Potential pollution could include litter, oil, hydrocarbon based fuels and antifoulants. These will increase the pollution loading on the reef and estuary habitats and their associated species. See sections 5.4.4.3 and 5.4.7.5.

iii Disturbance

The noise and movement of power craft may disturb some marine wildlife such as birds and marine mammals. Although these species are important in terms of marine conservation and the overall maritime environment, not all of these mobile species can be considered to be a part of the reef and estuary features. Where they are considered to be part of the features, for example, certain bird aggregations in the estuaries, noise disturbance from power craft is a potential impact on the cSAC features. There is no evidence to show that through-water noise generated by vessel activity on the sea is likely to have a detrimental impact on fish species.

iv Infrastructure development

Development and maintenance of the infrastructure supporting recreational boat use may affect reefs and estuaries in a variety of ways (see sections 5.4.1.1 - 5.4.1.3 and 5.4.2.2 - 5.4.2.3)

Organisation(s) involved

Welsh Yachting Association
Royal Yachting Association
Sports Council for Wales
Outdoor Activity Centres

Existing management

The Welsh Yachting Association (WYA) is the governing body for recreational boating (sailing and powered craft) in Wales; it is the Wales arm of the Royal Yachting Association which is the governing body for these activities in the UK. Both the WYA and RYA promote an environmental code of conduct (Tidelines), and many local yachting/boating clubs have club rules and sailing instructions. The British Marine Industries Federation (BMIF) also promotes the Navigate with Nature code of conduct.

Many outdoor activity centres also promote environmental awareness as an integral part of their courses.

There are some bylaws in force at various locations around the cSAC, and zoning and speed limits are enforced at some of the busier launch sites and public beaches. For example, at Aberdyfi there is a 4 knot speed limit within the harbour area. Speed limit enforcement can be problematical.

Sailing clubs usually demand that members adequately insure their boats.

Many, but not all, participants in sailing are likely to be associated with local clubs and/or the WYA/RYA, although there is no formal requirement for membership. Within the cSAC, the distribution of sailing activity is related to the location of the main facilities including launch sites. Club or association membership is not as common amongst powered craft owners except where the use of powered craft is part of an associated activity, e.g. diving.

There is a system of beach management operated by Gwynedd Council at Abersoch and Black Rock Sands during the summer months (June - September) which regulates where small sailing boats, powered craft and PWCs can be launched and, where relevant, limits their speed close inshore. To launch a PWC in Gwynedd, the owner/driver has to show proof of insurance and have their craft registered on the inventory of PWCs being used in Gwynedd. The launching of PWCs is generally discouraged along much of the Ceredigion coastline. Harbourmasters at New Quay and Aberaeron direct PWC users to a zone that has been developed at Borth. There are Codes of Conduct for both recreational and commercial boat users which are promoted through work on the Cardigan Bay Heritage Coast and the Cardigan Bay cSAC. Work is being undertaken to assess the effectiveness of these. Harbourmasters in Ceredigion are authorised to withdraw launching permits from defaulters of the County s Code of Conduct for recreational boat use. A Launch Officer is employed at Borth during the summer season.

The main harbour/marina facilities at Pwllheli, Porthmadog, Barmouth and Aberdyfi and the slipways at Abersoch and Black Rock Sands are run by Gwynedd Council. Most slipways are managed by harbour authorities/local authorities. The Abersoch Harbour Committee management the outer harbour moorings and the moorings in St. Tudwals Road are organised by a private company.

Considerations relevant to the management of recreational boating activities in relation to prevention of pollution from potential sources mentioned above are covered in section 5.4.4.3.

Management response

Type of response

F2: There is a known mechanism for the activity to have an effect, but no evidence to suggest that it is having a significant effect at present.

Rationale

Recreational boating use of the waters of the cSAC will continue and may well increase in the coming years.

Sailing, canoeing and other paddle/board sports are, on the whole, quiet activities which are very unlikely to have any impact on the reefs and estuaries of the site. In contrast, powered craft can produce levels of through-water noise that may disrupt the ability of cetaceans (dolphins, porpoises and whales) to

communicate, navigate and hunt prey. The presence of craft close to marine mammals may result in disturbance or possibly collision and has the potential to disturb rafts of birds at sea. While of concern for the conservation of these species, for the most part, disturbance of marine mammals and birds is not relevant to the reefs and estuaries because these species can not be considered to be part of the features for which the cSAC has been identified. Where mobile species can be considered to be part of the reef or estuary features, there is currently no evidence to suggest that the operation of powered craft is having a negative impact on their population and condition.

There are a number of associated activities and requirements of recreational boating and other watersports, such as launching, provision of mooring/berthing facilities and anchoring that have the potential to affect the reef and estuary communities. At the present time, there is no evidence to suggest that at their current levels and locations that these are having a negative impact on the features of the site.

Raising the awareness of boat users and others about the existence and purposes of the cSAC and promotion of existing codes of conduct should help encourage good practice with respect to sailing and its associated activities. There is potential to involve boat users in recording information about marine wildlife (cetaceans and aggregations of birds in particular) seen within the cSAC and thereby contribute to nationwide projects.

The disturbance of humans, rather than wildlife, by power craft (PWCs in particular) is a potentially emotive subject. It is not the aim of the management scheme to address human-use conflicts, and therefore it is not appropriate to consider this issue through the cSAC management plan. The issue of disturbance to humans by power craft should be addressed under local/regional initiatives.

The issue of damage from increase wash from powered craft is relevant to the estuaries of the cSAC but there is currently no evidence to suggest that this is having a significant impact on the estuary features.

The issue of pollution from powered craft is considered in section 5.4.4.3.

Management actions required (including links to other policies/plans/measures)

Actions:

- Promote relevant codes of conducts and encourage good practice amongst boat owners and operators and those participating canoeing, surfing and other watersports. (Relevant authorities, governing bodies of sports, outdoor activity centres and others)

- As part of the interpretation of the cSAC, provide information specifically for boat owners and operators, outdoor activity centres and people participating in all forms of recreational boat/craft us and watersports about the cSAC and its wildlife. (Relevant authorities)

- Encourage those participating in boating activities to submit records of wildlife sightings to the appropriate organisation. (Relevant authorities, governing bodes of sports, outdoor activity centres and others)

- Assess the potential impact of any future development of new or additional infrastructure facilities on the reefs and estuaries of the cSAC (many of these activities/developments are likely to be treated as plans or projects). (Gwynedd Council, Ceredigion County Council, Snowdonia National Park Authority, Countryside Council for Wales).

- Keep a watching brief on the scale and location of powered craft use within the estuaries. (Gwynedd Council, Ceredigion County Council, Snowdonia National Park Authority).

Links:

- Ceredigion Sport and Recreational Strategy (2000).

- Ceredigion Coast and Countryside Strategy (2000)

- Cardigan Bay cSAC Management Plan

5.4.6.2 Access to the shore including vehicle use on beaches

Extent of the activity

There are numerous access points around the coast of the cSAC both for walkers and for launching boats and other craft. Abersoch beach and Black Rock Sands are the two main beaches along the coast of the cSAC where vehicle access is allowed.

<< Further information to be collated about access and use of vehicles on beaches>>

How the activity may affect the features

Trampling by large numbers of people visiting specific locations or possibly the launching of craft from informal access points may result in compaction and erosion of features and possible damage to certain species in the intertidal area. Studies (Hill et al, 1998) have shown that repeated trampling of animals and plants on a rocky shore can damage them. Within the cSAC, some species in particular, e.g. the

honeycomb worm Sabellaria alveolata, are particularly sensitive to the effects of trampling (Holt et al, 1998).

The use of vehicles in sediment areas, e.g. saltmarsh, sandflats and mudflats in the estuaries, can also cause damage to the sediment communities as a result of habitat disturbance from compaction and erosion. Muddy habitats, including saltmarsh, are particularly susceptible to this sort of disturbance; the impact of vehicle tracks may remain in these areas for many months.

Organisation(s) involved

Gwynedd Council
Ceredigion County Council
Snowdonia National Park Authority
Land owners and occupiers
Crown Estate (as land owners)

Existing management

<< Further information to be sought about existing management of access and use of vehicles on beaches>>

Management response

Type of response

?F2: There is a known mechanism for the activity to have an effect, but no evidence to suggest that it is having a significant effect at present.

Rationale

<< To be completed once further information available to enable an assessment of any current and potential impact on the cSAC features. >>

Management actions required (including links to other policies/plans/measures)

I Actions:

- Document available information about existing slipway access and sites of access across the beach, including vehicle use on beaches, and assess the implications of this on the cSAC features. (Relevant authorities)

5.4.6.3 Diving

Extent of the activity

The inshore sea area around the Ll n Peninsula, and to a lesser degree the Sarnau, is a popular area for recreational divers. The varied underwater seascapes and wildlife attract many divers to the area from the north Wales locality and further afield.

Although some shore diving is undertaken (primarily at sites along the north Ll n coast), much of the diving is undertaking from boats. Popular launch sites for divers are Trefor, Nefyn, Morfa Nefyn, Porth Ysgaden, Porth Colmon, Aberdaron, Abersoch and Pwllheli.

Facilities for divers (e.g. air supply) are available locally from businesses in Llanbedrog, Abersoch and Mynytho. No recreational diving is undertaken in the estuaries.

Divers participate in a variety of activities associated with their sport, for example, wildlife observation or recording, underwater photography, wreck exploration, excavation or salvage. There were reports during the late 1960's and early 1970's of divers collecting common sea urchins (Echinus esculentus) in the area around SW Ll n and Bardsey Island, but over the past 15 years or so there has been virtually no collection of such marine curios . A proportion of divers do, however, collect marine crustacea (lobsters and brown (edible) crab) and scallops for personal consumption.

How the activity may affect the features

Diving activities have the potential to have an effect on some aspects of the reef communities:

i Collection of species

High levels of collection of certain species may have a detrimental impact on the population of species in commonly dived areas. This is particularly so for those species that are present in limited numbers and may be at the edge of their range, have limited mobility, have low rates of reproduction or take a long time to reach maturity. Significant changes in the populations of collected species may affect the associated community, particularly if the collected species plays a key role in the functioning of the community.

ii Damage of sensitive species

There is potential for divers to directly damage sensitive species, for example by hitting or crushing them. One species in particular that would be sensitive to such damage is Ross Coral - a bryozoan that forms large orange-coloured colonies and is present in some of the reef communities around Pen Ll n.

Disturbance to marine wildlife as a result of scientific/educational studies is covered under section 5.4.7.4.

Disturbance to marine wildlife as a result of underwater excavation work/salvage (official and unofficial): this is covered under section 5.4.7.3 (coastal and maritime archaeology).

Use of powered craft: See section 5.4.6.1.

Organisation(s) involved

Scuba diving associations/clubs: The main national governing bodies for scuba diving are:

British Sub Aqua Club
Sub Aqua Association
PADI
North Western and North Wales Sea Fisheries Committee (NW&NWSFC)

Existing management

The national governing bodies for scuba diving promote marine conservation awareness and they have Codes of Conduct that include conservation considerations. Individual clubs may operate no take policies on club dives.

The collection of commercially important shellfish species is regulated by NW&NWSFC byelaws which limit the number and size of edible crab, crawfish and lobsters that can be taken.

There is no statutory regulation of the collection of marine species not classed as fish or shellfish , although some marine species are protected from intentional killing, taking or injuring under the 1981 Wildlife and Countryside Act.

Issues relating to scientific/education studies are covered under section 5.4.7.4 and issues relating to marine salvage and excavation of wrecks are covered under section 5.4.7.3.

Management response

Type of response

F2: Diving activities have the potential to have an effect on certain components of the reef communities of the cSAC, but there is no evidence to suggest that this activity is having a significant effect at present.

Rationale

The collection of certain commercially important shellfish species is well regulated by the NW&NWSFC byelaws and by on-the-ground patrols by local fisheries officers.

As a result of national campaigns within the diving press and by organisations such as the Marine Conservation Society there is now a far greater awareness amongst the majority of divers about the problems caused by the collection of marine curios and possible damage to sensitive marine species. As a result, it is unlikely that these potential impacts will affect the reefs of the cSAC.

Divers are in a unique position amongst the recreational users of the cSAC in that they come into direct contact with, and are therefore able to experience first hand, the reef habitats and their wildlife. There is the potential for divers to contribute directly to the cSAC management through participation in projects to

record the marine wildlife of the site. Through the management scheme, divers should be encouraged to participate in and undertake appropriate projects and to raise awareness of others about the cSAC.

Management actions required (including links to other policies/plans/measures)

i Actions:

- Promote existing codes of conduct for divers. (Relevant authorities, scuba diving associations and clubs)
- Encourage the national governing bodies to promote awareness of the cSAC (and other SACs in the UK) and their management (Relevant authorities)
- Involve divers in carrying out biological surveys to get them more involved in the management process (Countryside Council for Wales, scuba diving associations)
- Raise awareness with divers and others about the cSAC, for example by publicising in an effective way the results of local surveys to generate interest in the area. (Countryside Council for Wales and other relevant authorities)
- Keep a watching brief on collection of non commercial marine species by divers (Relevant authorities).

ii Links:

- National Seasearch Project (Underwater recording project for divers)

5.4.7 Other activities

5.4.7.1 Forestry

Extent of the activity

Apart from the Mawddach and Dyfi estuaries, forestry is not a significant land use within the catchment area around the cSAC. These forests are composed of even-aged stands of predominantly mixed conifer.

It is possible that there will be an expansion of afforestation in line with UK Forest Policy and the Snowdonia National Park Forestry Accord, although this would not necessarily be of coniferous plantations. Logged areas will most likely be replanted as part of forest policy - unless there are overriding landscape, nature conservation or water quality issues when some areas can be left unplanted.

How the activity may affect the features

Forestry within the catchment area around the cSAC may have an adverse effect on water quantity and quality. Evapotranspiration in afforested areas has been shown to reduce water run-off into streams and rivers by as much as 30%, leading to concerns about possible reduced scour in estuary systems. Water quality may be affected by sedimentation, increased turbidity, iron precipitation, pollution and nutrient enrichment as a result of afforestation. Also, whilst coniferous afforestation is not the primary cause of acidification, it can exacerbate its impact by scavenging airborne impurities, although planned reductions in emission from power stations, etc should significantly reduce acid deposition.

Organisation(s) involved

Environment Agency Wales
Forestry Commission
Snowdonia National Park Authority
Countryside Council for Wales

Existing management

The Environment Agency Wales carries out hydrological monitoring of afforested catchments.

There are a series of guidelines for forestry management that have been produced by and are available from the Forestry Commission:

- Forest and Water Guidelines, 1993
- Forests and Soil Conservation Guidelines, 1998
- Forest Nature Conservation Guidelines, 1990
- The UK Forestry Standard, 1998

The catchments of the Mawddach and Dyfi are acid sensitive areas or Critical Local Areas where acidification from planting conifers is a concern due to the underlying geology and soil types. In these areas there is an agreed protocol where the Forestry Commission consults the Environment Agency. The aim is to control new planting and restocking in these areas. Procedures and revised guidelines will be

produced by the Foresty Commission for these areas, and an All Wales Acid Waters Strategy will be draft up by the various organisations to contribute towards reversing the effects of surface water acidification.

Forest design plans are available from Forest Enterprise for their forests at Beddgelert and around Dolgellau and the Dyfi. These plans clarify future policy on replanting, design etc. Plans are being drawn up for larger areas of privately managed woodland.

Management response

Type of response

F2: Forestry has an obvious potential to affect the estuary features in particular, but there is no evidence to suggest that this is happening.

Rationale

Although there is concern about the possible affect of evapotranspiration affecting water run-off into streams and rivers, it appears that peak flows are little affected by afforestation and so it is unlikely that afforestation at the present capacity will affect scour in these estuaries. However, it is recognised that little is known about the impact of forestry run-off on the geomorphological processes and wildlife of these estuaries. It is considered that any adverse affects associated with run-off from forestry are likely to be highly diluted and that their impact is likely to be insignificant. It is clear, however, that there is little information available about the potential affects of forestry on estuarine and coastal areas, particularly with respect to the Pen Ll n a r Sarnau cSAC.

Management actions required (including links to other policies/plans/measures)

i Actions:

- Maintain surveillance of possible impacts of afforestation on water quality. (Relevant authorities)
- Further work required to quantify the possible impact of afforestation on the cSAC (in terms of restricting water run-off, and water quality impacts of diffuse run-off). (Relevant authorities)

ii Links:

- Forest Enterprise Forest Design Plans
- Eryri/Ll n and Meirionnydd Local Environment Agency Plans (LEAPs).

5.4.7.2 Grazing

Extent of the activity

The coastal fringes of the National Park, particularly the saltmarsh areas of the Dyfi, Mawddach and Dwyryd estuaries, as well as other areas bordering the cSAC coast tend to be comparatively heavily grazed. Grazing is mainly by sheep but cattle and horses are also grazed. There are no figures easily

available for the numbers of farm stock grazing these areas. Within the Dyfi estuary, for example, another significant impact is from grazing wildfowl, which include Wigeon (recent average 3000-4000) wintering in the estuary and geese (predominantly Canada geese which now number approaching 2000) which graze both the saltmarsh and adjacent farmland. Many of these (farmed) areas receive appreciable amounts of agri-chemicals. A fair proportion of the land is also used for winter fodder conservation. The latest trend in the Dwyryd and Glaslyn areas is for forage maize.

How the activity may affect the features

Grazing and associated activities may affect the estuaries of the cSAC in a number of ways:

- overgrazing leading to soil erosion;
- under grazing and lack of maintenance leading to drainage impedance;
- land improvements.

These activities may cause changes in sediment and nutrient or agri-chemical (e.g. organophosphate or synthetic pyrethroids) loading within the estuaries or open sea areas of the cSAC.

Organisation(s) involved in management

National Assembly of Wales Agriculture Department
Snowdonia National Park Authority
Countryside Council for Wales
Royal Society for Protection of Birds
Crown Estate Commissioners
Farmers Union of Wales
Landowners

Existing management

Conventional farming is supported by livestock support mechanisms. The Tir Cymen and Tir Gofal agri-environment schemes operate in the area and many of the farms bordering the cSAC are participating in these schemes. It is likely that more will join in the future. For example, where saltmarsh habitats are considered to be of botanical significance, i.e. are not improved grassland, farmers participating in these schemes have to follow management prescriptions which involve suitable (often reduced) stocking levels and a cessation of fertilizer input and other management, in return for payments. Land notified as SSSI under section 28 of the Wildlife and Countryside Act 1981 may also involve payments for the appropriate management of farmed land in management agreements made under section 15 of the Countryside Act 1968. Much of the coastline of the cSAC has been notified as SSSI (e.g. Dyfi and Mawddach estuaries).

Management response

Type of response

F2: There is a known mechanism for farming on the land adjoining and draining into the cSAC to affect the features, but there is no evidence to suggest that it is having a significant affect at present.

Rationale

There are several mechanisms by which grazing and associated activities could have an impact on the estuaries of the cSAC. At present, however, there is little to suggest that agricultural grazing is causing any problems at present. As more farms within the land adjoining or draining into the cSAC come into the agri-environment schemes, it is likely that sediment and nutrient run-off will reduce. Although there are diffuse inputs associated with grazing (e.g. sediment, nutrient, or agri-chemical loading) within the estuaries, it is considered that the dilution of these is likely to be so large as to render these additions insignificant. It is however, recognised, that there is little information available with which to assess the scale and possible impact of these inputs.

Management actions required (including links to other policies/plans/measures)

i Actions:

- None at present.

ii Links:

- Coastal/estuary SSSI (draft) management plans and section 15 management agreements

5.4.7.3 Maritime / coastal archaeology

Extent of the activity

Archaeology is the identification and interpretation of the physical remains left by humans from the past. Archaeological studies are undertaken both in the sea and on land. Archaeological works of direct relevance to the cSAC are those undertaken in the sea or the coastal area, in particular the estuaries. Archaeology sites vary from ships to the remains of ancient structures and cultures from many periods in time as far back ancient structures dating from well before the huge sea level change that occurred during the Bronze Age, 2500BC to 500BC.

Maritime archaeology takes place around the coast of the United Kingdom out to the twelve mile limit. Around the coast of Wales there are, at the time of writing, five protected sites with others pending. One of these is within the Pen Ll n a r Sarnau cSAC; this is the Bronze Bell Wreck (designation No20 under the Protection of Wrecks Act, 1973). The site is the wreck of a Genoese ship lost in the first decade of the eighteenth century. This site is protected to a distance of 300 metres in all directions from the cargo mound, which is still intact on the seabed. Work on this designated site has been undertaken and further work is proposed.

There are other ships that have been lost within the cSAC, and the remains of some of these are still visible on the seabed. Some of these sites provide a hard surfaces which have become colonised by various reef species.

How the activity may affect the features

Excavation of archaeology sites both underwater and in coastal areas may affect the features of the cSAC as a result of direct disturbance to reef and estuary communities in the immediate and surrounding area. With coastal sites, there may be impact from trampling.

Organisation(s) involved in management

Cadw
The National Assembly for Wales
Gwynedd Council
Ceredigion County Council
Snowdonia National Park Authority
MAFF

Existing management

Most historically valuable archaeological excavation is carried out under the 1973 Protection of Wreck Act. All artefacts when removed from any site become the responsibility of the official Receiver of Wreck who has the legal responsibility to dispose of all materials either to there rightful owner or their descendants if they can be traced. If this is not possible artefacts can be sold off with proceeds going to the finder or the salvers in possession, with a small percentage going to the Crown.

Historic sites that are not protected under the 1973 Act but are within the twelve mile limit are subject to the Merchant Shipping Act 1895, amended 1995. Persons finding a structure can claim reward from such sites by becoming Salvers in Possession. This ensures that, by taking possession the finder has the first claim after the crown and their claim is protected in British Law.

The 1973 act will exclude all operations within a designated area around a historic site, which can be judged to damage the area unless the licensing authority has granted permission. All invasive activity within the exclusion zone is prohibited this includes fishing of all types both sport and commercial. No diving can take place unless a licence has been granted by one of the five heritage bodies in the UK; in Wales this is Cadw, which acts for the National Assembly for Wales. The site licence has to be held by a suitably qualified person who can then nominate divers to be placed on a diving list as part of the archaeological team. The designation of an area is only imposed on the seabed, not on the surface, other sports activities on the surface can continue without being in contravention of the law, but anchoring within the designated area does contravene the 1973 Act. Within the scope of the 1973 Act, protection can be granted up to the high water spring tide level. This includes estuaries, which are influenced by tides and extend several miles inland.

There is one protection that is automatically granted, that is on military aircraft lost whilst in military service. The designation of military vessels is not automatic and is only applied if the Ministry of Defence believe it to be justified (under the Protection of Military Remains Act 1986). Currently, no military vessel has been designated under this legislation.

Under the Habitats Regulations, archaeological excavations would constitute a plan or project and be subject to the tests of significance/appropriate assessment for the purposes of the Habitats Directive.

Management response

Type of response

F2: There is a known mechanism for archaeological excavations to affect the reefs and estuaries of the cSAC, but there is no evidence to suggest that it is having a significant effect at present.

Rationale

The number of licenced excavations occurring within the cSAC is small. While there is the potential for these to have an effect on the reefs and estuaries, there is a requirement for an assessment of these activities in accordance with the Habitats Regulations, and therefore any potential problems can be addressed at this stage.

Unlicensed excavations and salvage work are more difficult to manage. While these may be occurring on the site, there is no information available about their nature or extent to enable an assessment of their potential implications for the reefs and estuaries of the site.

As a competent authority, Cadw is required to comply with the Habitats Regulations in the exercise of its functions, including the giving of consents to excavate protected wrecks.

Management actions required (including links to other policies/plans/measures)

Actions:

- Ensure that all the appropriate competent authorities are aware of their responsibilities with respect to the cSAC. (Relevant authorities, Cadw, National Assembly for Wales)

- Review extant licenses for excavation and designated sites within the cSAC. (Cadw)

- Clarify the extent and nature of any excavations of coastal archaeology sites and unlicensed excavation/salvage and assess their potential impact on the cSAC features.

5.4.7.4 Scientific/educational studies

Extent of the activity

Although certain locations within the cSAC are used quite regularly for scientific and educational studies (e.g. the Dyfi estuary, Harlech dunes) most of the site is visited only infrequently by groups undertaking scientific and educational studies.

Probably the most long standing educational use of the cSAC is by Aberystwyth University which has had a close association with the Dyfi estuary with a long history of research into various aspects of saltmarsh vegetation, marine biology and geomorphology. In addition to providing a study site for undergraduate and post-graduate projects, the estuary is well used as a teaching resource by marine biologists studying at Aberystwyth and also by visiting school groups.

Greater interest in using the area for educational and scientific studies may increase with its selection as a cSAC.

How the activity may affect the features

i Trampling

Trampling caused by large numbers of people visiting specific locations or by frequent repeat visits to certain locations may result in compaction and erosion of features and possible damage to certain species in the intertidal area, including saltmarsh.. Within the cSAC, some species in particular, e.g. the honeycomb worm Sabellaria alveolata, are particularly sensitive to the effects of trampling.

ii Destructive sampling

Educational and scientific studies may involve destructive sampling techniques (where wildlife or habitats are removed as part of the study) or some sort of interference with wildlife.

iii Improved knowledge and understanding

Much scientific investigation, including the carrying out of fieldwork involving in situ measurement or observation and sampling, is required to improve the information base on which decisions relating to cSAC management are taken. Other sections of this plan describe research, monitoring and surveillance projects, some of which may involve limited impacts on the species or habitats concerned, but which will hopefully lead to better management.

Organisation(s) involved

Countryside Council for Wales (depending on location (e.g. within a National Nature Reserve) or species (e.g. if a protected species and a license is required)

North Western and North Wales Sea Fisheries Committee (authorisations are required to collect undersized fish and shellfish and for use of certain collecting techniques)
University of Wales, Aberystwyth

University of Wales, Bangor
Landowners

Existing management

There is no specific legislation regulating the undertaking of educational and scientific studies as such. In order to carry out these activities, though, it may be necessary, depending on the location and nature of the study, to seek access permission from a landowner/occupier and/or request the necessary permits or licences from the appropriate organisations.

Management response

Type of response

F2: There is a known mechanism for educational and scientific studies to affect the features, but there is no evidence to suggest that it is having a significant affect at present.

Rationale

The current level of use of the cSAC for educational and scientific studies is low and there is no evidence to suggest that past and existing levels of use have had a detrimental impact on the reefs or estuaries.

Management actions required (including links to other policies/plans/measures)

i Actions:

- Promote appropriate codes of conduct about educational/scientific activities within the cSAC. (Relevant authorities)

- Raise awareness about the cSAC with those undertaking educational/scientific studies. (Relevant authorities)

- Encourage appropriate studies into the reefs and estuaries of the cSAC (Countryside Council for Wales, Gwynedd Council, Ceredigion County Council, Snowdonia National Park Authority, Environment Agency).

- Encourage sustainable use of the marine environment around Pen Ll n and north Cardigan Bay as a resource for teaching.

- Carry out more research, surveillance and monitoring relevant to the management of the cSAC (Relevant authorities and others)

5.4.7.5 Litter

Extent of the activity

Refuse and litter can enter the marine environment from a variety of sources. Much of the litter occurring within the cSAC comes from land-based sources, although some litter will originate from boats and shipping. Some litter originates from locations far away from the site.

Precise details on the distribution of litter within the cSAC are not known.

In 1999, Wales recorded the highest levels of marine litter in the UK with an average of 3,015 items per km surveyed, almost one third more items per km than the average recorded on the rest of UK beaches (MCS, 2000). Plastics make up the largest proportion of beach litter. The majority of litter is non-sourced but of the rest, fishing and tourist/recreational inputs are the largest.

How the activity may affect the features

Some marine wildlife may become entangled in, or ingest certain types of litter. Animals living fixed to the seabed can be smothered by plastic debris which may affect their ability to feed and may cause sediment to become anoxic.

The affects of removing organic strandline material as a result of beach clean-up are covered in section 5.4.5.9.

Organisation(s) involved in management

Gwynedd Council
Ceredigion County Council
Snowdonia National Park Authority

Existing management

Marine litter can enter the site from a wide variety of sources and from some distance away. Whilst most types of littering at sea are offences under the Merchant Shipping Regulations, 1998 (the UK s transposition of Annex V of MARPOL) and it is an offence to drop litter in any public place (including beaches) under section 87 of the Environmental Protection At 1990, there is little policing of these. As a result, significant littering still occurs.

The Merchant Shipping (Prevention of Pollution by Garbage) Regulations 1998 apply to all shipping and boating, as well as to offshore platforms. They prohibit the disposal of plastics anywhere in UK territorial waters and the disposal of other types of pollutant within significant distances from nearest land.

In the Atlantic Ocean and Irish Sea the dumping of specific waste types is prohibited within specific distances:

> 25 nautical miles from land
12 - 25 nautical miles from land

3 - 12 nautical miles from land
0-3 nautical miles from land
Plastics

Oily waste
Plastics

lining & packaging material that floats

Oily wastes
Plastics

lining & packaging material that floats

Oily wastes

Garbage if not ground to <25mm
No waste or rubbish of any kind may be thrown overboard.

Gwynedd Council is involved in occasional beach clean ups with the Council s Countryside wardens working with local schools and community groups. Beaches that have been cleaned through this initiative are Aberdaron, Porth Neigwl and Porth Ysgaden. There have also been voluntary beach clean ups at Morfa Bychan involving the local community and Greenacres Caravan Park.

The beaches at Borth and Clarach are cleaned by hand by Ceredigion County Council during the summer season (Easter - September). Ceredigion County Council Coast and Countryside section also work with schools and local groups on beach cleans. Borth beach has been adopted as part of the MCS Adopt a beach scheme.

There are a number of Blue Flag and Green Coast award beaches and marinas in the cSAC:

Blue Flag: Pwllheli (Marian y De)
Pwllheli Marina
Barmouth
Borth

Green Coast: Harlech (Llaneddwyn)
Morfa Dyffryn (Bennar)

Borth Beach is regularly cleaned and has Blue Flag status. An adopt-a-beach scheme was introduced in 2000 to monitor levels and types of litter.

Management response

Type of response

F2: There are mechanisms by which litter could have an affect on the reef and estuary wildlife, but there is not evidence to suggest that it is having a significant affect at present.

Rationale

Although the entanglement and ingestion of litter can affect seabed communities there is no information available that suggests that this is currently a problem for the reefs and estuaries of the cSAC. Entanglement and ingestion are, however, more direct and significant problems for dolphins, porpoises and other cetaceans, seals and turtles. Although these species are not strictly part of the reef and estuary features, they are present within the site.

Improvements are needed in everyone s attitude to littering and also to the provision of services to facilitate removal of waste in ports and harbours. Reductions in litter on beaches are made through beach cleaning operations including local council and voluntary beach cleaning events as well is improvements in waste water treatment facilities by DCWW. Removal of beach litter might appear to only address the problem one litter has come ashore and is of reduced risk to marine life, but as it is likely that a certain amount of beach litter is re-mobilised into the marine environment, any removal from beaches is likely to be beneficial.

Management actions required (including links to other policies/plans/measures)

i Actions:

- Ensure provision of adequate rubbish disposal and recycling facilities for the public, along with publicity on their location, etc
- Stricter enforcement of anti-littering laws to deter fly-tipping and littering by businesses and the public.
- Encourage participation in voluntary local initiatives such as Adopt-a-Beach and river clean-ups.
- Provision of information and education to encourage everyone to properly dispose of litter.

ii Links:

- Cardigan Bay cSAC Management Plan
- Marine Conservation Society Beachwatch campaign and Adopt a Beach initiative.

5.4.7.6 Military activities

Extent of the activity

The Llanbedr Defence Evaluation and Research Agency (DERA), and executive Agency of the UK Ministry of Defence (MOD) responsible to the Secretary of State for Defence) airfield is operated in conjunction with the DERA Ranges further to the South, at Aberporth. Part of the cSAC is within the Llanbedr Safeguarding Area.

Pilotless drones tow targets out to sea which are fired at from the Aberporth ranges. The drones are controlled either from the control tower, when in close proximity to the airfield, or from manned aircraft flying alongside. There is some overflying of the cSAC, but the impact area is a considerable distance away, well out to sea.

There is also an RAF Resource and Initiative Training Centre located at Fairbourne which runs a number of boating activities (canoeing, kayaking and other open boats) in the Mawddach estuary as part of the training courses. Other military units use the Dwyryd, Mawddach and Dyfi estuaries of watermanship training, principally with canoes and sailboards, and there is also offshore sailing. The training activities take place throughout the year, and all the activities require prior clearance by the MOD Training Officer, who obtains all necessary consents and approvals.

In accordance with the Statement of Intent between the MOD and the Countryside Council for Wales, Service personnel assist, where possible, in foreshore environmental protection schemes.

Ynyslas beach and dunes were used in the 2nd World War for missile testing, and live shells are still occasionally discovered.

How the activity may affect the features

Potential impacts on the reefs and estuaries may occur as a result of pollution and physical disturbance from military activities. The presence of toxic materials and their leakage from munitions or targets used in the Cardigan Bay sea area may result in increased contamination of marine life.

The possible impact of boat-based training events is the same as for recreational boating (section 5.4.6.1).

Organisation(s) involved in management

MOD
DERA

Existing management

Operations are managed by DERA and MoD.

Management response

Type of response

F2: There is a mechanism by which the activity could affect the reefs of the cSAC, but there is not evidence to suggest that it is having a significant affect at present.

Rationale

Although military operations occur within the area of the cSAC, the main area of activity lies further out to sea.

Management actions required (including links to other policies/plans/measures)

i Actions:

- Ensure that as competent authorities, MOD and DERA are aware of their responsibilities with respect to the cSAC.

5.4.7.7 Introduction/spread of non-native species

(see also section 5.4.7.8 dealing with the spread of Spartina.)

Extent of the activity

A non-native species (defined in Eno et al 1997) is a species that has been introduced directly or indirectly by human agency (deliberately or otherwise) to an area where it has not occurred in historical times (taken as being since 5000 years before present), and which is separate from and lies outside the area where natural range extension would not be expected.

There are about 50 non-native marine species which have been introduced into British waters, including red algae, diatoms, angiosperms and invertebrates. Many of these still have a restricted distribution within the British Isles whilst several are widespread and occur, or are likely to occur, within the cSAC. In recent decades most introductions occurred between 1970 and 1979, the rate of spread varying significantly with each species (Eno et al 1997).

There are variety of sources/pathways for the introduction or spread of non-native species into coastal and estuarine waters:

- accidental/incidental introduction (e.g. from ships discharging of ballast water, escape of domestic animals/plants into rivers/estuaries)
- deliberate licensed introduction (e.g. for fisheries enhancement purposes)
- deliberate illegal introduction
- arrival of new species caused by changing environmental conditions (e.g. climate, sea temperature)

There are records of the following non-native marine species within the cSAC, but these are not currently believed to be having a detrimental affect on the features of the cSAC:

- Oyster thief Colpomenia peregrina
- Green sea fingers Codium fragile subsp. tomentosoides
- Cord grass Spartina anglica (see section 5.4.7.8)
- Barnacle Elminius modestus
- Soft-shelled clam Mya arenaria
- Leathery Sea squirt, Styela clava

One non-native species that has recently extended its range into SW Wales is Jap Weed Sargassum muticum, although there are currently no records of this species within the cSAC. There is now an established population of Sargassum in Strangford Lough in Northern Ireland. Sargassum is know to be able to cause physical displacement of native species through over-growing and shading underlying species including replacement of kelp Laminaria saccharina, pod weed Halidrys siliquosa and seagrass Zostera marina,

How the activity may affect the features

The introduction of new non-native species into the cSAC may result in changes which impact upon the species and communities of the reefs and estuaries. The effects of any individual non-native species may be negligible but could potentially be wide ranging.

Work by Rosenthal (1980) and Kohler & Coutenay (1986) catagorised detrimental effects of introduced species, some of these, given in Eno et al (1997) include:

- Competition with native species
- Concomitant introduction of new pests, diseases and parasites harmful to resident species
- Habitat alteration, provision of new niches and changes in water quality
- Trophic alterations, including dietary competition and predation
- Spatial alteration, namely competition for space
- Gene pool deterioration through hybridisation

There may also be secondary effects, such damage to the sea bed from subsequent fishing/harvesting activity. The effects of some species may be beneficial, such as improvements to water quality and the provision of a new food source to native species.

Organisation(s) responsible for management

In Wales, the licensing authority for the deliberate introduction or translocation of animals and plants into the wild is the NAW acting jointly with DETR and MAFF. CCW provides advice on the wildlife implications. The enforcement of legislation relating to illegal introduction of species is with the police/courts.

Existing management

There is a variety of International and national legislation aimed at preventing or controlling the introduction and spread of non-native species, including:

- Bonn Convention
- Berne Convention
- Rio Convention
- Habitats Directive
- EC Fish Health Directive
- Wildlife and Countryside Act (1981)

Procedural guidelines and best practice are provided by the 1994 International Council for the Exploration of the Sea Code of Practice (ICES 1994) and the International Maritime Organisation (IMO).

Under UK law, the introduction to the wild of any animal not ordinarily resident or regularly visiting Great Britain is an offence under section 14 of the 1981 Wildlife & Countryside Act. Schedule 9 of the Act also contains named species of animals and plants which may not be released (some of which are or have become established in Great Britain). The power to grant licences for the release of such organisms

in Wales is held jointly by the NAW and DETR. Note however that it is not generally an offence to translocate or release animals or plants to the wild if they are normally resident in Great Britain, if they are not named on Schedule 9 of the 1981 Act.

Management response

Type of response

F2: There is a known mechanism for the activity to have an effect, but no evidence to suggest that it is having a significant effect at present.

F6: The activity constitutes a plan or project and should be subject to the provision of Regulations 48-53 of the Habitats Regulations.

Rationale

On the whole, very few introduced marine species become established in British waters, and of those which do, only a small proportion prove to be a threat to the environment. Ribera & Boudouresque (1995) stated that, in general, 80% of introduced species have no effect on the indigenous community.

Unfortunately, the effects of non-natives can be environmentally disastrous. The effects are compounded by activities associated with their presence. Where a species is commercially important and present in sufficient numbers, it may be exploited and, depending upon the method of collection or intensity of cultivation, may have impact upon the nature conservation interest of the area. The control of species which become a nuisance can have quite far reaching effects. For instance, mechanical removal or use of pesticides on a non-native would almost certainly affect non-target species, and there are many historical terrestrial examples of the disastrous use of biological control where a second non-native has been introduced to control the first only to preferentially or additionally target natives. Activities associated with introducing commercial species, for instance preparing the ground or installing culture equipment, also may have an important effect.

The potential effect of an introduction is hard to predict and control methods are generally ineffective. Indeed, no non-native has successfully been eradicated from British waters. The only way of preventing detrimental effects from occurring as a result of non-native introductions is to ensure they do not gain entry in the first place.

In view of the uncertain, but potentially serious consequences of the introduction or further spread of non-native species, the deliberate introduction of any non-native species in the vicinity of the cSAC should be discouraged, and any applications for licenses should be subject to rigorous scrutiny by the licensing authorities. There is little positive action that can be taken within the context of this management scheme to discourage the accidental release of non-natives, other than those actions described below. However, it would be possible to seek the active involvement of people using the site in reporting possible sightings of easily recognised non-natives, in particular those which could have a series detrimental impact on the cSAC features, for example, Jap Weed Sargassum muticum.

Management actions required (including links to other policies/plans/measures)
i Actions:

- All competent authorities should take due account of relevant national and international legislation on the control and prevention of the introduction/spread of non-native and alien species.

- NAW/DETR/MAFF to consider any applications for the translocation or release of any species listed on schedule 9 of the WCA, or any non-native species, to waters or estuarine areas within or adjacent to the cSAC, in view of their potential to affect the features of the cSAC. Such applications should be treated as plans or projects, and consultation with CCW should take place as part of such consideration.

- Maintain surveillance of the introduction and spread of non-native species which may adversely effect the condition of the cSAC features, in particular Sargassum muticum. (CCW in conjunction with others).

- Through a programme of awareness and interpretation, seek the involvement of people using the cSAC to report sightings of particular non-native species. (CCW).

5.4.7.8 Further spread of Spartina

Extent of the activity

An American species of Spartina was originally introduced into Britain from North America in 1829. By 1870, it had formed a non-fertile hybrid with a native British species. Further hybridisation produced a fertile form, Spartina anglica which was first recorded in 1892. This hybrid grows readily on estuarine salt marsh fringes and mudflats and its potential for saltmarsh reclamation was quickly recognised. It was sold to some 40 countries world-wide and a great deal of land, notably in the Netherlands, was reclaimed, principally due to its rapid and vigorous growth.

It was planted in the Mawddach estuary in 1920, probably for reclamation purposes. In the Dyfi estuary, it was planted in the same year and within twelve years, evidently from seed produced by the introduced plants or from rhizome fragments, had spread to produce a continuous stand of some 300x30 m in extent as well as a number of smaller patches. While the rate of spread was slow in the Dyfi, it almost certainly increased dramatically as a result of war time activity. By the 1980s, Spartina dominated stands occupied about 276 ha of the Ceredigion sector of the estuary, equivalent to 50% of the total saltmarsh vegetation. A survey undertaken on behalf of the Snowdonia National Park Authority (SNPA) in 1983 showed Spartina colonies in all estuaries in North Wales. Many of these stands were probably derived from the deliberate plantings in the Mawddach and Dyfi estuaries.

How the activity may affect the features

Spartina is a primary coloniser of bare sand and mud habitats in the intertidal zone at the seaward edge of saltmarsh. These habitats, particularly those made up of the finer grain size, support rich invertebrate communities which are an important food source for a number of duck and wader species. The Dyfi estuary is designated as a Biosphere Reserve and is recognised as one of the most important wildfowl and shorebird centres in Wales. In addition, there was concern for some time that the spread of Spartina was in some measure responsible for the silting up of estuaries.

While the spread of Spartina in these estuaries is generally perceived as undesirable, there is now a generally held view that the rate of spread is decreasing and that Spartina is being replaced by other saltmarsh species. Indeed, in the Dyfi estuary, Spartina now appears to be undergoing natural regression. This may partially be due to grazing pressure (Dwyryd and Dyfi). It is also believed that the contribution of Spartina colonisation to the silting up of these estuaries is very slight. This appears to be a natural process and Spartina is simply colonising an available and suitable habitats. The Mawddach and Dyfi are also important Mullet and Bass nurseries and there is evidence that Spartina growth along creek margins may actually provide an improved habitat structure for these fish.

Organisation(s) involved in management

Snowdonia National Park Authority
Gwynedd Council
Ceredigion County Council
Countryside Council for Wales
Existing management

i Past management

Due to the landscape and nature conservation implications of the spread of Spartina, a number of colonies were sprayed in the Mawddach estuary by the Snowdonia National Park Authority in 1989, largely as a result of public concern. Spraying had only a partial success. Indeed a survey of that estuary in 1993 showed that the stands had increased in area by 52%. No surveys have been conducted since then and no further control programmes have been undertaken.

ii Current management

Apart from sheep grazing, there is currently no known management of Spartina colonies in the cSAC estuaries.

Management response

Type of response

F2: There is a known mechanism for Spartina spread to have an effect on the estuaries, but there is little evidence to suggest that it is having a significant effect at present.

Rationale

It is important to distinguish between the effects that the spread of Spartina may have and the practicability of the response. One could argue that the type of response to invasion should be F5 (there is evidence to suggest that an operation is having a significant effect and the mechanism is known). If it is considered that F5 should be the response rather than F2, we will have to be very clear what management measures need to be implemented, and clear what operational limits need to be set. Under the circumstances, the actions described below are suggested.

If control is to be considered, a very careful analysis will have to be made of the techniques available. Herbicide control as met with extremely mixed success in the many areas it has been attempted world-side. Mechanical control using a turf burying machine has been successfully trialed in England and some consider that it should now be the standard control option in all estuaries.

Management actions required (including links to other policies/plans/measures)

i Actions:

- Maintain a watching brief on the extent of Spartina colonies through surveillance. (CCW)

- Maintain close links with organisations which are monitoring bird numbers in the estuaries (RSPB, British Trust for Ornithology, North Wales Bird Monitoring Team) and attempt to relate any significant declines in bird numbers to habitat loss/food availability and the spread of Spartina. (CCW).

ii Links:

Mawddach SSSI
Dyfi SSSI/NNR

5.4.7.9 Removal of sand, gravel and rocks from the foreshore

Extent of the activity

There are reports of sand, gravel and rocks being removed from the shore by people although the actual extent of this activity within the cSAC is not know. Gwynedd Council has reported several incidences of this to the police. Much of the material used appears to be being collected for garden landscaping projects, inspired by the many gardening programmes on television. The removal of shingle is a particular problem which has been highlighted recently at Barmouth and Fairbourne.

How the factor may affect the features

Removal of beach material may affect the cSAC features by affecting beach stability (erosion and deposition) and as a result of removal of habitats (particularly where larger rocks are removed). The potential impact is primarily in the intertidal area.

Organisation(s) involved management

Gwynedd Council
Ceredigion County Council
Landowners
Crown Estate (as landowner)

Existing management

Removal of shingle, sand or rocks from a beach without prior consent from the land owner or occupier is illegal. There has been little enforcement of this although one case reported to the police resulted in an official caution.

Management response

Type of response

F2: The activity as the potential to affect the features of the cSAC but there is no evidence to suggest that it is doing so at present

Rationale

Further information is required about the extent of the activity before an assessment of the current and potential impact of this activity on the cSAC features can be made.

Management actions required (including links to other policies/plans/measures)

i Actions:

- Collate information about instances of unauthorised collection of shingle, sand and rocks from the foreshore of the cSAC. (Gwynedd Council, Ceredigion County Council)

- Raise awareness about the potential environmental implications of this type of activity with the public and others. (Relevant authorities).

5.5 Other considerations relevant to management of the cSAC

5.5.1 Legislation for marine SACs

A challenge for the development of marine SAC management plans is the nature of the legislation on which they are based and its interpretation. The 1992 Habitats Directive establishes the obligations of EU member states in relation to SACs, and in Great Britain the 1994 Habitats Regulations transpose these requirements into more specific powers and responsibilities of the competent (including relevant) authorities (see section 1.1 and Appendix 1.1 and 1.2). The development of this management plan, and experiences on other marine SACs, has revealed uncertainties over the interpretation of the legislation.

At a superficial level, the legislation is relatively straightforward. Each relevant authority is required to exercise its functions so as to comply with the requirements of the Habitats Directive, and each is empowered to establish a management scheme, in cooperation with the others, under which it will exercise those functions. However, an important task for the group of relevant authorities is to establish a common understanding of what exactly are the requirements of the Directive in relation to the site, and to integrate those requirements with the various other functions that each authority invariably has. The UK legislation and associated government policy do not resolve much of the uncertainty.

For example, CCW is required to advise the other relevant authorities as to the conservation objectives for the site, and any operations which may cause deterioration or disturbance. However, it is not clear to what extent this advice is to be regarded by the other relevant authorities as a legally definitive expression of the requirements of the legislation in relation to the site. Relevant authorities are clearly to be guided by that advice, but are not, it seems, legally bound by it. Therefore, in practice each of the relevant authorities, within the context of the management plan, needs to satisfy itself that it is meeting its obligations. Although considerable progress has been made, our collective understanding of the process is still developing.

Another area of uncertainty is the relationship between the management plan prepared by the relevant authorities, and the functions of other competent authorities who are not part of that process. As is clear from the preceding sections of this chapter, many of the potential factors affecting the features of the site would arise from plans and projects , for which specific statutory procedures are set out independently of the preparation of the management plan. Many of the important decisions that might affect the features of the cSAC will therefore be made outside the context of the management plan, including by competent authorities who are not relevant authorities.

Further uncertainty arises from the fact that it has not been established what types of operation do or do not constitute plans or projects. The UK Regulations in practice limit the term to a number of specific types of works (e.g. planning permissions, highway works, pipe-line construction, transport and works orders, discharge consents), even though no such limitation is defined in the Habitats Directive. Recent guidance from the EC suggests that the term should be used very broadly and should, as the term suggests, include plans (e.g. development plans, sectoral management plans) as well as actual operations. The relevant authorities, in preparing this management plan, have sought to make sensible judgements about what should be considered within the management plan, and what it is most practical to treat as a plan or project. It is important to note that, like the rest of the plan, this is an area that will be kept under review.

Actions, including links to other policies/plans/measures

- Raise awareness in Government and elsewhere about the problems likely to be encountered with the implementation of marine SAC legislation. The outputs from the LIFE project (see section 1.4), the aim of which is to provide experience of establishing marine SAC management schemes, will provide an opportunity to do this.

- Keep this management plan under review so that, in addition to improved understanding of the site itself, developments in understanding of the legislation can be taken into account.

5.5.2 Public Rights

5.5.2.1 Navigation

The entire area of the cSAC lies within tidal waters or intertidal land. Traditionally, there is a public right of navigation in UK tidal waters and over the foreshore. The right of navigation includes anchoring, and does not generally discriminate between different types of vessel. In other words, any vessel, whether recreational or commercial, may in law navigate anywhere within the cSAC. This does not only apply to vessels operated by UK citizens. The waters of the cSAC are also subject to rights of innocent passage by foreign registered vessels, under the UNCLOS. All commercial vessels (but not generally leisure craft) are subject to a range of national, European and international legislation concerning safety and environmental protection.

The existence of public rights of navigation is a basic fact of life for marine SACs. Fortunately, the exercise of such rights per se in and around the Pen Ll n a r Sarnau cSAC is not thought to pose a general threat to the wildlife features, although there may be specific local issues concerning recreational vessels (see section 5.4.6) and construction of associated shore-based facilities (see sections 5.4.1.1 and 5.4.2.2), and there is, of course, the ever-present risk of ship-source pollution from commercial vessels passing the area (see section 5.4.4.3).

On the positive side, the use of the cSAC by some recreational boat users may help generate an interest in, and concern for, its wildlife and habitats. The quality of the marine environment of Cardigan Bay and the Ll n Peninsula is one of the things that makes it so attractive to waterborne recreation, and hence is a significant factor in the local economy. The cSAC management process needs to harness the support of recreational users for the conservation of the marine wildlife as a key part of the natural environment of the area.

5.5.2.2 Sea Fisheries

There is a public right of fishery in UK tidal waters. This generally extends to any species of sea fish (except where protected from exploitation under other legislation, eg wildlife protection) and does not generally discriminate between persons or classes of persons. There are powers available to the UK fisheries authorities to regulate the exercise of this right - for example in relation to particular sea areas, the removal of particular species/sizes, the use of particular types of gear - but not to extinguish it. The fisheries within the cSAC are subject to a range of such regulatory measures (see section 5.4.5).

As with many types of recreational use, the conservation of wildlife of the cSAC and the protection of the quality of the marine environment, can be of benefit to fisheries interests and similarly, the sustainable management of fisheries can help conserve marine wildlife. Many of the potential threats to the wildlife of the area - such as from pollution of various kinds - are also threats to the well-being of local fisheries. While some types of fishing can be extremely damaging to marine habitats, the long term interests of local fishing communities surely lie in a healthy marine ecosystem.

5.5.2.3 Access to the foreshore

There is a custom (though not actually a right) of public access to the foreshore. Specific provision for access to the foreshore in some parts of the site is made by the local authorities (Gwynedd Council, Snowdonia National Park Authority and Ceredigion County Council) and in the case of coastal nature reserves, CCW.

As with water-borne recreation, widespread public access to the foreshore can have both positive and negative aspects. Negative effects can arise, for example, from over-exploitation of intertidal species (see sections 5.4.5.7 to 5.4.5.10), or from damage by trampling (see sections 5.4.6.4 and 5.4.6.5). On the positive side, the shoreline is the most accessible part of the marine environment, where the presence of diverse and interesting wildlife and habitats enhances people s enjoyment of the coast and can help raise awareness of the value of the marine environment.

Actions, including links to other policies/plans/measures

- Maintain links with interest groups, site users and local communities, especially fisheries and recreational users, through the Liaison Group, occasional public meetings and publications (relevant authorities)

5.5.3 Owner/occupier objectives

5.5.3.1 Crown Estate Commissioners

The subtidal sea bed, and much of the foreshore, is owned by the Crown and managed on its behalf by the Crown Estate Commissioners (CEC), under the Crown Estate Act 1961. The Crown Estate Commissioners have an obligation to maintain and enhance the value of the Crown Estate, including the marine estate.

The Crown Estate Commissioners are a competent authority under the Habitats Regulations, and therefore have certain duties and functions under the Habitats Directive and Regulations (see Section 1 and Appendix 1).

Ownership of the oil and gas resources of the seabed is vested in the Crown and managed by the DTI (see section 5.4.3.1). The aims and objectives of the UK government in this respect are:

- to maximise the economic benefit to the United Kingdom of its oil and gas resources, taking into account the environmental impact of hydrocarbon development, and the need to ensure secure, diverse and sustainable supplies of energy at competitive prices. In support of this aim the Directorate's objectives are to promote exploration for oil and gas resources over the maximum extent of the UKCS by means of an appropriate licensing

regime which pays due regard to the environment and to the interests of other land and sea users.... (quoted from DTI Oil and Gas Directorate website).

5.5.3.2 Leases of Crown foreshore to other bodies

A significant proportion of the beach area between mean low and mean high water around the cSAC is leased by the Crown Estate to Gwynedd Council, the National Trust and Ceredigion County Council. Some areas are leased by other organisations and/or individuals. Land leased to Ceredigion County Council prohibits the removal of sand, shingle etc. or other materials from the beach without prior consent in writing.

<< Further information about Crown foreshore leases to be sought >>

5.5.3.3 Harbour authorities

Gwynedd Council are the harbour authority for all the harbours within the cSAC.

Unless the harbour areas are leased from the Crown Estate (see above), this does not strictly make them ownerÄoccupiers. However, they represent a significant legal interest in the site. The objectives of harbour authorities are to maintain the safety of navigation and to regulate the use of harbours. Harbour authorities are also required to conform with a variety of environmental legislation, including of course the Habitats Directive and Habitats Regulations.

<< Further information about role of Harbour Revision Orders and Harbour Empowerment Orders to be added>>

5.5.5.4 Private landowners

Private ownership of land does not generally extend below mean low water mark. However, in the estuaries of the cSAC, there are substantial areas of land above MHWM which are in private ownership and subject to the varied and legitimate interests of their owners and occupiers (mainly agricultural activities). Such land, where included within the cSAC, is notified by CCW under section 28 of the 1981 Wildlife & Countryside Act as a Site of Special Scientific Interest (SSSI). SSSI status requires owners/occupiers to obtain the consent of CCW before carrying out any of a number of potentially damaging operations included by CCW in the notification. SSSIs included within the Pen Ll n a r Sarnau cSAC will take into account the conservation needs of the cSAC in identifying these notifiable operations . Thus the cSAC, and associated SSSIs do not remove the rights of owners and occupiers to use their, but requires them to do so in ways which do not threaten the wildlife interest.

5.5.4 Aspirations of local communities

The purpose of this section is to record, as best we can, the aspirations of local communities which sit alongside the nature conservation aims of the cSAC. Such information is vital to gain a proper understanding of the cSAC s management issues. And in any event, the legislation underpinning the cSAC - the 1992 Habitats Directive and the UK Regulations - make clear that the management of SACs must take account of economic, social, cultural requirements and local characteristics. It is hoped that this has been achieved by involving members of the public and representatives of local communities in the

development of this plan, both directly through public meetings, and indirectly through the creation of the Liaison Group. Furthermore, many of the relevant authorities themselves are answerable to their elected members.

In such a large area with such a diverse range of stakeholders including local communities and individuals, commercial and recreational users of the area, conservation groups and statutory authorities, it is no easy task to summarise in an inevitably limited space, people s aspirations in relation to the area. The following is based largely on the notes of the discussions that took place at the series of public meetings about the cSAC between October 1999 and February 2000.

Rather than simply list the many and varied comments that have been made concerning people s aspirations in relation to the area covered by the cSAC, an attempt has been made here to summarise them into main themes. Inevitably some aspirations are much more specific than others, some conflict with others, and some may have been missed. The following is not presented as a comprehensive account of all the aspirations of people living and working in and around the cSAC (an impossible task!). What it is however is a summary of the wide range of hopes, fears, positive views and doubts about the cSAC that have been made known to the authors of this management plan.

A thriving local economy....

- The SAC must not constrain the economic sustainability of the area.
- The area needs a sustainable local fishing industry, not hampered by burdensome regulations, and not threatened by pollution and over-fishing.
- The area must continue to attract water-based competitive events (for example as a potential Olympic watersports venue), and this will require investment in recreational boating facilities and infrastructure.
- The SAC must not compromise the needs of shoreline defences where they are protecting property.
- The area needs a diverse local economy which is not over-dependent on tourism.
- The SAC must not unnecessarily constrain new developments which could generate income.

A healthy environment rich in wildlife....

- The coastline is naturally dynamic and should be allowed to evolve more naturally.
- We should seek to restore the diversity and abundance of marine fish species, and especially reverse the declining populations of skates, rays and sharks.
- We need to reduce (or prevent) pollution from land-based sources, such as sewage effluents, agricultural chemicals, litter.
- We need to reduce (or prevent) pollution from sea-based sources, such as oil and litter.
- We need to address the threats to the hydrology, water quality, habitats and birds of the estuaries from damaging land uses in the estuaries themselves and in their catchment areas.
- Rare species like cetaceans and turtles should be protected, and we should ensure that the SAC provides suitable habitat for them.
- We should be conserving the whole marine ecosystem as well as protecting species and habitats

A high quality of life (for local humans!) and opportunities for enjoyment of the coast and sea....

- A balance is needed between the reliance of the local economy on tourism, and the social and environmental impacts of the influx of visitors.
- We need to protect the natural beauty and rural tranquillity of the area, and people s ability to enjoy them.
- We need to protect the recreational value of the wildlife itself, from children studying rockpools to scuba diving.
- The SAC must not threaten the quality of life and cultural identity of the area, such as its strong maritime traditions, and the importance of the Welsh language.
- Vested interests should be prevented from developing marinas with dubious wider social and economic benefits and risks of environmental damage.
- We should promote awareness of the wildlife of the cSAC amongst children and adults
- We need to be free of the menace of jet-skis.
- We need to ensure that there are safe and enjoyable areas for jet-skiers to use.

Looking to the future....

- Local people must be able to contribute meaningfully to the management of the area. They must be part of the decision-making processes, which must therefore be open, democratic and based on timely and effective communication.
- The management plan needs to keep options open . It must not close the door to future development and must always be subject to review.
- The young people of the area are the key to its future, so we need to stimulate their interest in the cSAC and the issues it raises.
- Our ability to protect the marine environment is limited. We need more resources for research into the causes of damage, and for the implementation of conservation measures.

Actions, including links to other policies/plans/measures

(See also actions in relation to particular factors (sections 5.3 and 5.4) many of which are relevant here.)

- Maintain links between interest groups, site users, local communities and relevant authorities, through the Liaison Group, occasional public meetings and publications, to ensure timely and effective communication about conservation issues and people s aspirations.

- Keep the liaison process under review to ensure that it is meeting needs of both relevant authorities and other stakeholders.

- Continue to operate a bilingual policy with respect to meetings and publications.

- Explore ways to raise awareness and interest among schools and young people.

5.5.5 Environmental Considerations

5.5.5.1 Geographic scale of processes affecting features

Owing to the mobility of marine waters, organisms and sediments, often over considerable distances, the features of the cSAC may be affected by influences originating at a considerable distance from the site boundary. Similarly, rivers and land runoff entering the cSAC can carry materials from the adjacent land catchment areas. Therefore, even leaving aside natural processes, the management of many factors affecting the features is not directly within the remit of the relevant authorities for the site, but to other relevant and competent authorities, and even, in the case of influences originating further offshore, to other countries and international organisations. A document such as this needs to acknowledge its own limitations, and do what it can to raise wider awareness of the conservation requirements of the cSAC.

Actions, including links to other policies/plans/measures

- Distribute the management plan widely, in particular to competent authorities.

- Ensure all relevant departments within relevant authorities are aware of responsibilities and best means of securing compliance.

5.5.5.2 Challenges of management and monitoring in the marine environment

Unlike a terrestrial site managed for nature conservation, there is no clear means of direct management of marine habitats (for example equivalent to scrub clearance, grazing regimes, planting). We are only able to contribute to the maintenance of a favourable condition of wildlife and habitats by tailoring our management such that it enables, as far as possible, natural processes to take their course.

A considerable proportion of condition and compliance monitoring as well as most site research and surveillance will need to take place on or in the sea. The marine environment poses considerable logistical, health and safety and resource constraints to those who undertake such work.

Actions, including links to other policies/plans/measures

- Make effective use of new technology to minimise the amount of work required at sea.

5.5.5.3 Level of current knowledge

Our understanding of the wildlife of the cSAC, its ecological relationships and interactions with human activities in the area, is limited, and this presents a considerable challenge to effective management. Recent, and on-going work under the auspices of the LIFE-funded UK Marine SACs Project (see section 1.6 and Appendix 1.5) has made progress with collating existing information and developing our current level of understanding. However, to answer some of the most fundamental management questions a comprehensive programme of research over many years is required. Such programmes are costly. The UK Marine SACs Project is nearing completion, and it is not known what resources will be available in future to fund such work. (See section below on resources.)

Actions, including links to other policies/plans/measures

- Seek funding to resource further essential research.

- Initiate further relevant research.

5.5.5.4 Lack of awareness and understanding

It is possible that competent authorities (and the general public) some distance from the cSAC will not consider the potential for their actions to affect a species on a site many miles away and of which they might not be aware.

Actions, including links to other policies/plans/measures

- Distribute the management plan widely, in particular to competent authorities.

- Ensure all relevant departments within relevant authority organisations and local competent authorities are aware of responsibilities and best means of securing compliance.

5.5.6 Resources

The development of this management plan has required a significant resource investment by some of the site s relevant authorities. This has mostly been in the form of officers time, but considerable additional resources have also been required to undertake research projects, and to involve users of the site and local communities in the development of the management plan.

5.5.6.1 The UK Marine SACs Project

Fortunately this cSAC has been one of 12 demonstration SACs in the UK where the development of management plans has directly benefited from European funding under the LIFE II programme. The UK Marine SACs Project is a four and a half year programme run jointly by the UK nature conservation agencies, with the help of the relevant authorities on the 12 pilot sites and a range of other partners. Details of the project are given in Appendix 1.6.

LIFE funds have helped to support research work, publications and community participation in the Pen Ll n a r Sarnau cSAC over the last few years. However, the UK Marine SACs Project comes to an end in 2001. Beyond this, resources to support the further development of the management plan, and indeed the management of the cSAC, will either have to come from the relevant authorities themselves or from an external funding source. With few exceptions, funding for relevant authorities has not been increased in conjunction with their new SAC management responsibilities.

5.5.6.2 EU Objective 1 Funding

West Wales and the valleys have qualified for Objective 1 status, the European Union s highest level of regional aid. A programme document (Single Programme Document) that identifies priorities and measures for the period year 2000 to 2006 has been submitted to the EU. The potential for supporting SAC management through Objective 1 will be explored.

Actions, including links to other policies/plans/measures

- Identify and seek funding for initiatives arising from this management plan from internal and external sources, including Objective 1.

6. SUMMARY LIST OF ACTIONS ARISING FROM THIS MANAGEMENT PLAN, AND LINKS TO OTHER PLANS / PROGRAMMES

This section simply lists together, as a checklist, all the actions arising from the consideration of all the factors in Chapter 5. The headings follow those in Chapter5, and the relevant section number of Chapter 5 is given in brackets next to each heading. Note also that a number of actions arise from Chapter 4 (Conservation objectives), mainly to do with the research/monitoring functions of CCW.

6.1 Natural factors *(5.3)*

Actions

- Develop and establish a programme of surveillance for key aspects of the natural processes within the cSAC. There is already a certain amount of relevant work that has been, or is being carried out by the relevant authorities and others that is appropriate to this. CGP (in prep) reviews existing data sets and environmental surveillance programmes, and contains some recommendations for the types of surveillance needed to improve understanding of the effects of natural processes on the reefs and estuaries. The relevant authorities will need to consider the conclusions of this work in developing and undertaking future surveillance and research programmes.

- Maintain 'watching brief' surveillance of climate change and other natural processes affecting Cardigan and Caernarfon Bays through occasional liaison with relevant research institutions.

- Encourage and support policies and management within and around the site which will help minimise any potential impacts of climate change on the reefs and estuaries. For example, consider the potential implications of sea level rise and likely change in the estuaries when assessing development proposals in the estuaries.

Links

X Existing beach profiling and estuary dredging carried out by Gwynedd Council and others

X Ongoing development of shoreline management plans (SMPs)

X Local Environment Agency Plans (LEAPs)

6.2 Activities related to the construction of coastal and inshore structures *(5.4.1)*

6.2.1 Construction of ports, harbours, marinas, slipways (and other similar coastal developments) *(5.4.1.1)*

Actions

- Treat the construction of ports, harbours, marinas, slipways and similar coastal developments as a Plan or Project. (Appropriate competent authorities).

- Competent authorities to review extant planning permissions for such developments. (Appropriate competent authorities).

- Review the extent of unauthorised slipway develompents and take enforcement action where appropriate.

- Consider the preparation of a strategy for the northern Cardigan Bay area covering the future requirements for port, harbour, marina, and slipway developments to assist with planning future management of the cSAC within the framework of the Unitary Development Plan (UDP) process. (Gwynedd Council, Ceredigion County Council and Snowdonia National Park Authority to incorporate within their UDPs).

- Carry out an appropriate screening assessment of any port, harbour, marina, slipway developments (or other similar developments) likely to affect the Pen Ll□n a'r Sarnau cSAC. (Gwynedd Council, Ceredigion County Council and Snowdonia National Park Authority).

- Ensure that the SAC is taken fully into account in the preparation of strategic plans (e.g. Unitary Development Plans), and combined development proposals (e.g. in relation to European or other funding) and ensure a consistency of approach amongst the appropriate competent authorities. (Gwynedd Council, Ceredigion County Council, Snowdonia National Park Authority and other competent authorities).

Links

- Cardigan Bay cSAC Management Plan – developments addressed within this may be relevant to the Pen Ll□n a'r Sarnau cSAC and vice-versa.

6.2.2 Shoreline defence structures, including maintenance and improvement of existing defences and construction of new defences *(5.4.1.2)*

Actions

- Review extant planning permissions for coastal defence works (Competent authorities)

- Review the extent of unauthorised slipway develompents and take enforcement action where appropriate (Competent authorities).

- Treat shoreline defence works as a Plan or Project (Competent authorities).

- Encourage the use of more modern, holistic approaches to the future design of coastal defence in the cSAC (Gwynedd Council, Ceredigion County Council, Snowdonia National Park Authority, Environment Agency Wales)

- Continue the programme of monitoring of coastal processes which has been set up as part of the

work for Shoreline Management Planning to provide advice on best coastal defence options. Keep this programme under review and identify any new requirements as appropriate. (Gwynedd Council, Ceredigion County Council, Ynys Enlli to Llandudno Coastal Group).

- Ensure that the implications of possible alterations to sea level, wave exposure and other physical processes as a result of climate change are fully considered in the development and maintenance of new and existing coastal defence works. (Gwynedd Council, Ceredigion County Council, Ynys Enlli to Llandudno Coastal Group).

Links

- Ensure that the cSAC is taken fully into account in the preparation and review of the relevant Shoreline Management Plans.

- Local Authority Unitary Development Plans

6.2.3 Land reclamation *(5.4.1.3)*

Actions

- Review extant planning permissions for land reclamation works (Competent authorities.)

- Treat land reclamation works as a Plan or Project . (Competent authorities)

- Review the Habitats Regulations (Plans and Projects) with respect to permitted developments which may affect an SAC. (UK Government / National Assembly of Wales)

- Carry out an appropriate screening assessment for land reclamation proposals likely to affect the Pen Ll□n a'r Sarnau cSAC (Gwynedd Council, Ceredigion County Council, Snowdonia National Park Authority)

- Develop an overview of land reclamation proposals for each of the cSAC estuaries in order to enable a strategic consideration of the potential overall impact of these works on the estuary features and to identify requirements and opportunities to reverse previous land claim. (Countryside Council for Wales)

- Raise awareness of the potential implications of land reclamation for the cSAC amongst those responsible for managing and undertaking such work. (Gwynedd Council, Ceredigion County Council, Snowdonia National Park Authority, Countryside Council for Wales, Environment Agency Wales).

Links

- Eryri/Ll□n Local Environment Agency Plan (LEAP)

- Meirionnydd LEAP

- Shoreline management plans

- Unitary Development Plans - see Appendix 5.2 (Gwynedd Council, Ceredigion County Council, Snowdonia National Park Authority (in preparation))
- Snowdonia National Park Authority Eryri Local Plan (see Appendix 5.2)
- Dyfi SSSI/National Nature Reserve (NNR) plan

6.3 Dredging, dumping and depositing of material (s.5.4.2)

6.3.1 Aggregates dredging *(5.4.2.1)*

Actions
- Treat marine aggregate dredging as a plan or project (Competent authorities)

Links
- Cardigan Bay cSAC management plan

6.3.2 Capital and maintenance dredging *(5.4.2.2)*

Actions
- Review extant planning permissions for capital and maintenance dredging works (competent authorities)
- Seek clarification of the relationship between Harbour Revision Orders and Harbour Empowerment Orders and the Habitats Regulations. Assess the implications of existing and proposed HRO's and HEO's for the cSAC features.
- Treat capital and maintenance dredging as a Plan or Project. (Competent authorities)
- Produce Dredging Plans for the area within and immediately adjacent to the cSAC to clarify the future dredging requirements within the area and consider disposal options. Link to those being produced as part of the Cardigan Bay cSAC management plan. (Gwynedd Council)
- Ensure that the cSAC is taken fully into account in the preparation and review of Harbour Revision Orders and Harbour Empowerment Orders. (Gwynedd Council).
- Ensure the cSAC is taken fully into account in the preparation of any regional development proposals (e.g. in relation to European or other funding). (Gwynedd Council, Ceredigion County Council).

Links
- Cardigan Bay cSAC management plan
- Dyfi SSSI/NNR management plan

6.3.3 Disposal/dumping of sediment / material *(5.4.2.3)*

Actions

- Review any extant authorisations for sediment disposal/dumping (Competent authorities)
- Treat sediment disposal/dumping as a Plan or Project (Competent authorities).
- Produce Dredging Plans to clarify future requirements for sediment disposal (Gwynedd Council, Ceredigion County Council).
- If new sea disposal site closer to the cSAC is considered, the assessment for this will need to include appropriate monitoring and surveillance to ensure the requirements of the cSAC features are taken fully into account. (MAFF &/or National Assembly of Wales)
- Ensure the cSAC is taken fully into account in the preparation of any regional development proposals (e.g. in relation to European or other funding) that may involve requirements for sediment disposal/dumping. (Local authorities and others).
- Ensure that any proposals for sediment disposal/dumping (in particular in coastal/intertidal areas) are assessed in the context of the relevant Shoreline Management Plans. (Local authorities and other competent authorities)
- Ensure that any proposals for sediment disposal/dumping (in particular within and adjacent to the estuaries) are assessed in the context of the relevant Local Environment Agency Plans (LEAPs). (Environment Agency and other competent authorities)

Links

- Cardigan Bay cSAC Management Plan

6.3.4 Mineral / ore extraction *(5.4.2.4)*

Actions

- Competent authorities to review any extant authorisations for mineral extraction
- Treat mineral extraction operations as a Plan or Project
- Ensure that any proposals for mineral extraction are assessed in the context of the relevant Local Environment Agency Plans (LEAPs).

6.3.5 Artificial reefs (excluding offshore coastal defence structures) *(5.4.2.5)*

Actions

- Treat the construction of artificial reefs as a Plan or Project (Competent authorities)

- If the artificial reef is associated with habitat enhancement for the local fishery, ensure that the need for and suitability of an artificial reef has been considered in relation to the existing availability of habitat and whether this is a limiting factor for the fishery stock. (Competent authorities)

- Ensure the cSAC is taken fully into account in the preparation of any regional development proposals (e.g. in relation to European or other funding) that may involve requirements for artificial reef construction. (Local authorities and others).

- Ensure that any proposals for artificial reef structures (in particular in shallow coastal areas) are considered in the context of the relevant Shoreline Management Plans. (Local authorities).

6.4 Offshore activities *(5.4.3)*

6.4.1 Oil and gas exploration and development *(5.4.3.1)*

Actions

- Ensure that EIAs and appropriate assessments under the 1994 Habitats Regulations, where required, are carried out on all operations associated with offshore oil or gas developments within the UK sector of the southern Irish Sea. (Dti)

- Ensure that oil spill and other emergency continency plans adequately address the requirements of the cSAC features. (Gwynedd Council, Ceredigion County Council, Snowdonia National Park Authority, Environment Agency Wales, Countryside Council for Wales, MAFF, Maritime and Coastguard Agency).

6.4.2 Offshore windfarms and other alternative energy structures *(5.4.3.2)*

Actions

- Treat such developments as a Plan or Project. (Competent authorities)

- Monitor the development of UK government policy/strategy with respect to the development of offshore alternative energy generation, and ensure that the SAC is appropriately considered in the development of such a policy, e.g. in any consultation exercises. (Countryside Council for Wales, Gwynedd Council, Ceredigion County Council, Snowdonia National Park Authority).

6.4.3 Cables & pipelines *(5.4.3.3)*

Actions

- Ensure the competent authorities are aware of their responsibilities with respect to the cSAC (includes Manweb, British Telecom, National Grid and others listed in table above).

- Treat the installation of submarine pipelines or cables as a plan or project (competent authorities)

- Ensure Environmental Impact Assessment legislation is followed (competent authorities)

6.5 Discharges from land and shipping *(5.4.4)*

6.5.1 Discharges: sewage, stormwater, industrial etc *(5.4.4.1)*

Actions

- Continue to influence investment on maintenance and improvement in D□r Cymru's sewage treatment works and outfalls through the Asset Management Plan (AMP) process, for example the recent upgrading of treatment at Porthmadog STW (EAW, D□r Cymru)
- EAW continue water quality monitoring and implement appropriate actions from the Eryri/Ll□n and Meirionnydd LEAPs.
- EAW to review existing discharge consents.
- Work towards defining water quality requirements for the estuarine communities (CCW)
- Surveillance on coastal water quality and occupance of algal blooms etc (CCW in conjunction with EAW)
- Document/clarify industrial discharges into the cSAC and its catchment and the effect of any known defunct industries that could still have discharges occurring.

Links

- Asset Management Plan (AMP) 3 process

6.5.2 Agricultural run-off and other diffuse inputs *(5.4.4.2)*

Actions

- EAW to continue monitoring agricultural discharges.
- EAW to provide available information via public register on diffuse agricultural inputs, e.g. details of groundwater authorisations for disposal of sheep dip
- Clarify the nature and scale of diffuse inputs going into the cSAC, and assess their significance in terms of their possible effect on the features (singly or in combination with other inputs). As part of this, clarify which organisations collect data relevant to this issue (Countryside Council for Wales, EAW, Local authorities)
- EAW to implement appropriate actions from the Eryri/Ll□n and Meirionnydd LEAPs, for example with regard to sheep dip, acidifications and metal levels.
- Raise awareness about water quality issuesin the catchment areas around the estuaries and other parts of the cSAC (e.g. through production and distribution of a leaflet).

Links

- Eryri/Ll□n and Meirionnydd Local Environment Agency Plans (LEAPs).

6.5.3 Accidental, unlicensed, unregulated discharge from land or shipping (including oil pollution and use of anti-fouling) *(5.4.4.3)*

Actions

- Clarify existing contingency plans and ensure that they are up to date. (Gwynedd Council, Ceredigion County Council, Environment Agency Wales, Countryside Council for Wales, Port/Harbour authorities).

- Ensure the cSAC is addressed through the setting up and running of a Shadow Environment Group for North Wales (Environment Agency Wales, MAFF, Countryside Council for Wales).

- Clarify regulatory mechanisms and policies with respect to re-fueling of vessels in harbours, marinas and on beaches (Local authorities, port/harbour/marina authorities and operators).

- Promote good practice with respect to re-fueling operations at all locations around the cSAC. (Local authorities, port/harbour/marina authorities and operators.

- Carry out further work to clarify the rate of incidence of minor fuel and oil spills within the cSAC including re-fueling on beaches. (Local authorities, port/harbour/marina authorities and operators, Environement Agency Wales).

- Promote codes of conduct and good practice guidelines for use and disposal of antifoulants and disposal of sewage from small vessels. (Local authorities, port/harbour/marina authorities and operatora, Welsh Yachting Association, DETR, Environment Agency Wales.)

- Continue to be vigilant over activities and pollutant sources which might threaten the integrity of the cSAC and take action based on a realistic assessment of risk. (Everybody)

Links

- Port Waste Management Plans

6.5.4 Discharges from mineral, ore extraction and quarrying activities *(5.4.4.4)*

Actions

- Continue water quality monitoring and implement appropriate ations from the Eryri/Ll□n and Meirionnydd Local Environment Agency Plans (LEAPs), including continued monitoring of the discharges from the former Gwynfynydd gold mine (EAW).

- Assess the effects on the reefs and estuaries of diffuse inputs going into the cSAC, including from old mines (EAW, local authorities and CCW)

- Promote, in partnership with others, the reclamation of disused metal mines where there is significant environmental benefit. (Competent authorities)

Links

- Local Authority Unitary Development Plans (UDPs) - see Appendix 5.2

- Eryri/Ll□n and Meirionnydd LEAPs.

- Gwynedd County Council - Supplementary Planning Guidance (SPG) on Minerals: adopted March 1996 - in force until UDP comes out, in which there will be a chapter on minerals issues.

6.6 Fishing activities *(5.4.5)*

6.6.1 Towed bottom fishing gear: Scallop dredging and trawling *(5.4.5.1)*

Actions
- NW&NWSFC to maintain restriction area to protect the horse mussel reef

- NW&NWSFC to continue to collate information on number of vessels and fishing locations to better understand where scalloping takes place within the cSAC

- Observe numbers of vessels using towed bottom gear. If a significant increase in fishing activity using towed bottom gear is observed, other management actions might be needed.

6.6.2 Suction and mechanised dredging for shellfish *(5.4.5.2)*

X No actions necessary.

6.6.3 Netting (including tangle nets and other bottom set nets) *(5.4.5.3)*

Actions
- Watching brief on the extent of netting.

6.6.4 Potting (crustacea and whelks) *(5.4.5.4)*

Actions
- Watching brief on the extent/intensity of potting.

- Lobster stock assessments?

6.6.5 Fish/shellfish farming *(5.4.5.5)*

Actions
X No actions presently required.

6.6.6 Cockling (hand collection) *(5.4.5.6)*

Actions
- NW&NWSFC to continue to monitor the cockle stocks in the estuaries

- Promote the intertidal shellfisheries voluntary code of conduct to people undertaking shellfish

collection

6.6.7 Bait collection *(5.4.5.7)*

Actions
- Promote national code of conduct for anglers within the cSAC.

6.6.8 Angling *(5.4.5.8)*

Actions
- Promote national code of conduct for anglers within the cSAC.

- Promote the adoption of "catch and release" as the basis for sea angling competitions within the cSAC, rather than bag sizes.

- Improve publicity to anglers about thc cSAC and bass nursery areas.

6.6.9 Collection of marine plants (including macro-algae and glasswort) *(5.4.5.9)*

Actions
- Collate any available information on nature and scale of marine plant collection within the cSAC. (Relevant authorities)

6.7 Recreational activities *(5.4.6)*

6.7.1 Recreational boat use *(5.4.6.1)*

Actions
- Promote relevant codes of conducts and encourage good practice amongst boat owners and operators and those participating canoeing, surfing and other watersports. (Relevant authorities, governing bodies of sports, outdoor activity centres and others)

- As part of the interpretation of the cSAC, provide information specifically for boat owners and operators, outdoor activity centres and people participating in all forms of recreational boat/craft us and watersports about the cSAC and its wildlife. (Relevant authorities)

- Encourage those participating in boating activities to submit records of wildlife sightings to the appropriate organisation. (Relevant authorities, governing bodes of sports, outdoor activity centres and others)

- Assess the potential impact of any future development of new or additional infrastructure facilities on the reefs and estuaries of the cSAC (many of these activities/developments are likely to be treated as plans or projects). (Gwynedd Council, Ceredigion County Council, Snowdonia National Park Authority, Countryside Council for Wales).

- Keep a watching brief on the scale and location of powered craft use within the estuaries. (Gwynedd Council, Ceredigion County Council, Snowdonia National Park Authority).

Links
- Ceredigion Sport and Recrational Strategy (2000).

- Ceredigion Coast and Countryside Strategy (2000)

- Cardigan Bay cSAC Management Plan

6.7.2 Access to the shore including vehicle use on beaches *(5.4.6.2)*

Actions
- Document available information about existing slipway access and sites of access across the beach, including vehicle use on beaches, and assess the implications of this on the cSAC features. (Relevant authorities)

6.7.3 Diving *(5.4.6.3)*

Actions
- Promote existing codes of conduct for divers. (Relevant authorities, scuba diving associations and clubs)

- Encourage the national governing bodies to promote awareness of the cSAC (and other SACs in the UK) and their management (Relevant authorities)

- Involve divers in carrying out biological surveys to get them more involved in the management process (Countryside Council for Wales, scuba diving associations)

- Raise awareness with divers and others about the cSAC, for example by publicising in an effective way the results of local surveys to generate interest in the area. (Countryside Council for Wales and other relevant authorities)

- Keep a watching brief on collection of non commercial marine species by divers (Relevant authorities).

Links
- National Seasearch Project (Underwater recording project for divers)

6.8 Other activities *(5.4.7)*

6.8.1 Forestry *(5.4.7.1)*

Actions
- Maintain surveillance of possible impacts of afforestation on water quality. (Relevant authorities)

- Further work required to quantify the possible impact of afforestation on the cSAC (in terms of restricting water run-off, and water quality impacts of diffuse run-off). (Relevant authoriites)

Links
- Forest Enterprise 'Forest Design Plans'

- Eryri/Ll□n and Meirionnydd Local Environment Agency Plans (LEAPs).

6.8.2 Grazing *(5.4.7.2)*

Actions

- None at present.

Links
- Coastal/estuary SSSI (draft) management plans and section 15 management agreements

6.8.3 Maritime / coastal archaeology *(5.4.7.3)*

Actions
- Ensure that all the approriate competent authorities are aware of their responsibilties with respect to the cSAC. (Relevant authorities, Cadw, National Assembly for Wales)
- Review extant licenses for excavation and designated sites within the cSAC. (Cadw)

- Clarify the extent and nature of any excavations of coastal archaeology sites and unlicensed excavation/salvage and assess their potential impact on the cSAC features.

6.8.4 Scientific/educational studies *(5.4.7.4)*

Actions
- Promote appropriate codes of conduct about educational/scientific activities wihtin the cSAC. (Relevant authorities)

- Raise awareness about the cSAC with those undertaking educational/scientific studies. (Relevant authorities)

- Encourage approriate studies into the reefs and estuaries of the cSAC (Countryside Council for Wales, Gwynedd Council, Ceredigion County Council, Snowdonia National Park Authority, Environment Agency).

- Encourage sustainable use of the marine envionrment around Pen Llyn and north Cardigan Bay as a resource for teaching.

X Carry out more research, surveillance and monitoring relevant to teh management of the cSAC (Relevant authorities and others)

6.8.5 Litter *(5.4.7.5)*

Actions

- Ensure provision of adequate rubbish disposal and recycling facilities for the public, along with publicity on their location, etc

- Stricter enforcement of anti-littering laws to deter fly-tipping and littering by businesses and the public.

- Encourage participation in voluntary local initiatives such as Adopt-a-Beach and river clean-ups.

- Provision of information and education to encourage everyone to properly dispose of litter.

Links

- Cardigan Bay cSAC Management Plan

- Marine Conservation Society 'Beachwatch' campaign and 'Adopt a Beach' initiative.

6.8.6 Military activities *(5.4.7.6)*

Actions
- Ensure that as competent authorities, MOD and DERA are aware of their responsibilities with respect to the cSAC.

6.8.7 Introduction/spread of non-native species *(5.4.7.7)*

Actions
- All competent authorities should take due account of relevant national and international legislation on the control and prevention of the introduction/spread of non-native and alien species.

- NAW/DETR/MAFF to consider any applications for the translocation or release of any species listed on schedule 9 of the WCA, or any non-native species, to waters or estuarine areas within or adjacent to the cSAC, in view of their potential to affect the features of the cSAC. Such applications should be treated as plans or projects, and consultation with CCW should take place as part of such consideration.

- Maintain surveillance of the introduction and spread of non-native species which may adversely effect the condition of the cSAC features, in particular *Sargassum muticum.* (CCW in conjunction with others).

- Through a programme of awareness and interpretation, seek the involvement of people using the cSAC to report sightings of particular non-native species. (CCW).

6.8.8 Further spread of *Spartina* *(5.4.7.8)*

Actions
- Maintain a watching brief on the extent of *Spartina* colonies through surveillance. (CCW)

- Maintain close links with organisations which are monitoring bird numbers in the estuaries (RSPB,

British Trust for Ornithology, North Wales Bird Monitoring Team) and attempt to relate any significant declines in bird numbers to habitat loss/food availability and the spread of Spartina. (CCW).

Links
- Mawddach SSSI management plan

- Dyfi SSSI/NNR Management plan

6.8.9 Removal of sand, gravel and rocks from the foreshore *(5.4.7.9)*

Actions
- Collate information about instances of unauthorised collection of shingle, sand and rocks from the foreshore of the cSAC. (Gwynedd Council, Ceredigion County Council)

- Raise awareness about the potential environmental implications of this type of activity with the public and others. (Relevant authorities).

6.9 Other considerations relevant to management of the cSAC *(5.5)*

6.9.1 Legislation for marine SACs *(5.5.1)*

Actions

X Raise awareness in Government and elsewhere about the problems likely to be encountered with the implementation of marine SAC legislation. The outputs from the LIFE project (see section 1.4), the aim of which is to provide experience of establishing marine SAC management schemes, will provide an opportunity to do this.

X Keep this management plan under review so that, in addition to improved understanding of the site itself, developments in understanding of the legislation can be taken into account.

6.9.2 Public Rights *(5.5.2)*

Actions
- Maintain links with interest groups, site users and local communities, especially fisheries and recreational users, through the Liaison Group, occasional public meetings and publications (relevant authorities)

6.9.3 Owner/occupier objectives *(5.5.3)*

Actions

X No specific actions proposed (but see actions in response to other factors).

6.9.4 Aspirations of local communities *(5.5.4)*

Actions (See also actions in relation to other factors, many of which are relevant here.)

X Maintain links between interest groups, site users, local communities and relevant authorities, through the Liaison Group, occasional public meetings and publications, to ensure timely and effective communication about conservation issues and people's aspirations.

X Keep the liaison process under review to ensure that it is meeting needs of both relevant authorities and other stakeholders.

X Continue to operate a bilingual policy with respect to meetings and publications.

X Explore ways to raise awareness and interest among schools and young people.

6.9.5 Environmental Considerations *(5.5.5)*

Actions

X Distribute the management plan widely, in particular to competent authorities

X Ensure all relevant departments within relevant authorities are aware of responsibilities and best means of securing compliance.

6.9.5.1 Geographic scale of processes affecting features *(5.5.5.1)*

Actions

X Distribute the management plan widely, in particular to competent authorities.

X Ensure all relevant departments within relevant authorities are aware of responsibilities and best means of securing compliance.

6.9.5.2 Challenges of management and monitoring in the marine environment *(5.5.5.2)*

Actions

X Make effective use of new technology to minimise the amount of work required at sea.

6.9.5.3 Level of current knowledge *(5.5.5.3)*

Actions

X Seek funding to resource further essential research.

X Initiate further relevant research.

6.9.5.4 Lack of awareness and understanding *(5.5.5.4)*

Actions

X Distribute the management plan widely, in particular to competent authorities.

X Ensure all relevant departments within relevant authority organisations and local competent authorities are aware of responsibilities and best means of securing compliance.

6.9.6 Resources *(5.5.6)*

Actions

X Identify and seek funding for initiatives arising from this managament plan from internal and external sources, including Objective 1.

7. RECORDING, REVIEW AND REPORTING

Site management will require regular review as circumstances in the Pen Ll_n a'r Sarnau cSAC change over time. This section explains the mechanism and timetable for such a review process.

At any given time, the current version of this plan can, at best, only be based on the current state of knowledge. As our understanding of the site improves, and changes take place in the physical, biological and socio-economic environment, it will be important to review and revise the management plan.

The Action Plan (Chapter 6) identifies all the specific "projects" (items of work) arising from the parts of the plan dealing with conservation objectives and feature monitoring, and consideration of the factors affecting the features of the cSAC. The projects provide the basis for recording and review of the management plan.

7.1 Recording

It is essential that records are kept of all the actions taken towards each project identified in the Action Plan. In particular, the following must be recorded:

- results of survey and research projects
- results of monitoring of the condition of the reefs and estuaries
- results of surveillance or monitoring of factors affecting the features
- the implementation of all of the actions in the management plan

It is also important to record any significant "events" that may affect the site and the features. Events might include unforeseen environmental events or human actions that would not already be identified through on-going surveillance of the factors identified in section 5, and also socio-political events that might affect the arrangements through which this management plan is implemented (e.g. developments in legislation or policy affecting the functions and priorities of relevant and other competent authorities).

In general, responsibility for recording actions and results associated with a project of work resides with the body responsible for the project. This information will be reported to the relevant authorities group at regular intervals so that a complete summary of the state of implementation of the management plan can be maintained.

Ideally records should be made as soon as possible after completion of a project. For on-going or composite projects (e.g. monitoring or surveillance programmes, or research projects), a suitable interval for recording progress needs to be defined. Ideally, record keeping will be part of the specification for each individual project.

7.2 Review

Record keeping is a pre-requisite to review of the management plan. Overall, the purposes of review are to:

- ensure that the site is being managed in accordance with the management plan
- ensure that the plan is suitable for achieving the objectives,
- enable the relevant authorities to report on the implementation of measures and the success of the plan in delivering the requirements of the Habitats Directive.

Responsibility for review of this management plan is held by all the relevant authorities, as these are the bodies with the statutory responsibility for preparing and implementing it. As with the preparation and implementation of the plan, all significant review of the plan will take place in consultation with other interests in the site, in particular through the Liaison Group and, if appropriate, public consultation.

The appropriate timescales for review vary with the subject under review, and this is outlined below. In general however, elements of the plan should be reviewed annually, with major reviews at 6 yearly intervals (this is the reporting interval required by the Habitats Directive - see section 7.3 below).

An effective process of review of the management plan needs to address a number of areas, namely:

- whether the objectives are being met;
- whether agreed management actions have been implemented;
- whether the management measures have had the desired effect on the factor affecting the feature;
- whether the agreed management actions are appropriate;
- whether the objectives themselves should be revised.

Each of these is considered in turn below.

7.2.1 Review of condition of the features against the conservation objectives

Ultimately, this is the most important element of the review of the management plan: whether it is achieving what it is meant to achieve. The purpose of the projects concerned with monitoring the condition of the reefs and estuaries is to provide the information required for this aspect of the review.

If the objectives are met, changes in management are not required. If the objectives are not met, it is necessary to review other elements of the management plan, in order to determine what steps, if any, are required. A failure to meet the objectives may be for many different reasons, such as:

- agreed actions may not have been implemented
- agreed actions may have been implemented but may be inappropriate to the achievement of the objectives
- actions may be required but have not been agreed or implemented
- influence of factors outside any management control
- the objectives may not be achievable

As can be seen from Chapter 4 of this plan, the conservation objectives are not precisely defined at present, and are, themselves, subject to review (see section 7.2.5 below). Even if the objectives were precisely defined, it may be some time before it is possible to determine with any certainty whether they are being met, owing to the difficulties of monitoring many of the attributes.

Timescale: The frequency with which it is possible and desirable to undertake this element of the review will be determined largely by the time-frame within which the monitoring can provide the necessary information. Ideally, this element of the review should take place as frequently as possible (e.g. up to annually), but should not in any case be less than once every 6 years, owing the reporting timetable of the Habitats Directive. Monitoring of the condition of the features is a long term project and the first substantive review of this type may not be possible for some time.

7.2.2 Review of implementation of management actions

It is necessary to determine whether or not the agreed management actions have been implemented. Each action identified in the action plan should be recorded and any agreed actions not implemented need to be identified. The relevant authorities (and other competent authorities) are the bodies responsible for most of the actions arising from the management plan, and each is therefore responsible for ensuring that the projects in the action plan are implemented.

Timescale: This should take place annually.

7.2.3 Review of the effectiveness of management actions on factors

Most if not all of the management actions that are not concerned with the gathering of information, are concerned with managing factors rather than directly influencing the features themselves. It is essential therefore to review whether the actions are having the desired effect on the factor - this requires monitoring of the factor. For example, it is important to know whether a measure taken to, for example, reduce pollution of an estuary (which can be recorded as an action taken) is having the desired effect on water quality in the estuary.

Timescale: As with the monitoring of the condition of the feature, the timescale for this type of review is determined largely by the type of action and monitoring required. In general, review should be as frequent as possible (up to annually) and not less than once every 6 years.

7.2.4 Review of what management is required

The need to review what management actions are required can come either from the determination of whether or not the objectives are being achieved, or from other sources of information which suggest that the prescribed management actions should be changed

None of the actions in this plan arise from a firm conclusion that the features of the cSAC are in an unfavourable condition and that site management therefore needs to be changed. Our knowledge of the population, its condition and the factors affecting it is limited, and therefore many of the actions arise from a precautionary approach and the need to improve our understanding of the site. Research work, either on this site or relating to the effects of human activities on similar types of habitats elsewhere, can provide valuable information which may warrant re-examination of the actions set out in this plan.

Timescale: Annually.

7.2.5 Review of the conservation objectives

As mentioned above, the conservation objectives themselves need to be subject to review. At present they are not precisely defined and an important area of work arising from this plan is to enable the objectives and associated monitoring to be refined (see Chapter 4). As our knowledge of the reef and estuary communities improves, and techniques for monitoring their attributes are developed, it should be possible to improve the precision with which the objectives are expressed, both in terms of the attributes used and the targets and limits identified.

Timescale: The objectives should ideally be revised as soon as there are grounds to do so. However, as with monitoring of the condition of the features, the process of improving the objectives is a long term one and significant revisions of the objectives at frequent (e.g. annual) intervals is not possible.

7.3 Reporting

Under the Habitats Directive, the UK is required to report to the EC every six years, on the measures taken under the Directive and on the conservation status of the habitats and species identified in the Directive. Therefore for each SAC, including Pen Ll_n a'r Sarnau, the equivalent information is likely to be required, i.e. the measures taken, an evaluation of their effectiveness in conserving the features of the site, and the condition of the features.

This statutory requirement for reporting serves several important functions:

- it provides a means of evaluating the effectiveness of SACs in contributing to the aims of the Habitats Directive, namely the achievement of favourable conservation status of habitats and species of European importance;
- it enables the EC to monitor progress with the implementation of the Directive across all member states, including through SACs and other measures;
- it provides a means for the relevant authorities for each UK marine SAC to be held accountable for their actions, against the requirements of the legislation and, most importantly, against the condition of the habitats and species for which the sites are selected. Note that the government (In Wales, this means the National Assembly) has powers to intervene in management schemes;
- where factors are outside the control of the relevant authorities, it enables them to report that to Government, which is ultimately responsible to the EC for the implementation of the Habitats Directive in the UK.

The precise type and format of information that will need to be provided by the relevant and competent authorities to the UK government in relation to individual SACs has not yet been determined. However, this management plan is intended to contain all the information necessary to satisfy the Habitats Directive's requirement in relation to this site. Therefore it is one possibility that a copy of the plan itself, together with the information to be documented under sections 7.1 and 7.2 above, could itself constitute the "report" for this site.

8. Bibliography

This section lists both the references cited in the plan and general references relevant to particular sections. The information is presented separately for each section of the plan.

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8.2 Chapter 2

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Appendix 1

Appendix 1.1

The Habitats Directive: Definition of favourable conservation status for habitats and species

Favourable conservation status, for both habitats and species, is defined in Article 1 of the Habitats Directive.

For a habitat, the definition is as follows (Article 1.e):

> "conservation status of a natural habitat means the sum of the influences acting on a natural habitat and its typical species that may affect its long term natural distribution, structure and functions as well as the long-term survival of its typical species within [the European territory of the Member States...]"
>
> The conservative [sic] status of a natural habitats will be taken as 'favourable' when:
>
> · its natural range and 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, and
>
> · the conservation status of its typical species is favourable."

For a species (including "typical species" referred to above), the definition is as follows (Article 1.I):

> "conservation status of a species means the sum of the influences acting on the species concerned that may affect its long-term distribution and abundance of its populations within [the European territory of the Member States...
>
> The conservation status will be taken as favourable when:
>
> · population dynamics data on the species concerned indicate that it is maintaining itself on a long-term basis as a viable component of its natural habitats, and
>
> · the natural range of the species is neither being reduced nor is likely to be reduced for the foreseeable future, and
>
> · there is, and will probably continue to be, a sufficiently large habitat to maintain its population on a long-term basis."

Appendix 1.2

Extracts from the Conservation (Natural Habitats &c.) Regulations 1994 (SI 1994/2716)

Regulation 3: General duties of competent authorities
3(1) These Regulations make provision for the purpose of implementing, for Great Britain, Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora (referred to in these Regulations as 'the Habitats Directive').

3(2) The Secretary of State, the Minister of Agriculture, Fisheries and Food and the nature conservation bodies shall exercise their functions under the enactments relating to nature conservation so as to secure compliance with the requirements of the Habitats Directive.

Those enactments include:
- Part III of the National Parks and Access to the Countryside Act 1949
- section 49A of the Countryside (Scotland) Act 1967 (management agreements)
- section 15 of the Countryside Act 1968 (areas of special scientific interest)
- Part I and sections 28 to 38 of the Wildlife and Countryside Act 1981
- sections 131 to 134 of the Environmental Protection Act 1990
- sections 2, 3, 5, 6, 7 and 11 of the Natural Heritage (Scotland) Act 1991 and these Regulations

3(3) In relation to marine areas any competent authority having functions relevant to marine conservation shall exercise those functions so as to secure compliance with the requirements of the Habitats Directive.

This applies, in particular, to functions under the following enactments:
- the Sea Fisheries Acts within the meaning of section 1 of the Sea Fisheries (Wildlife Conservation) Act 1992
- the Dockyard Ports Regulation Act 1865
- section 2(2) of the Military Lands Act 1900 (provisions as to use of sea, tidal water or shore)
- the Harbours Act 1964
- Part II of the Control of Pollution Act 1974
- sections 36 and 37 of the Wildlife and Countryside Act (marine nature reserves)
- sections 120 to 122 of the Civic Government (Scotland) Act 1982 (control of the seashore, adjacent waters and inland waters)
- the Water Resources Act 1991
- the Land Drainage Act 1991, and
- these Regulations

3(4) Without prejudice to the preceding provisions, every competent authority in the exercise of any of their functions, shall have regard to the requirements of the Habitats Directive so far as they may be affected by the exercise of those functions.

Regulation 5: Identification of relevant authorities for marine areas
5 For the purposes of these Regulations the relevant authorities, in relation to a marine area or European marine site, are such of the following as have functions in relation to land or waters within or adjacent to that area or site:

(a) a nature conservation body;
(b) a county council, district council, London borough council or, in Scotland, a regional, islands or district council;
© the National Rivers Authority, a water undertaker or sewerage undertaker, or an internal drainage board;
(d) a navigation authority within the meaning of the Water Resources Act 1991 (k);
(e) a harbour authority within the meaning of the Harbours Act 1964 (l);
(f) a lighthouse authority;
(g) a river purification board or a district salmon fishery board;
(h) a local fisheries committee constituted under the Sea Fisheries Regulation Act 1966(m) or any authority exercising the powers of such a committee.

Regulation 6: Identification of competent authorities
6(1) For the purposes of these Regulations the expression "competent authority" includes any Minister, government department, public or statutory undertaker, public body of any description or person holding a public office.

The expression also includes any person exercising any function of a competent authority in the United Kingdom.

Regulation 33: Advice by CCW for European marine sites
33(2) As soon as possible after a site becomes a European marine site, the appropriate nature conservation body shall advise other relevant authorities as to:

(a) the conservation objectives for that site, and
(b) any operations which may cause deterioration of natural habitats of the habitats of species, or disturbance of species, for which the site has been designated.

Regulations 34 and 35: Management schemes for European marine sites
34(1) The relevant authorities, or any of them, may establish for a European marine site a management scheme under which their functions (including any power to make bylaws) shall be exercised to as to secure in relation to that site compliance with the requirements of the Habitats Directive.

34(2) Only one management scheme may be made for each European marine site

34(3) A management scheme may be amended from time to time

34(4) As soon as a management scheme has been established, or is amended, a copy of it shall be sent by the relevant authority or authorities concerned to the appropriate nature conservation body.

35(1) The relevant Minister may give directions to the relevant authorities, or any of them, so to the establishment of a management scheme for a European marine site.

35(2) Directions may, in particular:

(a) require conservation measures specified in the direction to be included in the scheme;
(b) appoint one of the relevant authorities to co-ordinate the establishment of the scheme;
© set time limits within which any steps are to be taken;
(d) provide that the approval of the Minister is required before the scheme is established; and

(e) require any relevant authority to supply to the Minister such information concerning the establishment of the scheme as may be specified in the direction.

35(3) The relevant Minister may give directions to the relevant authorities, or any of them, as to the amendment of a management scheme for a European marine site, either generally or in any particular respect.

35(4) Any direction under this regulation shall be in writing and may be carried or revoked by a further action.

35(5) In this regulation "the relevant Minister" means, in relation to a site in England, the Secretary of State and the Minster of Agriculture, fisheries and Food action jointly and in any other case the Secretary of State.

Regulations 48 to 53: Consideration of plans and projects

Assessment of implications for a European site

48(1) A competent authority, before deciding to undertake, or give any consent, permission or other authorisation for, a plan or project which:
(a) is likely to have a significant effect on a European site in Great Britain (either alone or in combination with other plans or projects), and
(b) is not directly connected with or necessary to the management of the site, shall make an appropriate assessment of the implications for the site in view of that site's conservation objectives

48(2) A person applying for any such consent, permission or other authorisation shall provide such information as the competent authority may reasonably require for the purposes of the assessment.

48(3) The competent authority shall for the purposes of the assessment consult the appropriate nature conservation body and have regard to any representations made by that body within such reasonable time as the authority may specify.

48(4) They shall also, if they consider it appropriate, take the opinion of the general public; and if they do so, they shall take such steps for that purpose as they consider appropriate.

48(5) In the light of the conclusions of the assessment, and subject to regulation 49, the authority shall agree to the plan or project only after having ascertained that it will not adversely affect the integrity of the European site.

48(6) In considering whether a plan or project will adversely affect the integrity of the site, the authority shall have regard to the manner in which it is proposed to be carried out or to any conditions or restriction subject to which they propose that the consent, permission or authorisation should be given.

Considerations of overriding public interest

49(1) If they are satisfied that, there being no alternative solutions, the plan or project must be carried out for imperative reasons of overriding public interest (which, subject to paragraph (2), may be of a

social or economic nature), the competent authority may agree to the plan or project notwithstanding a negative assessment of the implications for the site.

49(2) Where the site concerned hosts a priority of natural habitat type or a priority species, the reasons referred to in paragraph (1) must be either:

(a) reasons relating to human health, public safety or beneficial consequences of primary importance to overriding public interest, or

(b) other reasons which in the opinion of the European Commission are imperative reasons of overriding public interest.

49(3) Where a competent authority other than the Secretary of State desire to obtain the opinion of the European Commission as to whether reasons are to be considered imperative reasons of overriding public interest, they shall submit a written request to the Secretary of State:

(a) identifying the matter on which an opinion is sought. And

(b) accompanied by any documents or information which may be required.

49(4) The Secretary of State may thereupon, if he thinks fit, seek the opinion of the Commission; and if he does so, he shall upon receiving the Commission's opinion transmit it to the authority.

49(5) Where an authority other than the Secretary of State propose to agree to a plan or project under this regulation notwithstanding a negative assessment of the implications for a European site, they shall notify the Secretary of State.

Having notified the Secretary of State, they shall not agree to the plan or project before the end of the period of 21 days beginning with the day notified to them by the Secretary of State as that on which their notification was received by him, unless the Secretary of State notifies them that they may do so.

49(6) In any such case the Secretary of State may give directions to the authority prohibiting them from agreeing to the plan or project, either indefinitely or during such period as may be specified in the direction.

This power is without prejudice to any other power of the Secretary of State in relation to the decision in question.

Review of existing decisions and consents, &c.

50(1) Where before the date on which a site becomes a European site or, if later, the commencement of these Regulations, a competent authority have decided to undertake, or have given any consent, permission or other authorisation or, a plan or project to which regulation 48(1) would apply if it were to be reconsidered as of that date, the authority shall as soon as reasonably practicable, review their decision or, as the case may be, the consent, permission or other authorisation, and shall affirm, modify or revoke it.

50(2) They shall for that purpose make an appropriate assessment of the implications for the site in view of that site's conservation objectives; and the provisions of regulation 48(2) to (4) shall apply, with the appropriate modifications, in relation to such a review.

50(3) Subject to the following provisions of this Part, any review required by this regulation shall be carried out under existing statutory procedures where such procedures exist, and if non exist the Secretary of State may give directions as to the procedure to be followed.

50(4) Nothing in this regulation shall affect anything done in pursuance of the decision, or the consent, permission or other authorisation, before the date mentioned in paragraph (1).

Consideration on review

51(1) The following provisions apply where a decision, or a consent, permission or other authorisation, falls to be reviewed under regulation 50.

51(2) Subject as follows, the provisions or regulation 48(5) and (6) and regulation 49 shall apply, with the appropriate modifications, in relation to the decision on the review.

51(3) The decision, or the consent, permission or other authorisation, may be affirmed if it appears to the authority reviewing it that other action taken or to be taken by them, or by another authority, will secure that the plan or project does not adversely affect the integrity of the site.

Where that object may be attained in a number of ways, the authority or authorities concerned shall seek to secure that the action taken is the least onerous to those affected.

51(4) The Secretary of State may issue guidance to authorities for the purposes of paragraph (3) as to the manner of determining which of different ways should be adopted for securing that the plan or project does not have any such effect, and in particular -

(a) the order of application of different controls, and
(b) the extent to which account should be taken of the possible exercise of other powers;

and the authorities concerned shall have regard to any guidance so issued in discharging their functions under that paragraph.

51(5) Any modifications or revocation effected in pursuance of this regulation shall be carried out under existing statutory procedures where such procedures exist.

If none exist, the Secretary of State may give directions as to the procedure to be followed.

Compensatory measures

53 Where in accordance with regulation 49 (considerations of overriding public interest) -

(a) a plan or project is agreed to, notwithstanding a negative assessment of the implications for a European site, or
(b) a decision, or a consent, permission or other authorisation, is affirmed on review, notwithstanding such an assessment,
© the Secretary of State shall secure that any necessary compensatory measures are taken to ensure that the overall coherence of Natura 200 is protected.

Appendix 1.3

Marine habitats and species for which SACs can be selected

Special Areas of Conservation may be selected for the following marine habitats and species which are listed in Annex I and Annex II, respectively, of the Habitats Directive:

Marine and halophytic habitats listed in Annex I:

- Sandbanks which are slightly covered by seawater at low tide
- Estuaries
- Mudflats and sandflats not covered by seawater at low tide
- Lagoons
- Large shallow inlets and bays
- Reefs
- Submerged of partly submerged sea caves
- Annual vegetation of drift lines
- Perennial vegetation of stony banks
- Vegetated sea cliffs of the Atlantic and Baltic coasts
- *Salicornia* and other annuals colonising mud and sand
  Spartina swards
- Atlantic salt meadows
- Continental salt meadows
- Mediterranean salt meadows
- Mediterranean and thermo-Atlantic halophilous scrubs

Marine mammals and fish listed in Annex II:

- Bottlenose dolphin *Tursiops truncatus*
- Common seal *Phoca vitulina*
- Grey seal *Halichoerus grypus*
- River lamprey *Lampetra fluviatilis*
- Brook lamprey *Lampetra planeri*
- Sea lamprey *Petromyzon marinus*
- Allis shad *Alosa alosa*
- Twaite shad *Alosa fallax*
- Atlantic Salmon *Salmo salar*
- Spined loach *Cobitis taenia*
- Bullhead *Cottus gobio*

Appendix 1.4

Relevant authority functions and responsibilities with respect to the Pen Ll_n a'r Sarnau cSAC and Terms of Reference for the relevant authorities group

The regulation and management of sea areas within UK Territorial waters takes place under a complex system of legislation and policies that are operated by a number of statutory bodies and sometimes overlapping jurisdictions.

Ceredigion County Council

The County Council is a multi-purpose authority with responsibilities covering the environment, transport, education, social services, housing and economic development. The following duties, responsibilities and activities are of particular relevance to the SAC:

- Town and Country Planning (Development Plan and Development Control)
- Coastal Defence
- Economic development and tourism
- Coastal management
- Local biodiversity action planning
- Beach management
- Harbour authority
- Emergency Planning
- Water quality monitoring
- Countryside access
- Foreshore lease holder

Countryside Council for Wales

The Countryside Council for Wales is the Government's statutory advisor on sustaining natural beauty, wildlife and the opportunity for outdoor enjoyment in Wales and its inshore waters. CCW is the national wildlife conservation authority. CCW:

- give advice to Government, local authorities and others to help them make well informed decisions on matters which affect the environment;
- help maintain the natural beauty of the land and coast by encouraging appropriate efforts of landowners and land managers;

- ensure and enhance the survival of species and their habitats, and protect earth science features, on National Nature Reserve and Sites of Special Scientific Interest, and, wherever possible, beyond such designated areas;
- monitor change in habitats and species and in the landscape;
- promote access to the countryside for enjoyment whilst respecting the landscape, wildlife work patterns and rural traditions;
- help those who work in the countryside to strike a balance between sustaining country products, such as timber and food, with maintaining landscape character and wildlife;
- strives to ensure that all forms of recreation in the countryside are in harmony with the needs of wildlife and appropriate land management;
- works to increase people's understanding and appreciation of the countryside, its wildlife and habitats;
- would like to persuade everybody in Wales to join CCW, in various ways, as a partner in our aims;
- seek effective policies and other means of protecting the countryside, its habitats and wildlife;
- provide information on all our work.

D_r Cymru Welsh Water*(part of the Hyder group)*

D_r Cymru Welsh Water (DCWW) is appointed by the Secretary of State for Wales to be the water and sewerage undertaker for Wales under the Water Industry Act 1991.

As such, the Company is entrusted with supplying its customers with clean, wholesome drinking water and disposing of their sewage waste, whilst furthering conservation in all of its activities.

Whilst the Company has no water supply interest within the boundaries of the cSAC, it does have a number of sewage outfalls which dispose of effluent, directly or indirectly to the marine boundary of the site.

DCWW is committed to undertaking all its work in such a way as to protect the environment and with respect to sewage disposal is pledged to the eventual provision of full treatment and disinfection at all of its works which discharge to sea or estuary, including those to be found within the Pen Ll_n a'r Sarnau cSAC.

Environment Agency Wales

The Environment Agency covers the whole of England and Wales, comprising the Environment Agency Wales and seven Regions in England. It has a wide range of duties and powers relating to different aspects of environmental management, and is required and guided by Government to use these duties and powers in order to help achieve the objective of sustainable development.

Although it only has duties and powers to protect some environmental resources, it needs to contribute to other aspects of environmental managements, even if these are the responsibility of others. The Agency's vision is "a better environment in England and Wales for present and future generations".

As the principal regulator of pollution and water management, the Agency has a key role to play in ensuring that operations it authorises, and activities it undertakes, do not have an adverse effect on Natura 200 sites. The Agency has statutory duties under the Habitats Directive to review all existing permissions (including consents and authorisations) which might be affecting European sites. The Agency will be assessing the likely significance of any permissions that potentially affect the Pen Ll_n a'r Sarnau cSAC.

Gwynedd Council

Gwynedd Council is a multi-purpose authority with responsibilities covering the environment, transport, education, social services, housing and economic development. The following duties, responsibilities and activities are of particular relevance to the SAC:

· Town and Country Planning (Development Plan and Development Control)

· Coastal Defence

· Economic development and tourism

· Coastal management

· Local biodiversity action planning

· Beach management

· Harbour authority

· Emergency Planning

· Water quality monitoring

· Countryside access

· Foreshore lease holder

North Western & North Wales Sea Fisheries Committee

The North Western & North Wales Sea Fisheries Committee (NW&NWSFC) is a statutory body constituted under the Sea Fisheries Regulation Act 1966 to regulate, protect and develop fisheries for shellfish and to regulate the fishing for or taking of seafish. Since 1992, Sea Fishery Committees (SFCs) have also been under a duty to have a regard for the conservation of the wider marine environment, in addition to more specific responsibilities recently introduced arising from the EU Habitats and Birds Directives.

The jurisdiction of the NW&NWSFC is currently between Cardigan in Ceredigion and Millom in Cumbria, and to the 6 nautical mile offshore fishery limit.

Powys County Council
<< Information to be provided>>

Severn Trent Water

Severn Trent Water covers and area stretching from mid Wales to the Humber and Severn estuaries. Its goal is to help create a sustainable environment for the communities it serves. In particular it protects public health by delivering safe drinking water and effective sanitation services and protects the environment by safely recycling waste water.

The company assesses the environmental impact of all its activities and by active risk management, good operation and investment, strives to ensure the prevention or reduction of adverse effects. In addition, wherever possible it enhances the biodiversity of its extensive land holdings and the aquatic ecosystems within its operating area. Through its own biodiversity action plan it takes action in four key areas: water management, management of its land, activity on land owned by others and education and partnerships.

Severn Trent Water are not responsible for any sewage discharges in the cSAC, but manage water supply in part of the site.

Snowdonia National Park Authority

Designated in 1951, the Snowdonia National Park Authority was established by the Environment Act 1995 as a single purpose Local Authority. It has the following purposes as defined by the Act:

· to conserve and enhance the natural beauty, wildlife and cultural heritage, and

· to promote opportunities for the understanding and enjoyment of the special qualities of the (National) Park by the public.

The National Park is required also "to seek to foster the economic and social well-being of local communities within the National Park".

The Snowdonia National Park Authority is the Local Planning Authority for the whole of the Park and is responsible for the Unitary Development Plan and Local Development Plan which sets out the policies that guide development in the National Park.

The objectives and policies for managing the National Park are covered in the Park Management Plan.

The National Park boundary extends to the high water mark on the coast and includes areas of the Dwyryd, Mawddach and Dyfi estuaries. Between the high and land water mark, Gwynedd Council is the planning authority.

Trinity House Lighthouse Service
Trinity House Lighthouse Service is the General Lighthouse Authority for England, Wales, the Channel Islands and Gibraltar. It provides aids to general navigation around the coasts of its areas of responsibility: lighthouses, light vessels, buoys, beacons and radio-navigation systems.

Terms of Reference for the Pen Ll_n a'r Sarnau Relevant Authorities Group

1. The Relevant Authorities Management Group is established in accordance with the guidance[1] issued by the DoE and Welsh Office (1998)

2. The membership of the Group will comprise all the relevant authorities, as defined in the Habitats Regulations, for the Pen Ll_n a'r Sarnau European Marine Site.

3. The Group will establish a Management Scheme for the Pen Ll_n a'r Sarnau European Marine Site as provided for in Regulation 34 of the Habitats Regulations[2]. Further guidance on the development of management schemes is contained in the DoE/WO guidance.

4. No relevant authority will have precedence or powers over any of the others, but a chair and secretariat could be agreed by the relevant authorities to assist the activities of the Group.

5. The relevant authorities shall exercise their functions under the management scheme so as to secure compliance with the requirements of the Habitats Directive. The primary purpose of the management scheme is to achieve the conservation objectives for the site.

6. The creation and operation of the Group will not affect the statutory functions of the relevant authorities except in so far as the exercise of those functions in relation to the European Marine Site should be guided by the decisions taken by the Group.

7. The Group will ensure that there is wide participation in developing, and ownership of, the management scheme by:

   - consultation with competent authorities who are not also relevant authorities
   - consultation with the wide range of other interested parties as appropriate
   - publication of the management scheme and other information appropriate to its development and establishment.

8. The Group may choose to establish other groups that will provide a framework to secure wide participation in the preparation of the management scheme.

1 DoE/Welsh Office. 1996. *European Marine Sites in England and Wales. A guide to the Conservation (Natural Habitats &c.) Regulations 1994 and to the preparation and application of management schemes.*

2 *The conservation (Natural Habitats, &c.) Regulations 1994.* SI No.2716. HMSO, London.

Appendix 1.5

Terms of reference of the Pen Ll_n a'r Sarnau cSAC Liaison Group

Background

The Liaison Group aims to bring together the diverse interests around the Pen Ll_n a'r Sarnau candidate Special Area of Conservation (cSAC) to work closely with the relevant authorities, to help them develop and keep under review a management scheme for the site. It is composed of selected representatives of varied interests around the site, local authorities and community councils. It should deal in a businesslike manner with issues concerning the management of the cSAC.

Terms of Reference

1. The Liaison Group is established at the request of attendees of the public meetings which took place in October 1999, and in accordance with UK government guidance on the development of management schemes for European marine sites (see diagram and text below).

2. The Liaison Group will be composed of no more than 24 representatives at a time (excluding any Deputies) of the varied interests around the Pen Ll_n a'r Sarnau candidate cSAC, and may include elected members of the local authorities and community councils.

3. Membership is open to any individual. The selection of members is by common consensus achieved at public gatherings, which shall take place at intervals to be agreed between the Liaison Group and the relevant authority officers.

4. The Liaison Group will:

(I) meet with officers of the relevant authorities from time to time, at intervals to be agreed between the Liaison Group and the relevant authority officers;

(ii) assist the relevant authorities with the preparation and review of a management scheme for the Pen Ll_n a'r Sarnau candidate Special Area of Conservation.

(iii) offer information and advice to the relevant authorities concerning issues relevant to the achievement of the aims of the Habitats Directive in relation to this cSAC;

(iv) in its discussions with the relevant authorities, seek to represent the wide spectrum of interests in the site;

(v) advise the relevant authorities on all matters relating to the raising of public awareness about the cSAC and management scheme, including publicity and education.

5. Each member of the Liaison Group will:

(I) act in accordance with the principles under item 4 above;
(ii) be prepared to raise with the relevant authorities issues or information brought to their attention by interested bodies and members of the public.

6. These Terms of Reference may be revised by agreement between the Liaison Group and relevant authorities. They do not legally bind any individual or organisation.

Official guidance on the creation of liaison groups for marine candidate SACs

In June 1998, the Welsh Office published a guidance document on the preparation of management schemes for marine cSACs[20], which addresses among other things the establishment of Advisory or Liaison Groups. The following is an extract from this publication:

'Although only relevant authorities have the statutory responsibility for establishing the management scheme, it is essential that owners and occupiers, right holders, local interests, user groups and conservation groups should be encouraged to participate in the process of developing the scheme at the earliest opportunity. The management group should take note of the best practice adopted for estuary and shoreline management plans and meet periodically to consult with representatives from such interest groups in one or more advisory [i.e. liaison] groups. Care should be taken to ensure that the membership of such groups reflects a balanced range of interests. Regular cycles of meetings should be established, the frequency of which would be dependent on the particular needs of each site. Full public consultation should be undertaken on any proposals for managing the site and wide publicity should be given at appropriate stages.'

[20] *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.* London: Department of Environment, Transport and the Regions and Welsh Office, June 1998.

Appendix 1.6

The UK Marine SACs Project

Background and main aim of the Project

The UK Marine SACs Project is an initiative to help implement the Habitats Directive in the UK. The Project is running for four years (1996-2001) and is organised through a partnership of organisations:

- English Nature
- Scottish Natural Heritage
- Countryside Council for Wales
- Environment and Heritage Service, Department of the Environment for Northern Ireland
- Joint Nature Conservation Committee, and
- Scottish Association of Marine Science.

Funding is provided by the UK's nature conservation bodies and matched equally by the European Commission's Life – Nature Programme.

The main aim of the Project is to establish management schemes for 12 of the candidate marine SACs in the UK (*insert figure showing other cSAC sites*?). The Pen Ll_n a'r Sarnau cSAC is one of these 12 sites and has received support for development of the site's management scheme and a number of specific projects associated with this. These have included:

- Publications, literature and public events
- Collation and review of information about human activities around the site
- Collation and review of information about the nutrient status of the Dyfi, Mawddach and Glaslyn/Dwyryd estuaries
- Collation and review of information about the physical processes operating around the site and recommendations for monitoring and surveillance work
- Comparative trials of approaches and techniques for monitoring the reef and estuary habitats and their wildlife

The experience and knowledge gained through the process of establishing management schemes on the 12 sites will be made available to guide the management of marine SACs elsewhere in the UK and Europe.

Associated tasks

In addition to the site-specific work, a series of tasks looking at a range of more generic issues have also been implemented as part of the Project. These have focussed on bringing together a very large amount of information across a range of marine conservation issues to assist the development of the management schemes both on the 12 Project sites and on other marine SACs in the UK. Two key areas for these tasks have been:

1. Assessing the interaction that can take place between human activities and the Annex I and II interest features; and

2. Assessing the dynamics and sensitivity characteristics of Annex 1 and II interest features.

Human activities

Seven areas where human activity may impact on marine features were identified for study on the grounds that each area includes issues that need to be considered by relevant authorities in managing many of the marine SACs. The information is aimed at staff from the relevant authorities who jointly have the responsibility for assessing activities on marine SACs and ensuring appropriate management. The reports will also provide an important source of information for other organisations, groups and individuals involved in the management of marine SACs. The areas covered are:

- port and harbour operations (complete)
- recreational use interactions (in draft?)
- water quality in lagoons (in draft?)
- water quality in coastal areas (complete)
- aggregate extraction (in draft)
- fisheries (complete)
- collection of bait and other shoreline animals (complete)

In each case, part of the initial work has involved collating what has often been widely dispersed existing knowledge about each activity and putting this together in a format suitable for the specific purpose of managing marine SACs. For each activity there as been wide consultation with the nature conservation agencies, other relevant authorities, user and interest groups.

Dynamics and sensitivity characteristics

The aim of these studies was to collate and review scientific information about a series of sub-features of the Annex 1 marine habitats. The sub-features/communities studied were selected on the basis that they are key constituents of several candidate SACs, that they are important components of Annex 1 habitats in defining their quality and extent, and that either extensive information existed that required collating and targeting, or there was minimal knowledge needing verification and extended study.

These reports are aimed primarily at staff in the nature conservation bodies to assist with providing conservation objectives and monitoring advice for the SAC management schemes. However, they will also provide a valuable information source for other people involved in marine conservation, marine and coastal marine protected areas and coastal management.

A nine-volume review series has been produced for the following sub-features:
Vol. I *Zostera* Biotopes
Vol. II Intertidal Sand and Mudflats & Subtidal Mobile Sandbanks
Vol. III Sea Pens and Burrowing Megafauna
Vol. IV Subtidal Brittlestar Beds
Vol. V Maerl
Vol. VI Intertidal Reef Biotopes
Vol. VII Infralittoral Reef Biotopes with Kelp Species
Vol. VIII Circalittoral Faunal Turfs
Vol. IX Biogenic Reefs

A succinct synthesis document will be produced as a summary of the 9 volumes. This sill summarise the main points from the individual reviews and expand on linkages between biotopes, habitats and sites and related conservation initiatives.

Further information

Copies of the reports described above and other information about the LIFE Project is available via the internet at: **http://www.english-nature.org.uk/uk-marine/**

or by contacting:

The LIFE Project team **Tel: (01733) 455308**
UK Marine SACs Project **Fax: (01733) 568834**
English Nature
Northminster House
Peterborough PE1 1UA

Appendix 2

Appendix 2.1

Pen Ll_n a'r Sarnau cSAC: Coordinates of the seaward boundary

Starting at Penrhyn Nefyn (52° 56.45' N, 4° 32.18' W) on the north coast of the Ll_n Peninsula, the boundary extends on a line bearing 302°T to:
a point at 52° 58.35'N, 4° 37'W, then on a line bearing 227°T to
a point at 52° 51.05'N, 4° 50'W, then on a line bearing 180°T to
a point at 52° 43.4'N, 4° 50'W, then on a line bearing 90°T to
a point at 52° 43.4'N, 4° 47.3'W, then on a line bearing 59°T to
a point at 52° 47.5'N, 4° 36.2'W, then on a line bearing 125°T to
a point at 52° 45.3'N, 4° 31.0'W, then on a line bearing 50°T to
a point at 52° 48.4'N, 4° 24.9'W, then on a line bearing 315°T to
a point at 52° 50.0'N, 4° 27.5'W, then on a line bearing 60°T to
a point at 52° 52.64'N, 4° 20.0'W, then on a line bearing 70°T to
a point at 52° 54.22'N, 4° 12.65'W, then on a line bearing 150°T to
a point at 52° 51.46'N, 4° 10.0'W, then on a line bearing 222°T to
a point at 52° 41.18'N, 4° 25.29'W (the end of Sarn Badrig), then on a line bearing 132°T to
a point at 52° 34.8'N, 4° 13.52'W (the end of Sarn y Bwch), then on a line bearing 190.5°T to
a point at 52° 25.82'N, 4° 16.28'W (the end of Sarn Cynfelin/Cynfelin Patches), then on a line bearing 136.5°T to meet at point (52° 24.4'N, 4° 14.1'W) a line drawn from Afon Clarach (52° 26.14'N, 4° 4.82'W) on a bearing of 252.9°T.

Appendix 2.2

Definitions of reefs and estuaries

The following definitions of reefs and estuaries are taken from the European Commission's interpretation manual of European Union Habitats (European Commission. 1996. *Interpretation manual of European Union Habitats.* European Commission, DG XI - Environment, Nuclear Safety and Civil Protection).

Reefs

These are defined as:

"Submarine, or exposed at low tide, rocky substrates and biogenic concretions, which arise from the sea floor in the sublittoral zone but may extend into the littoral zone where there is an uninterrupted zonation of plant and animal communities. These reefs generally support a zonation of benthic communities of algae and animals species including concretions, encrustations and corallogenic concretions."

Estuaries

These are defined as:

"Downstream part of a river valley, subject to the tide and extending from the limit of brackish waters. River estuaries are coastal inlets where, unlike 'large shallow inlets and bays' there is generally a substantial freshwater influence. The mixing of freshwater and seawater and the reduced current flows in the shelter of the estuary lead to deposition of fine sediments, often forming extensive intertidal sand and mud flats. Where the tidal currents are faster than flood tides, most sediments deposit to form a delta at the mouth of the estuary.

Appendix 2.3

List and description of the different reef communities found within the Pen Ll_n a'r Sarnau cSAC

The following reef biotopes[21] have bee n recorded from the Pen Ll_n a'r Sarnau cSAC. A * by the biotope code indicates a biotope that is considered to be nationally uncommon; a ** by the biotope code indicates a biotope that is considered to be nationally scarce; a * by the biotope code indicates a biotope that is considered to be nationally rare (Conner, et al, 1997).**

1. Intertidal

Most of the biotopes listed in the table below are low eulittoral (lower shore) communities that occur seawards of mean low water mark. This is due to the limited amount of intertidal reef currently within the boundary of the cSAC (see section 2.1). The other, higher shore intertidal communities recorded for North Ll_n have been recorded from the area of Porth Dinllaen SSSI where the cSAC boundary extends to mean high water mark.

Biotope codes and descriptions according to: Conner, D.W., Brazier, D.P., Hill, T.O., & Northern, K.O. 1997. Marine Nature Conservation Review: marine biotope classification for Britain and Ireland. Volume 1. Littoral biotopes. Version 97.06. *JNCC Report, No. 229.*

The areas of the cSAC referred to in the table are:
1. North Ll_n – Penrhyn Nefyn to Braich-y-Pwll
2. Ynys Enlli
3. SW Ll_n – Braich y Pwll to Penrhyn Du (opposite Tudwal Islands)
4. South Ll_n – Penrhyn Du to Porthmadog
5. Meirionnydd/Ceredigion coast (Harlech to Afon Clarach)

[21] A biotope can be defined as a community of plants and animals in association with their physical habitat

Biotope code	Biotope description	North Ll_n	Ynys Enlli	SW Ll_n	South Ll_n	Meirionnydd/ Ceredigion coast
Littoral rock - lichens or algal crusts						
LR.L.YG	**Yellow and grey lichens on supralittoral rock**	_				
LR.L.Ver.Por	***Verrucaria maura* and *Porphyra umbilicalis* on very exposed littoral fringe rock**	_				
LR.L.Ver.B	***Verrucaria maura* and sparse barnacles on exposed littoral fringe rock**	_				
LR.L.Ver.Ver	***Verrucaria maura* on moderately exposed to very sheltered upper littoral fringe rock**	_				
Exposed littoral rock						
ELR.MB.MytB	***Mytilus edulis* and barnacles on very exposed eulittoral rock**	_		_	_	
ELR.MB.BPat	**Barnacles and *Patella* spp. on exposed or moderately exposed, or vertical sheltered, eulittoral rock**	_				
****ELR.FR.Coff**	***Corallina officinalis* on very exposed lower eulittoral rock**	_	_			
ELR.FR.Him	***Himanthalia elongata* and red seaweeds on exposed lower eulittoral rock**		_			
Moderately exposed littoral rock						
MLR.BF.PelB	***Pelvetia canaliculata* and barnacles on moderately exposed littoral fringe rock**	_				

Biotope code	Biotope description	North Ll_n	Ynys Enlli	SW Ll_n	South Ll_n	Meirionnydd/ Ceredigion coast
MLR.BF.FvesB	***Fucus vesiculosus* and barnacle mosaics on moderately exposed mid eulittoral rock**	_				
MLR.BF.Fser	***Fucus serratus* on moderately exposed lower eulittoral rock**	_	_		_	
MLR.BF.Fser.R	***Fucus serratus* and red seaweeds on moderately exposed lower eulittoral rock**	_	_	_		_
MLR.BF.Fser.Fser	**Dense *Fucus serratus* on moderately exposed to very sheltered lower eulittoral rock**	_	_	_		_
MLR.BF.Fser.Fser.Bo	***Fucus serratus* and under-boulder fauna on lower eulittoral boulders**			_	_	_
****MLR.R.XR**	**Mixed red seaweeds on moderately exposed lower eulittoral rock**	_	_			
****MLR.R.Mas**	***Mastocarpus stellatus* and *Chondrus crispus* on very to moderately exposed lower eulittoral rock**	_				
****MLR.R.Osm**	***Osmundea (Laurencia) pinnatifida* and *Gelidium pussilum* on moderately exposed mid eulittoral rock**	_				
****MLR.Eph.EntPor**	***Porphyra purpurea* or *Enteromorpha* spp. on sand-scoured mid or lower eulittoral rock**	_		_		_
***MLR.Eph.Rho**	***Rhodothamniella floridula* on sand-scoured lower eulittoral rock**		_			_
Biotope code	**Biotope description**	**North Ll_n**	**Ynys Enlli**	**SW Ll_n**	**South Ll_n**	**Meirionnydd/ Ceredigion**

						coast
****MLR.MF.MytFves**	***Mytilus edulis* and *Fucus vesiculosus* on moderately exposed mid eulittoral rock**	_				
*****MLR.MF.MytFR**	***Mytilus edulis*, *Fucus serratus* and red seaweeds on moderately exposed lower eulittoral rock**					_
****MLR.Sab.Salv**	***Sabellaria alveolata* reefs on sand-abraded eulittoral rock**				_	_
Sheltered littoral rock						
SLR.F.Fspi	***Fucus spiralis* on moderatley exposed to very sheltered upper eulittoral rock**	_				
SLR.F.Fves	***Fucus vesiculosus* on sheltered mid eulittoral rock**	_				
SLR.F.Asc.Asc	***Ascophyllum nodosum* on full salinity mid eulittoral rock**	_				
SLR.F.Fserr	***Fucus serratus* on sheltered lower eulittoral rock**		_		_	
SLR.FX.FvesX	***Fucus vesiculosus* on mid eulittoral mixed substrata**	_				
SLR.FX.FserX	***Fucus serratus* on lower eulittoral mixed substrata**	_				
SLR.FX.EphX	**Ephemeral green and red seaweeds on variable salinity or disturbed eulittoral mixed substrata**	_				
SLR.MX.MytX	***Mytilus edulis* beds on eulittoral mixed substrata**					_
Biotope code	**Biotope description**	**North Ll_n**	**Ynys Enlli**	**SW Ll_n**	**South Ll_n**	**Meirionnydd/ Ceredigion coast**
Other littoral rock						

LR.Rkp.G	**Green seaweeds (*Enteromorpha* spp. and *Cladophora* spp.) in uppers shore rockpools**	_				
LR.Rkp.Cor	***Corallina officinalis* and coralline crusts in shallow eulittoral rockpools**	_	_	_	_	_
*****LR.Rkp.Cor.Bif**	***Bifurcaria bifurcata* in shallow eulittoral rockpools**		_			
LR.Rkp.FK	**Fucoids and kelps in deep eulittoral rockpools**	_				
LR.Rkp.SwSed	**Seaweeds in sediment (sand or gravel)-floored eulittoral rockpools**	_				
LR.Ov.SR	**Sponges and shade-tolerant red seaweeds on overhanging lower eulittoral rock**	_				
***LR.Ov.SByAs**	**Sponges, bryozoans and ascidians on deeply overhanging lower hore bedrock**			_	_	

Subtidal

Biotope codes and descriptions accoring to: Conner, D.W., Dalkin, M.J., Hill, T.O., Holt, R.H.F., & Sanderson, W.G. 1997. Marine Nature Conservation Review: marine biotope classification for Britain and Ireland. Volume 2. Sublittoral biotopes. Version 97.06. *JNCC Report, No. 230.*

The areas of the cSAC referred to in the table are:
1. North Ll_n – Penrhyn Nefyn to Braich-y-Pwll

2. Ynys Enlli
3. SW Ll_n – Braich y Pwll to Penrhyn Du (opposite Tudwal Islands)
4. South Ll_n – Penrhyn Du to Porthmadog
5. Sarn Badrig
6. Sarn y Bwlch
7. Sarn Cynfelin

Biotope code	Biotope description	North Ll_n	Ynys Enlli	SW Ll_n	South Ll_n	Sarn Badrig	Sarn-y-Bwlch	Sarn Cynfelin
Exposed infralittoral (shallow) rock								
EIR.Ala	*Alaria esculenta* on exposed sublittora fringe bedorck		_					
EIR..Ala.Ldig	*Alaria esculenta* and *Laminaria digitata* on exposed sublittoral fringe bedrock		_	_				
*EIR.LhypR.Ft	*Laminaria hyperborea* forest with dense foliose red seaweeds on exposed upper infralittoral rock	_	_	_				
*EIR.LhypR.Pk	*Laminaria hyperborea* park with dense foliose red seaweeds on exposed lower infralittoral rock		_	_				
EIR.FoR	Foliose red seaweeds on exposed or moderately exposed lower infralittoral rock	_	_	_		_		
Biotope code	**Biotope description**	**North Ll_n**	**Ynys Enlli**	**SW Ll_n**	**South Ll_n**	**Sarn Badrig**	**Sarn-y-Bwlch**	**Sarn Cynfelin**
EIR.FoR.Dic	Foliose red seaweeds with dense Dictyota dichotoma and/or *Dictyopteris membranacea* on exposed lower infralittoral rock	_	_	_		_		
EIR.FoSwCC	Foliose red seaweeds and coralline crusts in surge gully			_				

	entrances							
EIR.SCAn	**Sponge crusts and anemones on wave-surged vertical infralittoral rock**	_	_					
EIR.SCAn.Tub	**Sponge crusts, anemones and *Tubularia indivisa* in shallow infralittoral surge gullies**		_					
EIR.SCAs	**Sponge crusts and colonial ascidians on wave-surged vertical infralittoral rock**	_						
****EIR.SCAs.DenCla**	***Dendrodoa grossularia* and *Clathrina coriacea* on wave-surged vertical infralittoral rock**			_				
EIR.SCAs.ByH	**Sponge crusts, colonia (polyclinid) ascidians and a bryozoan/hydroid turf on wave-surged vertical or overhanging infralittoral rock**	_		_				
EIR.CC.BalPom	***Balanus crenatus* and/or *Pomatoceros triqueter* with spirorbid worms and coralline crusts on severely scoured vertical infralittoral rock**	_		_				
Moderately exposed infralittoral (shallow) rock								
MIR.Ldig.Ldig	***Laminaria digitata* on moderately exposed sublittoral fringe rock**			_				
Biotope code	**Biotope description**	**North Ll_n**	**Ynys Enlli**	**SW Ll_n**	**South Ll_n**	**Sarn Badrig**	**Sarn-y-Bwlch**	**Sarn Cynfelin**
MIR.Lhyp	***Laminaria hyperborea* and foliose red seaweeds on moderately exposed infralittoral rock**	_	_	_				
MIR.Lhyp.Ft	***Laminaria hyperborea* forest and foliose red seaweeds on moderately exposed upper infralittoral rock**	_	_	_	_	_		

MIR.Lhyp.Pk	***Laminaria hyperborea* park and foliose red seaweeds on moderately exposed lower infralittoral rock**	_		_				
***MIR.LhypT.Ft**	***Laminaria hyperborea* forest, foliose red seaweeds and a diverse fauna on tide-swept upper infralittoral rock**	_	_					
****MIR.Lhyp.TPk**	***Laminaria hyperborea* park with hydroids, bryozoans and sponges on tide-swept lower infralittoral rock**	_	_	_				
MIR.LsacChoR	***Laminaria saccharina*, *Chorda filum* and dense red seaweeds on shallow unstable infralittoral boulders and cobbles**		_		_	_	_	_
MIR.XKScrR	**Mixed kelps with scour-tolerant and opportunistic foliose red seaweeds on scoured or sand-covered infralittoral rock**	_	_	_	_	_		
***MIR.EphR**	**Ephemeral red seaweeds and kelps on tide-swept mobile infralittoral cobbles**	_	_	_	_	_	_	_
MIR.HalXK	***Halidrys siliquosa* and mixed kelps on tide-swept infralittoral rock with coarse sediment**		_	_	_	_	_	_
***MIR.PolAhn**	***Polyides rotundus*, *Ahnfelita plicata* and *Chondrus crispus* on sand-covered infralittoral rock**					_		
Biotope code	**Biotope description**	**North Ll_n**	**Ynys Enlli**	**SW Ll_n**	**South Ll_n**	**Sarn Badrig**	**Sarn-y-Bwlch**	**Sarn Cynfelin**
Infralittoral rock - other								
IR.FaSwV	**Fauna and seaweeds (shallow vertical rock)**	_						
IR.AlcByH	***Alcyonium digitatum* with a bryozoan, hydroid and ascidian turf on moderately exposed vertical infralittoral rock**		_					

Infralittoral - other								
IMX.LsacX	***Laminaria saccharina*, *Chorda filum* and filamentous red seaweeds on sheltered infralittoral sediment**					_		
Exposed circalittoral (deeper water) rock								
***ECR.CorCri**	***Corynactis viridis* and a crisiid/*Bugula*/*Cellaria* turf on slightly tide-swept exposed circalittoral rock**		_					
ECR.PomByC	***Pomatoceros triqueter*, *Balanus crenatus* and bryozoan crusts on mobil circalittoral cobbles and pebbles**	_		_		_		
***ECR.AlcTub**	***Alcyonium digitatum* with dense *Tubularia indivisa* and anemones on strongly tide-swept circalittoral rock**		_	_				
ECR.AlcMaS	***Alcyonium digitatum* with massive sponges (*Cliona celata* and *Pachymatisma johnstonia*) and *Nemertesia antennina* on moderately tide-swept exposed circalittoral rock**		_	_				
ECR.BalTub	***Balanus crenatus* and *Tubularia indivisa* on extremely tide-swept circalittoral rock**		_	_				
Biotope code	**Biotope description**	**North Ll_n**	**Ynys Enlli**	**SW Ll_n**	**South Ll_n**	**Sarn Badrig**	**Sarn-y-Bwlch**	**Sarn Cynfelin**
***ECR.TubS**	***Tubularia indivisa*, sponges and other hydroids on tide-swept circalittoral rock**		_	_				
****ECR.CuSH**	**Cushion sponges, hydroids and ascidians on tide-swept sheltered circalittoral rock**		_					
Moderately exposed circalittoral (deeper water) rock								
MCR.ErSEun	**Erect sponges, *Eunicella verrucosa* and *Pentapora foliacea* on**		_					

	slightly tide-swept moderately exposed circalittoral rock							
ECR.ErSPbolSH	**Cushion sponges (*Polymastia boletiformis*, *Tethya*), branching sponges, *Nemertesia* spp. and *Pentapora foliacea* on moderately exposed circalittoral rock**	_	_	_				
ECR.SNemAdia	**Sparse sponges, *Nemertesia* spp., *Alcyonidium diaphanum* and *Bowerbankia* spp. on circalittoral mixed substrata**	_	_	_	_	_	_	
ECR.Flu	***Flustra foliacea* and other hydroid/bryozoan turf species on slightly scoured circalittoral rock or mixed substrata**	_		_				
ECR.Fly.HByS	**Flustra foliacea with hydroids, bryozoans and sponges on slightly tide-swept circalittoral mixed substrata**	_	_	_		_	_	
ECR.Flu.SerHyd	***Sertularia argentea*, *S. Cupressina* and *Hydrallmania falcata* on tide-swept circalittoral cobbles and pebbles**	_	_	_		_	_	
ECR.Urt.Urt	***Urticina felina* on sand-scoured circalittoral rock**		_	_				_
***ECR.Urt.Cio**	***Urticina felina* and *Ciocalypta penecillus on sand-covered circalittoral rock***	_		_				
Biotope code	**Biotope description**	**North Ll_n**	**Ynys Enlli**	**SW Ll_n**	**South Ll_n**	**Sarn Badrig**	**Sarn-y-Bwlch**	**Sarn Cynfelin**
ECR.Sspi	***Sabellaria spinulosa* crusts on silty turbid circalittoral rock**	_						
ECR.MytHAs	***Mytilus edulis* beds with hydroids and ascidians on tide-swept moderately exposed circalittoral rock**	_		_				
***ECR.Mus**	***Musculus discors* beds on Moderately exposed circalittoral rock**	_						
***ECR.ModT**	**Modiolus modious beds with hydroids and red seaweeds on**	_						

	tide-swept circalittoral mixed substrata							
ECR.Oph	***Ophiothrix fragilis* and/or *Ophiocomina nigra* beds on slightly tide-swept circalittoral rock or mixed substrata**	_						
ECR.StoPaur	***Stolonica socialis* and/or *Polyclinum aurantium* with *Flustra foliacea* on slightly sand-scoured tide-swept moderately exposed circalittoral rock**	_	_	_				
ECR.MolPol	***Molgula manhattensis* and *Polycarpa* spp. with erect sponges on tide-swept moderately exposed circalittoral rock**	_	_	_				
****ECR.MolPol.Sab**	**Dense ascidians, bryozoans and hydroids on a crust of *Sabellaria spinulosa* on tide-swept circalittoral rock**	_						
Sheltered circalittoral (deeper water) rock								
SCR.SubsoAs	***Suberites* spp. and other sponges with solitary ascidians on very sheltered circalittoral rock**				_			
SCR.Aasp	***Ascidiella aspersa* on sheltered circalittoral rocks on muddy sediment**				_			
Biotope code	**Biotope description**	**North Ll_n**	**Ynys Enlli**	**SW Ll_n**	**South Ll_n**	**Sarn Badrig**	**Sarn-y-Bwlch**	**Sarn Cynfelin**
Circalittoral rock - other								
CR.Bug	**Bugula spp. And other bryozoans on verticla moderately exposed circalittoral rock**	_	_	_				
****CR.SCup**	**Sponges, cup corals and *Pareythropidioum coralloides* on shaded or overhanging circalittoral rock**	_	_	_				

Appendix 2.4

Nationally rare and scarce species recorded from the Pen Ll_n a'r Sarnau cSAC

The following species that are considered to be nationally rare or scarce have been recorded from the Pen Ll_n a'r Sarnau cSAC. A '*' denotes a species associated with the reef or estuary features. Note that assertions concerning rarity (*cf* Gilliand and Sanderson, 2000) are presently under review.

Nationally rare species:

Common Name/Group	Species	Location recorded
*Sponge	*Thymosia guernei*	Ynys Enlli, south Ll_n
*Sponge	*Tethyspira spinosa*	Ynys Enlli
*Cup coral	*Caryophyllia inornata*	Ynys Enlli
*Sea slug	*Trapania maculata*	Sarn Badrig (off Shell Island)
*Sea slug	*Caloria elegans*	Sarn Badrig (off Shell Island)
*Bryozoan	*Hincksina flustroides*	Ynys Enlli
*Vermillion sea squirt	*Polysyncraton lacazei*	North Ll_n
*Sea squirt	*Phallusia mammillata*	Ynys Enlli
Red seaweed (bearded anotrichium)	*Anotrichium barbatum*	South Ll_n
Red seaweed	*Dermocorynus montagnei*	South Ll_n
Red seaweed	*Polysiphonia furcellata*	South Ll_n
Red seaweed	*Polysiphonia elongella*	South Ll_n

Nationally scarce species:

Common Name/Group	Species	Location recorded
*Sponge	*Stelleta grubii*	Ynys Enlli, south Ll_n
Sea squirt	*Molgula oculata*	Ynys Enlli
*Red seaweed	*Schmitzia hiscockiana*	Ynys Enlli, north Ll_n, Sarnau
Red seaweed (in association with maerl species *Phymatolithon calcareum* and *Lithothamnium coralloides*)	*Cruoria cruoriaeformis*	South Ll_n
Mantis shrimp	*Rissoides desmaresti*	South Ll_n
*Lagoon cockle	*Cerastodera glauca*	Esutaries

Appendix 2.5

List and description of the sediment biotopes recorded in the three estuaries of the Pen Ll_n a'r Sarnau cSAC

The following biotopes have been recorded from the Glaslyn/Dwyryd, Mawddach and Dyfi estuaries. A * by the biotope code indicates a biotope that is considered to be nationally uncommon; a ** by the biotope code indicates a biotope that is considered to be nationally scarce; a * by the biotope code indicates a biotope that is considered to be nationally rare (Conner, et al, 1997).**

Intertidal

Biotope codes and descriptions accoring to: Conner, D.W., Brazier, D.P., Hill, T.O., & Northern, K.O. 1997. Marine Nature Conservation Review: marine biotope classification for Britain and Ireland. Volume 1. Littoral biotopes. Version 97.06. *JNCC Report, No. 229.*

Biotope code	Biotope description	Glaslyn/Dwyryd	Mawddach	Dyfi
Littoral rock - lichens or algal crusts				
LR.L.YG	Yellow and grey lichens on supralittoral rock	_	_	_
LR.L.Ver.B	*Verrucaria maura* and sparse barnacles on exposed littoral fringe rock	_		_
LR.L.Ver.Ver	*Verrucaria maura* on moderately exposed to very sheltered upper littoral fringe rock	_	_	_
***LR.L.UloUro	*Ulothrix flacca* and *Urospora* spp. On freshwater-influenced vertical littorla fringe soft rock			_
Exposed littoral rock				
ELR.MB BPat	Barnacles and *Patella* spp. on exposed or moderately exposed, or vertical sheltered, eulittoral rock	_		
ELR.MB.BPat.Cht	*Chthamalus* spp. on exposed upper eulittoral rock		_	
Moderately exposed littoral rock				
MLR.BF.PelB	*Pelvetia canaliculata* and barnacles on moderately exposed littoral fringe rock		_	
*MLR.Eph.Ent	*Enteromorpha* spp. on freshwater-influenced or unstable upper eulittoral rock	_		
**MLR.MF.MytFves	*Mytilus edulis* and *Fucus vesiculosus* on	_	_	_

	moderately exposed eulittoral rock			
Biotope code	**Biotope description**	**Glaslyn/Dwyryd**	**Mawddach**	**Dyfi**
Sheltered littoral rock				
SLR.F.Pel	***Pelvetia canaliculata* on sheltered littoral fringe rock**	_	_	_
SLR.F.Fspi	***Fucus spiralis* on moderately exposed to very sheltered upper eulittoral rock**		_	_
SLR.F.Fves	***Fucus vesiculosus* on sheltered mid eulittoral rock**	_	_	
SLR.F.Asc	***Ascophyllum nodosum* on very sheltered mid eulittoral rock**	_		
SLR.Asc.Asc	**Ascophyllum nodosum on full salinity mid eulittoral rock**	_		
****SLR.F.Asc.VS**	***Ascophyllum nodosum* and *Fucus vesiculosus* on variable salinity mid eulittoral rock**	_	_	_
****SLR.F.Fserr.VS**	***Fucus serratus* and large *Mytilus edulis* on variable sailinity lower eulittoral rock**			_
****SLR.F.Fcer**	***Fucus ceranoides* on reduced salinity eulittoral rock**	_	_	_
*****SLR.FX.BLlit**	**Barnacles and *Littorina littorea* on unstable eulittoral mixed substrata**			_
SLR.FX.FvesX	***Fucus vesiculosus* on mid eulittoral mixed substrata**	_	_	_
***SLR.FX.AscX**	***Ascophyllum nodosum* on mid eulittoral mixed substrata**	_	_	_
SLR.FX.EphX	**Ephemeral green and red seaweeds on variable sailinity or disturbed eulittoral mixed substrata**		_	_
SLR.FX.FcerX	***Fucus ceranoides* on reduced sailinity eulittoral mixed substrata**	_	_	_
SLR.MX.MytX	***Mytilus edulis* beds on eulittoral mixed substrata**	_	_	
Littoral gravels and sands				
***LGS.Sh.BarSh**	**Barren shingle or gravel shores**		_	
LGS.S.Tal	**Talitrid amphipods in decomposing seaweed on the strandline**	_		

LGS.S.BarSnd	**Barren coarse sand shores**	**_**	**_**	**_**
Biotope code	**Biotope description**	**Glaslyn/Dwyryd**	**Mawddach**	**Dyfi**
LGS.S.AEur	**Burrowing amphipods and *Eurydice pulchra* in well-drained clean sand shores**	**_**	**_**	**_**
LGS.S.AP	**Burrowing amphipods and polycheates in clean sand shores**			**_**
LGS.S.AP.P	**Burrowing amphipods and polychaetes (often with *Arenicola marina*) in clean sand shores**	**_**	**_**	
LGS.S.AP.Pon	**Burowing amphipods *Pontocrates* spp. and *Bathyporeia* spp. in lower shore clean sand.**	**_**	**_**	**_**
***LGS.S.Lan**	**Dense *Lanice conchilega* in tide-swept lower shore sand**		**_**	**_**
***LGS.S.Est.Ol**	**Oligochaetes in reuced or low sailinity gravel or coarse sand shores**		**_**	
Littoral muddy sands				
***LMS.MS.BatCor**	***Bathyporeia* spp. and *Corophium* spp. in upper shore slightly muddy fine sands**	**_**	**_**	
LMS.MS.PCer	**Polychaetes and *Cerastoderma edule* infine sand and muddy sand shores**			**_**
LMS.MS.MacAre	***Macoma balthica* and *Arenicola marina* in muddy sand shores**	**_**	**_**	**_**
****LMS.MS.MacAre.Mare**	***Arenicola marina*, *Macoma balthica* and *Mya arenaria* in muddy sand shores**	**_**		
Littoral muds				
***LMU.Sm.NVC SM8**	**Extreme upper shore mud with pioneer *Salicornia* spp. saltmarsh**	**_**	**_**	**_**
LMU.SMu.HedMac	***Hediste diversicolor*, *Macoma balthica* and *Arnicola marina* in muddy sand or sandy mud shores**	**_**	**_**	**_**
****LMU.SMu.HedMac.Mare**	***Hediste diversicolor*, *Macoma balthica* and *Mya arenaria* in sandy mud shores**	**_**		
***LMU.Mu.HedScr**	***Hediste diversicolor* and *Srobicularia plana* in reduced salinity mud shores**	**_**	**_**	**_**
***LMU.Mu.HedOl**	***Hediste diversicolor* and oligochaetes in low salinity mud shores**	**_**	**_**	**_**

Biotope code	Biotope description	Glaslyn/Dwyryd	Mawddach	Dyfi
Littoral mixed sediments				
****LMX.Mare**	***Mya arenaria* and polychaetes in muddy gravel shores**	_		_

Appendix 2.6

Biodiversity Action Plan species and habitats present within the Pen Ll_n a'r Sarnau cSAC

The following table lists the marine species and habitats occuring in Wales which have been targeted for development of specific Action Plans with the overall framework of the UK's Biodiversity Action Plan. Of the UK's total marine plans of 19 species/groups of species, 16 habitats and 10 species statements, there are 12 species/groups of species plans and 11 habitats plans which have become operational in Wales. Those occuring in the Pen Ll_n a'r Sarnau cSAC are marked with a '❍'. Where relevant, the lead agency for each action plan is identified. A * denotes a habitat or species relevant to the reef features of the cSAC, and a ** denotes a habitat or species relevant to the estuary features of the cSAC.

The early plans for these habitats and species are included in the UK Biodiversity Group Tranche 2 Actions Plans Volume V - maritime species and habitats.

Habitats	**Lead Agency for the Action Plan**
❍ ****Coastal saltmarsh**	**Environment Agency**
❍ ****Mudflats**	**Environment Agency**
❍ ****Sheltered muddy gravels**	**not decided**
❍ ***Honeycomb worm reefs *(Sabellaria alveolata)***	**English Nature**
❍ **Sublittoral sands and gravels**	**English Nature**
❍ **Seagrass beds *(Zostera* spp.)**	**EHS**
Saline lagoons	**English Nature**
***Sabellaria spinulosa* reefs**	**English Nature**
Tidal rapids	**EHS**
❍ ***Horse mussel beds (*Modiolus modiolus)***	**Countryside Council for Wales**
Maerl beds	**Scottish Natural Heritage**
Species	
Native Oyster *Ostrea edulis*	
❍ **Red seaweed *Anotrichium barbatum***	
Pink sea fan *Eunicella verrucosa*	**WWF& Wildlife Trusts**
Fan mussel *Atrina fragilis*	**Marine Conservation Society (MCS)**
❍ **Harbour porpoise *Phocoena phocoena***	**Joint Nature Conservation Committee**
❍ **Baleen whales**	**Joint Nature Conservation Committee**
❍ **Toothed whales**	**Joint Nature Conservation Committee**
❍ **Small dolphins**	**Joint Nature Conservation Committee**
❍ **Marine turtles**	**British Herpetological Society / MCS**
❍ **Basking shark *Cetorhinus maximus***	**WWF / Wildlife Trusts / Shark Trust**
Common skate Raja batis	**Shark Trust**
❍ **Commercial fish species**	**MAFF**

The Action Plans for each habitat and species include targets for the conservation, restoration and expansion of habitats and individual species, together with a series of actions required to meet the aims of the plans. There is substantial work being undertaken in response to the

requirements of the Habitats Directive which is contributing to the UK's Biodiversity Action Plan (BAP); this, and other work contributing to BAP in Wales includes:

· CCW's marine intertidal phase 1 survey programme which aims to map the coast of Wales by 2005;
· subtidal broadscale mapping of marine candidate Special Areas of Conservation;
· monitoring trials on horse mussel beds (Pen Ll_n a'r Sarnau cSAC);
· monitoring trials for bottlenose dolphin (Cardigan Bay cSAC);
· marine mammal strandings scheme (DETR);
· Seawatch Foundation cetacean sighting scheme;
· Seasearch subtidal phase 1survey;
· RSPB habitat action plan (HAP) and species action plan (SAP) atlas for Wales;
· Literature review of BAP species and habitats in Wales (CCW);
· Green Seas Initiative (Welsh Water)

Appendix 2.7

Maps and charts relevant to the Pen Ll_n a'r Sarnau cSAC

i. Admiralty charts

Chart number	Chart title	Scale
1970	Caernarfon Bay	1:75,000
1971	Cardigan Bay Northern Part	1:75,000
1972	Cardigan BayCentral Part	1:75,000
1484	Plans in Cardigan Bay	Various
1512	Plans on the Lleyn Peninsula	Various
1410	St George's Channel	200,000
1121	Irish Sea with Saint George's Channel and North Channel	500,000
1123	Western Approaches to Saint George's Channel and Bristol Channel	500,000

ii British Geological Survey charts

Small scale geological maps:

1:250,000 UTM series of the UK and continental shelf:

- Cardigan Bay (S (solid geology))
- Cardigan Bay (including part 52N 08W Waterford) (Ss (seabed sediments))
- Cardigan Bay (including part 52N 08W Waterford) (Q (quaternary geology))

Solid and drfit geology:

- England and Wales Sheet 133 : Aberdaron and Bardsey. Solid and Drift Geology.
- England and Wales Sheet 134 :. Solid and Drift Geology : Pwllheli.
- England and Wales Sheet 135 : Harlech. Solid Geology.
- England and Wales Sheet 149 : Cadair Idris. Solid and Drift Geology.
- England and Wales Sheet 163 : Aberystwyth. Solid Geology.

iii Ordnance Survey maps

- Ordnance Survey Land Ranger series (1:50,000 scale, colour) : no's 123, 124 &135
- Ordnance Survey Explorer series (1:25,000 scale, colour) : no's 12, 13 & 213

- Ordnance Survey Outdoor Leisure series (1:25,000 scale, colour) : no's 18 & 23
- Ordnance Survey 1:10,000 scale maps, black and while
- Ordnance Survey 1:2,500 scale Landline maps

Appendix 5

Appendix 5.1

Assessment of plans and projects

Plans and projects

Certain operations affecting marine and coastal areas (e.g. planning applications, discharge consents, transport and works orders) are defined as 'plans or projects' under the UK Habitats Regulations (see also Appendix 1.2).

The procedure for considering a plan or a project is set out in the Habitats Regulations. For any proposed plan or project the competent authority should make an initial consideration of the operation, in consultation with CCW, to establish whether or not it is likely to have a significant effect. Where a significant effect is not likely, the plan or project may proceed. If a significant effect is likely (either alone or in combination with other plans or projects), an "appropriate assessment" must be undertaken to establish whether the plan or project will have an adverse effect on the integrity of the sites. If the appropriate assessment does not identify any adverse effect, the plan or project may proceed.

A plan or project for which consent has been given, but which has not yet been implemented, must be reviewed as soon as practicable by the competent authority following a similar process as described above.

The decision about whether or not to give consent to a plan or project affecting a Special Area of Conservation is made by the competent authority responsible for authorising it. The authority should seek the advice of the Countryside Council for Wales who will, on request, advise on the significance of any activity or plan or project which has the potential to affect the features of the site.

Further information about plans and projects and the procedure for considering them in relation to SAC is provided in:

· Planning Guidance (Wales) Technical Advice Note (TAN) 5: Nature Conservation and Planning (Welsh Office, November 1996)

· European marine sites in England & Wales (Welsh Office and DETR, 1998)

· The Birds and Habitats Directives: Outline Government Position (DETR, 1998)

Environmental Impact Assessment

It is important not to confuse an "appropriate assessment" of a plan or project in an SAC with an "Environmental Impact Assessment" (EIA). EIA *legislation (add footnote referencing the relevant EIA Regulations)* is separate to the Habitats Directive. Under EIA legislation, certain types of development (e.g. planning consents, highway construction, afforestation) must undergo an assessment of their environmental effects. These requirements apply irrespective of whether there is an SAC involved, and would normally address a wider range of nature conservation and environmental aspects than the features of an SAC. Where a SAC is likely to be affected by a development requiring an EIA, it will be taken into account as part of the EIA, and the EIA may itself be used to fulfill the requirement for an appropriate assessment.

The competent authority responsible for considering a proposed activity or operation within a SAC must ensure that it complies with both sets of requirements (i.e. the Habitats Directive and the EIA Regulations). Some types of activity or operations will require an appropriate assessment but not an EIA, and vice versa.

Appendix 5.2

Plans and 'major' initiatives operating within and around the Pen Ll_n a'r Sarnau cSAC

In addition to this management plan, there are a number of other plans and initiatives which operate within and around the Pen Ll_n a'r Sarnau cSAC. Some of these relate to the planning framework while others are concerned more specifically with issues such as shore defence, catchment management or biodiversity. Further information about these plans and the frameworks in which they operate is provided below.

i The planning context

The development of land seaward down to mean low water mark is regulated through the planning system, which operates to balance the needs of development (encouraging the optimum use of existing resources) and the principles of sustainability. Development beyond mean low water mark is not within the jurisdiction of the provisions of the Town and Country Planning Acts.

Within the area in and around the cSAC, the planning system is operated primarily by Gwynedd Council, Snowdonia National Park, Ceredigion County Council and Powys County Council. The National Assembly for Wales has reserve and appellate powers, together with advisory functions. The Snowdonia National Park Authority's responsibilities as a Local Planning Authority apply within the boundaries of the National Park, where it is the sole Local Planning Authority. Along the open coast, this responsibility extends to mean high water mark, but in the estuaries the Authority's planning functions include areas below mean low water mark.

Local authorities prepare development plans to guide future development. The plans which are relevant to the Pen Ll_n a'r Sarnau cSAC are:

· Gwynedd Structure Plan (adopted 11/93) 1991 - 2003
· Dwyfor Local Plan (adopted 12/98) 1993 - 2003
· Porthmadog / Ffestiniog Local Plan (10/79) 1976 - 1991 (area between former Dwyfor District and Snowdonia National Park (Penrhyndeudraeth area)
· Ardudwy Local Plan (1/83) 1981 - 1996 (Barmouth area)
· Eryri Local Plan (adopted 1999)
· Snowdonia National Park Management Plan
· Ceredigion Local Plan
· Powys Local Plan

These plans set out detailed policies to guide development together with proposals for specific sites. The Ceredigion Local Plan will not become a formally adopted plan and will retain advisory status

In general, local planing policies place great emphasis on the high quality of the natural environment and seek to promote sustainable development.
Structure and Local Plans will be replaced in due course by Unitary Development Plans (UDPs). To assist in the preparation of UDPs in mid and west Wales, a Strategic Planning Forum has been

formed to establish a planning framework for the preparation of individual UDPs. The Forum has adopted a general objective of developing UDP strategies, policies and proposals that fully reflect the principles of sustainability, and move towards the principles of sustainable development[22].

Proposals for the development of land, including the change of use for buildings, require planning permission. Applications are made in the first instance to local planning authorities who are required to determine applications in accordance with the development plan, unless material considerations indicate otherwise. Material considerations include advice given by central government and the National Assembly for Wales in Planning Guidance (Wales) and circulars. Specific advice relevant to the Pen Ll_n a'r Sarnau cSAC is given in Technical Advice notes concerning coastal planning and nature conservation (add footnote: "Planning Guidance (Wales): Technical Advice Notes (Wales) – Coastal Planning (no. 14); Nature Conservation and Planning (no. 5).

Several of the plans listed above contain policies which are relevant to the cSAC:

Gwynedd Local Plan

Contains numerous references to the cSAC and contains a number of policies which directly /indirectly refer to the designation:
Chapter 3 - Development Control
· Policy C11 (ii) 'Renewable Energy'
· Policy C13 'coastal developments' 4.3.26

Chapter 5 - Industry and Employment
· Policy CH2 'Prestige sites at Penrhyn Glandon, Pwllheli'
· Policy CH6 'Special Locational Needs' 5.3.18
· Policy CH11 'Sea fishing' 5.3.30

Chapter 6 - Tourism
· Main aim 6.2 - objective c) 6.2.9
· Policy D27 (ii) 'Noisy Sports and Activities' (reference to 'nature and wildlife conservation')

Chapter 8 - Conservation and Environment
· SAC mentioned in section 8.2.4
· Policy E2 - 'Statutorily Designated Nature Conservation Sites'
· Policy E6 - 'Safeguarding Coastlands and Estuaries'
· Policy E7 - Sand Dunes'
· Policy E9 - 'Sites of Nature Conservation Importance, Sites of Geological Interest and Protected Species'

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[22] Draft Strategic Planning Statement. Mid & West Wales Strategic Planning Forum (Sept. 1998)

Draft Regional Guidance for North Wales (revised January 2000)

Eryri Local Plan

Nature Conservation

- **Section 4.2:**
  Many of the habitats in the Park and the species which rely on them, are now very restricted elsewhere in Europe. For this reason they are of national and international significance and designated as areas of nature conservation importance. 38,000 ha (18%) of Snowdonia is statutorily protected for wildlife and physiographic purposes, with over half of this area having been selected by the Welsh Office under the European Habitats Directive as Special Areas of Conservation (SAC). Three areas of the Park, the Dyfi Estuary World Biosphere Reserve, Cwm Idwal and Llyn Tegid, are RAMSAR wetlands which had international status before the Habitats Directive was introduced. In addition to these important habitats, the entire coast and marine environment below low water mark, has been selected for designation as a Marine SAC (Pen Ll_n a'r Sarnau SAC).

- **Section 4.7:**
  The National Assembly for Wales may also call in planning applications which affect sites designated under international Conventions and Directives, e.g. SACs, Ramsar sites and Biosphere Reserves. Likewise NPAs are encouraged to seek and Environmental Assessment (EA) for certain types of development which may have a significant effect on any designated wildlife site.

Nature Conservation - Internationally Designated Sites

- **Section 4.13:**
  The National Park Authority (NPA) is required to recognise and protect sites of international wildlife importance. These are shown on the Proposals Map and the NPA will maintain the integrity of these sites and fulfil its international obligations, by preventing their fragmentation or incremental loss as a result of inappropriate development.

- **Section 4.14:**
  An Environmental Assessment would normally be required where development would affect a Ramsar site, a potential or designated SPA or a candidate, agreed or designated SAC. In cases where development does not require an EA the NPA will require sufficient supporting information to be convinced that the environmental implications of the development proposed does not detrimentally affect the status of the site.

- **Policy GN 1:**
  Proposals for development on or close to any existing or proposed site of International Nature Conservation Importance or Priority Natural Habitats type, including Special Areas of Conservation, Ramsar sites and Biosphere Reserves, will be subject to the most rigorous examination and will be determined in accordance with Regulations 48 and 49 of the Conservation (Natural Habitats) Regulations 1994.

  Development or changes of use to land not directly connected with or necessary for the management of the site which would either on an individual or cumulative basis significantly harm the site or Priority Species, will not be permitted. Exceptions will be

made where the NPA is satisfied that there are imperative reasons of over-riding public interest for the development and no alternative solution is possible.

In cases where development does not automatically require an Environmental Assessment, the NPA will require sufficient supporting information to assess the environmental implications of the proposal.

If under these exceptional circumstances development is permitted, the NPA will use planning conditions or seek legal obligations, to ensure that the integrity of any site of international importance is safeguarded.

Landscape

· **Policy TI 1:**

The National Park Authority (NPA) will not permit coastal protection or sea defence works in the Undeveloped Coast as defined on the Proposals Map, unless such works can be undertaken in a way which are sympathetic to the unspoilt visual and ecological character of these areas.

Because of the important flood storage role of the Undeveloped coast, the NPA will not permit any engineering works or operations which will result in their reduction or loss.

Development in the Undeveloped Coast which would harm its unspoilt visual and ecological character will not be permitted. Development will only be permitted in the Undeveloped Coast where it can be demonstrated that such a location is necessary.

· **Policy TI 2:**

The NPA will permit artificial coastal defence structures, on sites outside the undeveloped coast, only where the scheme does not create any significant visual affect on the coastline and does not impact upon the conservation or amenity interests of the site or on adjacent areas. All significant sea defence or coastal protection works undertaken in the National Park must be accompanied by a comprehensive Environmental Assessment.

The NPA will permit managed retreat or soft engineering schemes along the coastline, where they are justified, practical, and do not create unacceptable environmental impacts or pressure for engineering works elsewhere.

· **Section 3.25:**

The interdependency of the marine and terrestrial environments has been highlighted by the Select Committee for the Envrionment[23] and the Countryside Council for Wales[24].

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[23] Coastal Zone Protection and Planning, House of Commons Select Committee Report, 1992.

[24] A Policy framework for the coastal and Marine zone of Wales, Countryside Council for Wales, 1994.

Although development within offshore and marine areas below Mean Low Water Mark is beyond the jurisdiction of the NPA, this does not imply that the environment of the National Park will be unaffected. Most of the coastline of the Park has been designated as Undeveloped coast and is protected by Policy TI 1. The sea adjacent is also protected under the European Habitats Directive as a Special Area of Conservation and is further protected from harmful development by Policy GN 1 (Internationally Designated Sites). Development in the marine environment below Mean Low Water Mark, must therefore be undertaken in ways which does not significantly harm its conservation status.

· **Section 3.26:**
Cardigan Bay has been surveyed for oil and gas deposits. If significant resources are found, the NPA will be concerned about the implications of their development on the marine environment of Cardigan Bay and the coastline of the Park. For this reason, the NPA believes that any major development, including oil and gas production or other types of mineral extraction, within the Special Area of Conservation should be resisted.

· **Policy TI 3:**
Within the Cardigan Bay and Sarnau Special Area of Conservation, the NPA believe that any development which is likely to affect the environmental integrity of this area or the adjacent coast of the Park should be resisted.

Coastal Boating Facilities

· **Section 13.17:**
Since the Structure Plan was adopted in 1993 the whole of the National Park's coastline has been recommended for inclusion in the Ll_n and Sarnau candidate Marine Special Area of Conservation (cSAC), under the Habitat Regulations 1994. Government policy treats candidate SACs as if they were designated and places particular emphasis on their protection. Applications for coastal boating facilities will there be judged against the test set out by the Habitats Regulations which apply special considerations to SACs.

· **Section 13.18:**
Proposals which would have an adverse effect on the integrity of the SAC should be refused. Integrity is defined as: *the coherence of its ecological structure and function across its whole area, that enables it to sustain the habitat, complex of habitats and/or the levels of population of the species for which it was classified.* The Countryside Council for Wales (CCW) is the body responsible for designating and managing SACs and it is therefore a very important consultee on coastal planning applications. The advice of CCW and the findings of an Environmental Assessment, will be of primary importance in gauging the affect a development would have on the 'integrity' of the SAC.

· **Section 13.19:**
The NPA therefore endorse the position in the Gwynedd Structure Plan which supports the small scale development of existing facilities such as slipways, jetties, improved car parking and access to the shore. The Authority will not however support the provision of larger scale facilities such as a marina or a major harbour redevelopment which would harm the integrity of the SAC or the character of the coast of the Park.

· **Policy AD 1:**
The NPA will only permit the redevelopment of enlargement of existing coastal boating or harbour facilities, or the development of new facilities of this nature, if the proposals would preserve the natural beauty, nature conservation value and all other special qualities of the Park's coastline. Any proposals which would have an adverse effect on the integrity of a site of international importance to nature conservation will note be permitted.

Other

· **Policy PC 4:**
Major Development will not be permitted in the National Park save in exceptional circumstances where it can be demonstrated that it is in the public interest. The NPA will only permit major development within the National Park where all the following criteria are satisfied:

i. It can be demonstrated that there is a need for the development at a national level;

ii. The development must or can only be located within the National Park and the developer can demonstrate to the satisfaction of the NPA that no alternative site or solution is possible;

iii. That the benefits of the development and any associated compensatory and mitigating measures, significantly outweigh the detrimental impact the development is likely to cause to the environment or cultural qualities of the Park.

Proposals which conflict with any of the above criteria will not be permitted. Where major development proposals are located in close proximity to the Park, the NPA will request adjacent Local Planning Authorities to consult with it an consider the implications of the proposed development on the environmental status and cultural heritage of the National Park.

ii Shoreline management plans

Shoreline Management Plans (SMPs) provide a framework for dealing with coastal defence by setting out a strategy for sustainable coastal defence within a 'sediment cell'. There are two Shoreline Management Plans relevant to the Pen Ll_n a'r Sarnau cSAC:

1. Cardigan Bay SMP: Production of this plan has been divided into three by political boundaries:
· Pembrokeshire
· Ceredigion - at Stage 2 consultation
· Gwynedd (Aberdyfi to Ynys Enlli) - Stage 1 completed, Stage 2 in preparation.

2. Ynys Enlli to Llandudno SMP - Stage 1 being prepared.

The SMPs provide guidance on coastal defence, taking account of natural coastal processes, coastal defence needs and environmental considerations. The main objectives of the SMPs are to:

· improve understanding of coastal processes;
· predict the likely future evolution of the coast;
· identify all assets which are likely to be affected by coastal change;
· identify research and survey requirements; and
· facilitate consultation between those bodies with an interest in the shoreline.

All SMPs in Wales are due to be completed by the end of 2000.

iii Local Environment Agency Plan (LEAPS)

Environment Agency Wales (EAW) has produced two Local Environment Agency Plans (LEAPs) covering the area adjacent to the cSAC (Eryri/Ll_n and Meirionnydd Plans).

The LEAPs are a local agenda of integrated action for environmental improvement. They help EAW to identify and assess, prioritise and solve envionmental issues related to its functions, taking into account the views of local customers. It enables EAW to deploy its resources to best effect and optimise benefit for the local environment.

Both Action Plans coering the period 2000-2005 were published in May 2000. Ther are subject to review on an annual basis and as well as reporting progress, the annual review will identify new, amended, completed or deleted actions.

iv National biodiveristy action plans

Marine habitats and species that have been highlighted for the development of specific Action Plans as part of the overall UK Biodiveristy Action Plan are listed in Appendix 2.7

v Local biodiversity action plans

As part of the implementation of the UK's Biodiversity Action Plan, local authorities are preparing and implementing local biodiversity action plans.

The following habitat action plans are part of the Snowdonia National Park Authority's (SNPA) Local Biodiversity Action Plan:

· Sand Dunes (co-ordinating body is Countryside Council for Wales)

· Coastal and floodplan grazing marsh (co-ordinating body is the SNPA). includes the following maritime habitats and species:

vi Dyfi National Nature Reserve plan

The whole of the cSAC area of the Dyfi estuary lies within the Dyfi SSSI. An 'overview plan' for the whole SSSI has been written and awaits approval. The overview plan contains objectives for estuary and saltmarsh features (plus birds and other features). The whole of the intertidal area and most of the saltmarsh is within the National Nature Reserve (NNR). A 'sub-plan' for the estuary - Ynys Las dunes NNR is complete. These plans have been prepared by the Countryside Council for Wales.

LIST OF ABBREVIATIONS USED

AALA	Adventure Activities Licensing Authority
ABP	Associated British Ports
BAP	Biodiversity Action Plan
BGS	British Geological Survey
BMIF	British Marine Industries Federation
CCW	Countryside Council for Wales
CEC	Crown Estate Commissioners
CEFAS	Centre for Environment, Fisheries and Aquaculture Sciences
CGP	Coastal Geomorphology Partnership
cSAC	Candidate Special Area of Conservation
DCWW	D_r Cymru Welsh Water
DERA	Defence Evaluation and Research Agency
DETR	Department of Environment, Transport and the Regions
DOE	Department of the Environment
DTI	Department of Trade and Industry
EA	Environment Agency
EAW	Environment Agency Wales
EC	European Commission
EIA	Environmental Impact Assessment
ERIS	Emergency Response in the Irish Sea
FCS	Favourable Conservation Status
FEPA	Food and Environment Protection Act
GV	Government View
HAP	Habitat Action Plan
HEO	Harbour Empowerment Order
HRO	Harbour Revision Order
ICES	International Council for the Exploration of the Seas
IDO	Interim Development Order
IMO	International Maritime Organisation
JNCC	Joint Nature Conservation Committee
LEAP	Local Environment Agency Plan
MAFF	Ministry of Agriculture, Fisheries and Food
MARPOL	International Convention for the Prevention of Pollution from Ships
MCA	Maritime and Coastguard Agency
MHWM	Mean High Water Mark
MOD	Ministry of Defence
NAW	National Assembly for Wales
nm	Nautical Mile
NNR	National Nature Reserve
NPA	National Park Authority
NWNWSFC	North Western and North Wales Sea Fisheries Committee
OPRC	Oil Pollution Preparedness, Response and Co-operation Convention
PADI	Professional Association of Diving Instructors
PPG	Pollution Prevention Guidelines
PWC	Personal Water Craft
RACER	Risk Assessment and Collaborative Emergency Response (in the Irish Sea)
RAF	Royal Air Force
RCAM	Royal Commission on Historic Monuments
RSPB	Royal Society for the Protection of Birds

RSPCA	Royal Society for the Prevention of Cruelty to Animals
RYA	Royal Yachting Association
SAC	Special Area of Conservation
SAP	Species Action Plan
SCW	Sports Council for Wales
SMP	Shoreline Management Plan
SNPA	Snowdonia National Park Authority
SPA	Special Protection Area
SSSI	Site of Special Scientific Interest
STW	Sewage Treatment Works
UDP	Unitary Development Plan
UKCS	United Kingdom Continental Shelf
UNCLOS	United Nations Convention on the Law of the Sea
WCA	Wildlife and Countryside Act 1981
WCA	Welsh Canoeing Association
WO	Welsh Office
WYA	Welsh Yachting Association