

UK Biodiversity Group

Tranche 2 Action Plans

Maritime Species and Habitats

THE RT HON JOHN PRESCOTT MP
DEPUTY PRIME MINISTER AND
SECRETARY OF STATE FOR THE
ENVIRONMENT, TRANSPORT
AND THE REGIONS

THE RT HON PETER MANDELSON MP
SECRETARY OF STATE FOR
NORTHERN IRELAND

SARAH BOYACK MSP
MINISTER FOR TRANSPORT AND
THE ENVIRONMENT
THE SCOTTISH EXECUTIVE

CHRISTINE GWYHER AM
ASSEMBLY SECRETARY FOR
AGRICULTURE, AND THE
RURAL DEVELOPMENT
NATIONAL ASSEMBLY FOR
WALES

Dear Deputy Prime Minister, Secretary of State, Minister and Assembly Secretary,

BIODIVERSITY ACTION PLANS

I am writing to you in my capacity as Chairman of the United Kingdom Biodiversity Group (UKBG) about the latest group of biodiversity action plans which UKBG have completed and published in the present volume. Publication of this fifth volume in the Tranche 2 Action Plan series fulfils the undertaking, given in the Government Response to the UK Biodiversity Action Plan Steering Group Report 1995, to produce maritime action plans covering further coastal and marine habitats and species.

The volume includes reprints of the marine and coastal species and habitat action plans originally published in the Steering Group's Report, as well as new action plans for 16 species/groups of species and 17 habitats. The reprinted saline lagoon habitat action plan has an additional annex containing statements on a further eight species whose conservation needs will be considered as part of that plan. Similarly, there are two species statements attached to the mud in deep habitats plan. The volume also has a technical introduction detailing the methodology and criteria used in determining the priority species and habitats.

The marine environment poses different challenges for action plan implementation and the introduction highlights some of the issues involved. Among these is the relative lack of scientific evidence to help explain the functioning of marine ecosystems and the requirements of marine species. Many of the plans identify the need for further research as being of paramount importance to their success.

Development of this volume was coordinated by the Coastal and Marine Sub-Groups and involved Government departments and agencies, voluntary conservation groups, industry and academic institutions. The plans set challenging but achievable targets to conserve and enhance the species and habitats. The new species action plans are accompanied by a table showing their indicative costings, so that those charged with implementation are clear about the scale of the financial consequences. The new habitat action plans include indicative costings.

As in earlier volumes, the new species action plans are accompanied by a list of lead partners (often a Non-Governmental Organisation) who will take the lead in their implementation, supported by a contact point (always a Government agency or department). We are pleased that some new voluntary organisations have agreed to become lead partners for certain of the action plans.

The plans in this volume represent a significant step for the UK Biodiversity Action Plan and put marine and coastal species and habitats on a similar footing to the key terrestrial plans. On behalf of the UKBG, I commend them to you and your ministerial colleagues.

A handwritten signature in black ink, reading 'Sophia Lambert' followed by a large checkmark.

SOPHIA LAMBERT

| Contents | Page |
|---|------|
| Introduction | |
| 1. Background | 9 |
| 2. Review of broad habitat classification and priority habitats and species | 9 |
| 3. Issues arising from the maritime action plans | 14 |
| 4. Priority Species Action Plans | 17 |
| Mammals | 19 |
| Reptiles | 35 |
| Fish | 41 |
| Molluscs | 61 |
| Sea anemones | 75 |
| Corals | 83 |
| Algae | 89 |
| 5. Priority Habitat Action Plans and associated Species Statements | 97 |
| Maritime cliff and slopes | 99 |
| Coastal sand dunes | 105 |
| Machair | 111 |
| Coastal vegetated shingle | 117 |
| Littoral and sub-littoral chalk | 121 |
| <i>Sabellaria alveolata</i> reefs | 125 |
| Coastal saltmarsh | 129 |
| Mudflats | 135 |
| Sheltered muddy gravels | 141 |
| <i>Sabellaria spinulosa</i> reefs | 145 |
| Tidal rapids | 149 |
| <i>Modiolus modiolus</i> beds | 153 |
| Seagrass beds | 157 |
| Maerl beds | 161 |
| Saline lagoons (plus annex with eight species statements) | 165 |
| Mud habitats in deep water (plus annex with two species statements) | 179 |
| Serpulid reefs | 185 |
| Sublittoral sands and gravels | 189 |
| <i>Lophelia pertusa</i> reefs | 195 |
| 6. Broad Habitat Statements | 201 |
| Annexes | |
| 1. List of abbreviations and acronyms | 237 |
| 2. Species action plan costings | 239 |
| 3. List of species and habitats, with Contact Points, Lead Partners and Lead Agencies/Departments | 241 |

1. Background

- 1.1 Following the preparation of the first tranche of action plans in 1995, it was concluded that a selection of marine and coastal habitats and species action plans needed to be prepared within a redefined broad habitat classification. The work of producing the action plans was co-ordinated by two sub-groups (coastal and marine) of the UK Biodiversity Targets Group.
- 1.2 The sub-groups were asked to:
- ! review the broad habitat classification for coastal and marine habitats;
 - ! assess whether the criteria, which had been developed for selecting terrestrial priority habitats and species on land, were appropriate for coastal and marine habitats and species, and recommend any adjustments;
 - ! apply the agreed criteria in order to select priority coastal and marine habitats and species;
 - ! and oversee the preparation of the action plans, including consultation with government departments, agencies and NGOs.

2. Review of broad habitat classification and priority habitats and species

Broad habitats

- 2.1 The original maritime broad habitats (table 1) were largely selected by geomorphological characteristics (eg estuary and open coast) with the result that each contained a range of habitats, some occurring in several physiographic features. In the review of priority habitats (see below) some of the original broad habitats were given priority status. The revised broad habitat classification was developed using a logical and hierarchical structure based closely on the JNCC Marine Nature Conservation Review marine biotopes classification system, and provides an overview of the extent and character of the entire UK maritime environment (table 2). The broad habitat statements for this revised classification are included in this volume. Figure 1 shows a map of the UK Waters¹ marked with the underwater features identified within the statements.

¹ 'UK Waters' are referred to throughout the marine plans. These are internal waters (inside the baselines from which the territorial sea is measured), territorial waters (whose limits extend to 12 nautical miles from these baselines) and waters within 200 nautical miles from the baselines within which the UK exercises certain rights and jurisdictions. The extent of potential UK action under the plans in marine areas beyond territorial waters is, under the UN Convention on the Law of the Sea, subject to the rights of other states.

Figure 1. UK waters, with features identified in the broad habitat statements

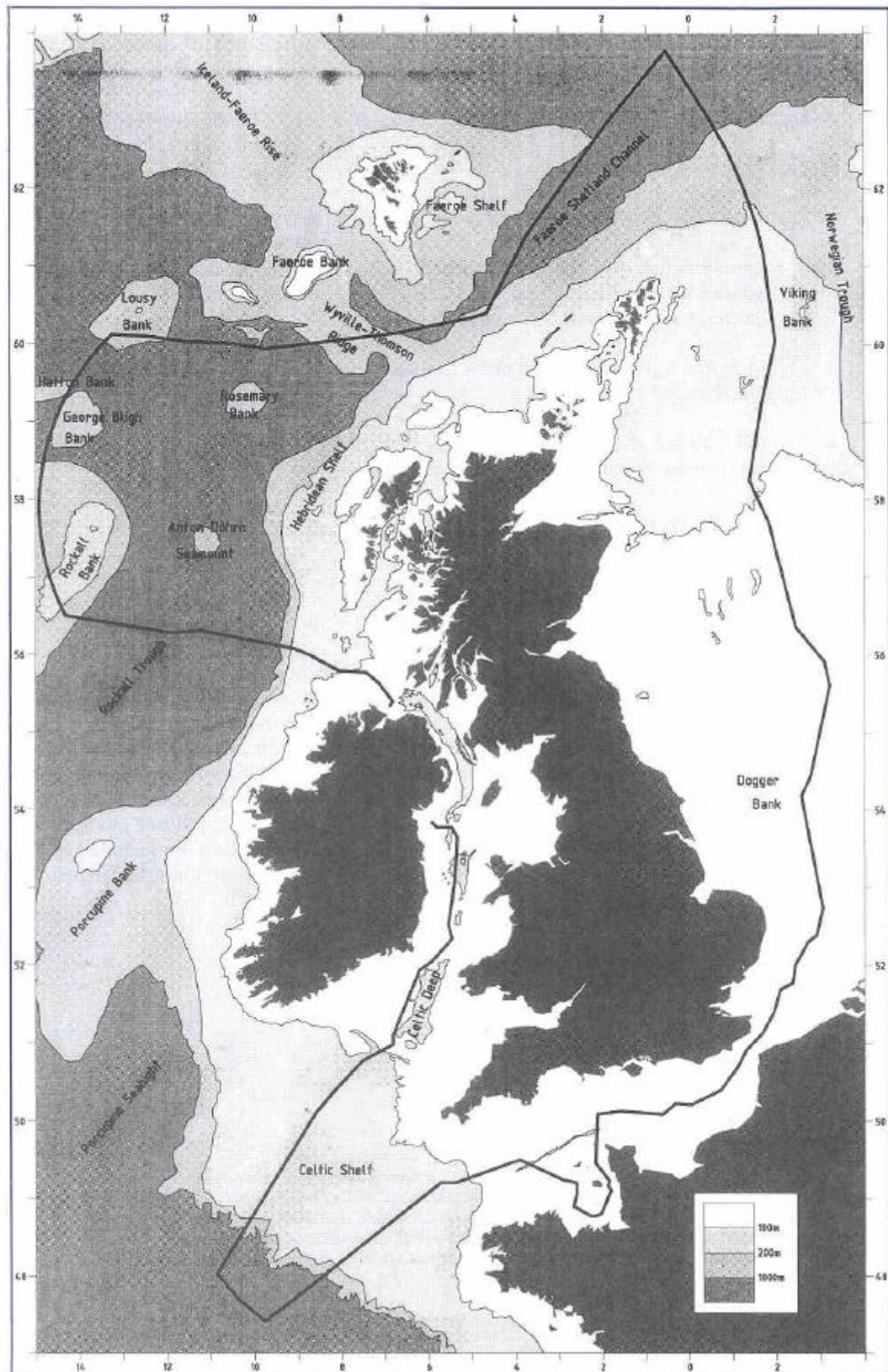


Table 1. Original broad habitats

| Habitat | Change made |
|--|--|
| Maritime cliff and slope Boulders and rock above high tide mark | turned into a priority habitat removed |
| Shingle above high tide mark | turned into a priority habitat and renamed coastal vegetated shingle |
| Coastal strandline Machair Saltmarsh Sand dune Estuaries | removed turned into a priority habitat turned into a priority habitat turned into a priority habitat removed |
| Islands and archipelagos Inlets and enclosed bays Open coast | removed removed removed |
| Shelf break | removed |
| Open sea water column Offshore seabed | removed removed |

Priority habitats

2.2 Within each broad habitat, priority habitats were identified that would benefit from conservation effort directed by a specific action plan. In the review of the selection criteria for these habitats, and the way in which they should be interpreted, two additional categories were identified and adopted:

! habitats for which a high proportion (over 40%) of the north-east Atlantic resource is located in the UK;

! habitats which may be formed from a keystone species - one which hosts a characteristic community of other species.

2.3 The full list of priority habitat criteria is given in table 3.

2.4 The modified criteria were circulated widely to organisations and individuals with maritime expertise, with the request that they should propose habitats that should be given priority for conservation action. The recommendations made were assessed by the marine sub-group to produce the list of priority habitats given in table 2.

Table 2. Revised maritime broad and priority habitats

| Broad habitat types | Priority habitats | Drafting group |
|------------------------|--|-------------------------------|
| Supralittoral rock | Maritime cliff and slopes (vegetated cliffs and lichen dominated cliffs) | Coastal |
| Supralittoral sediment | Coastal sand dunes Machair Coastal vegetated shingle | Coastal Coastal Coastal |
| Littoral rock | Littoral chalk (one plan with sublittoral chalk) <i>Sabellaria alveolata</i> reefs | Marine Marine |
| Littoral sediment | Coastal saltmarsh Mudflats Seagrass beds (<i>Zostera noltii</i>) Sheltered muddy gravels | Coastal Marine Marine |

| Broad habitat types | Priority habitats | Drafting group |
|------------------------------|--|--|
| Inshore sublittoral rock | Sublittoral chalk (one plan with littoral chalk) <i>Sabellaria spinulosa</i> reefs Tidal rapids <i>Modiolus modiolus</i> beds | Marine Marine Marine Marine |
| Inshore sublittoral sediment | Seagrass beds (<i>Zostera marina</i>) Maerl beds Saline lagoons Mud in deep water Serpulid reefs Sublittoral sands and gravels | Published 1995 Marine Published 1995 Marine Marine |
| Offshore shelf rock | | |
| Offshore shelf sediment | Sublittoral sands and gravels | Marine |
| Continental shelf slope | <i>Lophelia pertusa</i> reefs | Marine |
| Oceanic seas | | |

For priority habitats in bold (and which also occur in another broad habitat), the associated broad habitat is the main one for reporting purposes.

Table 3. Selection criteria for priority habitats

| | |
|---|--|
| ! | Habitats for which the UK has international obligations. |
| ! | Habitats at risk, such as those with a high rate of decline especially over the last 20 years. |
| ! | Habitats which are rare. |
| ! | Marine habitats which may be functionally critical for organisms inhabiting wider ecosystems (e.g. spawning areas for fish). |
| ! | Marine habitats for which 40% or more of the north-east Atlantic's occurrence is located in the UK. |
| ! | Habitats formed from keystone species. |
| ! | Habitats important for rare species. |

Priority species

2.5 A similar selection process was adopted for species. Particular account was taken of the limited knowledge surrounding distribution and population dynamics of species other than those that had been subject to recent and long term survey analysis. The original marine species selection criteria (table 4) were therefore supported by the following guidelines in order to produce the revised list of maritime priority species in table 5:

- ! wide ranging species which cannot be protected within a designated habitat;
- ! vulnerability to damage by pollution or physical disturbance such as trawling;
- ! low fecundity;
- ! high age of first maturity;
- ! inability to recolonise an area after loss or removal, due to particular developmental biology (sessile species with benthic larvae or brooding young).

Table 4. Selection criteria for priority species

| | |
|---|---|
| ! | Threatened endemic and globally threatened species. |
| ! | Species where the UK has more than 25% of the world or appropriate biogeographical population. |
| ! | Species where the number or range has declined by more than 25% in the last 25 years. |
| ! | Species found in fewer than 15 ten km squares around the UK. |
| ! | Species for which the UK has international obligations or which are protected under UK legislation. |

Table 5. Priority species

| Species | Plan or statement/notes |
|---|---|
| Mammals | |
| <i>Phocoena phocoena</i> - Harbour porpoise | Plan (published 1995) |
| Baleen whales | Grouped plan |
| Small dolphins | Grouped plan |
| Toothed whales | Grouped plan |
| Reptiles | |
| Marine turtles | Grouped plan |
| Fish | |
| <i>Cetorhinus maximus</i> - basking shark | Plan |
| <i>Raja batis</i> - common skate | Plan (species added due to serious decline) |
| Selected commercial fish species | Grouped plan |
| Selected deep-water fishes | Grouped plan |
| Crustacean | |
| <i>Gammarus insensibilis</i> - lagoon sand shrimp | Statement (associated with saline lagoons) |
| Mollusc | |
| <i>Atrina fragilis</i> - fan mussel | Plan |
| <i>Ostrea edulis</i> - native oyster | Plan |
| <i>Thyasira gouldi</i> - northern hatchett shell | Plan |
| Sea anemone group | |
| <i>Amphianthus dohrnii</i> sea-fan anemone | Plan |
| <i>Clavopsella navis</i> - a brackish water hydroid | Statement (associated with saline lagoons) |
| <i>Edwardsia ivelli</i> - Ivell's sea anemone | Plan (published in 1995) |
| <i>Nematostella vectensis</i> - Starlet sea anemone | Plan (published in 1995) |
| Sea slug | |
| <i>Tenellia adpersa</i> - lagoonal seaslug | Statement (associated with saline lagoons) |
| Sea squirt | |
| <i>Styela gelatinosa</i> - sea squirt | Statement (associated with mud in deep water) |
| Worm | |
| <i>Armandia cirrhosa</i> - lagoon sandworm | Statement (associated with saline lagoons) |

| | |
|--|---|
| Coral | |
| <i>Eunicella verrucosa</i> - broad sea-fan | Plan |
| <i>Funiculina quadrangularis</i> seapen | Statement (associated with mud in deep water) |
| <i>Leptosammia pruvoti</i> - Sunset cup coral | Plan |
| Alga | |
| <i>Anotrichium barbatum</i> - red alga | Plan |
| <i>Ascophyllum nodosum</i> ead <i>mackaii</i> - a brown alga | Plan (in place of a HAP) |
| Stoneworts | |
| <i>Chara baltica</i> - Baltic stonewort | Statement (associated with saline lagoons) |
| <i>Chara canescens</i> - bearded stonewort | Statement (associated with saline lagoons) |
| <i>Lamprothamnion papulosum</i> - foxtail stonewort | Statement (associated with saline lagoons) |
| <i>Tolypella nidifica</i> - bird's nest stonewort | Statement (associated with saline lagoons) |

- 2.6 Table 5 indicates whether action plans or statements have been written for the priority species. Statements were written for species closely associated with a priority habitat and for which their protection and conservation could be achieved through the habitat action plan. Grouped action plans were written for closely related species having similar requirements.
- 2.7 A number of coastal species (particularly those associated with saline lagoons) are included, though many other priority species that can be considered as coastal (eg dune gentian) appear in the UK Steering Group Report and other volumes of the tranche 2 action plan series.

Previously published action plans

- 2.8 Prior to the establishment of the Marine sub-group, two habitat action plans (seagrass beds and saline lagoons) and three species action plans (harbour porpoise, Ivell's sea anemone and Starlet sea anemone) had been published in the UK Steering Group Report (1995). Implementation groups were subsequently established for the harbour porpoise (lead partner Sea Mammal Research Unit), seagrass beds (lead agency Environment and Heritage Service (NI)) and saline lagoons (lead agency English Nature). The actions for the Ivell's sea anemone and Starlet sea anemone (lead partner WWF) are taken forward through the latter habitat action plan. The above plans are reproduced in this volume, to bring together as a single set plans relating to the marine environment.

3. Issues arising from the maritime action plans

- 3.1 A number of issues specific to the marine environment arose during the course of action plan implementation. One issue is in respect to ownership and use. On the land, there is usually a clearly defined ownership and a single dominant use of any given area. At sea the situation is quite different: there is, in general, no 'ownership' and any area of the sea is subject to a very wide range of uses that interact and often conflict, many of which are not under the direct or exclusive control of the UK. Even the seabed, which is owned, has traditional uses that render owners incapable of managing marine habitats in a way that is possible on land. These factors make it difficult to devise protective actions that are compatible with all users and uses.
- 3.2 Issues arising from the conflict of interest between different users of the sea is exacerbated by the relative lack of scientific evidence to help explain the functioning of marine ecosystems and

the requirements of marine species. As a result, it is difficult to establish a strong universally accepted case for specific protective actions.

- 3.3 For the effective implementation of the published action plans close attention is required to identify the common issues between particular habitats and species. This will therefore require co-ordination and co-operation by the groups involved. An example is provided by the actions plans for mudflats (a marine habitat) and saltmarsh (a coastal habitat) which share common issues related to sea-level rise and flood defence. Similarly, the pelagic marine species action plans will require detailed attention across the plans so as to focus effort and resources accurately at common actions.

Costings

- 3.4 Cost estimates were produced for each of the action plans, following the methodology described more fully in Volume II (for habitats) and Volume VI (for species) of the *Tranche 2 Action Plans* series. The work was undertaken by independent contractors, with the Marine and Coastal Sub-groups commenting on the initial estimates. The habitat cost estimates are attached to each plan; for the species a summary table is provided (Annex 2). In both cases the estimates are average annual figures for 5 or 10 year periods in the life of the action plan. They represent additional expenditure resulting from the undertaking of the actions contained in the plan.
- 3.5 The total figures are built up from estimates for each of the specific actions in the plan. The costing of these actions was based on a list generic costs derived from collected data and expert opinion, as well as estimations and assumptions on how the actions would be implemented. The costs are therefore indicative only, particularly as many of the actions in the plans are dependent on research and exploration that has not yet been carried out, and also because activity at sea is subject to much uncertainty due to the weather and other problems of operating in locations remote from land. The scale of the costs reflect the high expense associated with research, survey and monitoring at sea.
- 3.6 More detailed information on the cost estimates will be available in a series of reports to be published by English Nature in its Research Report series, available from English Nature's Enquiry Service. There will be separate reports for habitats and species, together with a summary report for all species and habitats.

Priority Species Action Plans

Mammals

Harbour porpoise (*Phocoena phocoena*)

Species Action Plan

| | | |
|---|--|---|
| 1. Current status | | cause of death and condition of the animals at the time of death. |
| 1.1 There is some evidence of a decline in numbers of harbour porpoise in UK waters since the 1940s, especially in the southern North Sea and English Channel. The conservation status of the species around the whole UK coast is unknown, but the recent 'SCANS' survey of small cetaceans in the North Sea, Channel and Celtic Sea indicated the population in those waters was approximately 350,000. | 3.6 | Conservation, management and research action is being undertaken and planned under ASCOBANS. |
| 1.2 The harbour porpoise is listed on Appendix II of CITES, Appendix II of the Bern Convention and Annexes II and IV of the EC Habitats Directive. It is also on Appendix 2 of the Bonn Convention and is covered by the terms of the Agreement on the Conservation of Small Cetaceans of the Baltic and North Seas (ASCOBANS), a regional agreement under the Bonn Convention. It is protected under Schedule 5 of the Wildlife and Countryside Act 1981. | 4. Action plan objectives and targets | |
| | 4.1 | Maintain the current range and abundance of the harbour porpoise, with a longer term aim of ensuring that no anthropogenic factors inhibit a return to waters that previously held the harbour porpoise. |
| 2. Current factors causing loss or decline | 5. Proposed action with lead agencies | |
| 2.1 The current factors affecting this species are not clear but may include: | 5.1 Policy and legislation | |
| 2.1.1 Incidental capture and drowning in fishing nets. | 5.1.1 | Extend the ASCOBANS boundary to include the Western Approaches and the Irish Sea through a bilateral treaty with the Republic of Ireland and agreement of ASCOBANS Parties. (ACTION: DoE, DoE(NI)) |
| 2.1.2 Environmental contaminants (toxic substances at sea, marine debris, disease, noise disturbance). | 5.1.2 | Seek to improve coastal water quality by reducing the discharge of substances which are toxic, persistent and liable to bioaccumulate, giving priority to phasing out identifiable PCBs, and reducing discharges of organohalogens to safe levels. (ACTION: DANI, MAFF, EA, SE, SEPA) |
| 2.1.3 Environmental change (effects of fishing and possibly climate change). | 5.1.3 | Continue the duty on sea fisheries regulators to take account of potential wider impacts on wildlife and habitats (in addition to target species) when deciding fishery management measures. (ACTION: DANI, DETR, MAFF, SE) |
| 3. Current action | 5.1.4 | Consider, in the light of research at 3.2, the possible need to monitor and control gill nets and other set net fisheries. (ACTION: DANI, MAFF, NAW, SE) |
| 3.1 Distribution studies have been undertaken by JNCC since 1980. The Sea Mammal Research Unit co-ordinated the international 'SCANS' survey in 1994. | 5.1.5 | Continue to introduce agreed codes of conduct to reduce disturbance from acoustic sources and physical pressures. (ACTION: CCW, EN, DoE(NI), JNCC, SNH) |
| 3.2 Studies of the scale and effects of by-catch by the Sea Mammal Research Unit and others took place during 1995-1998. | 5.2 Site safeguard and management | |
| 3.3 Experiments to increase the acoustic detectability of fishing nets have been undertaken to reduce by-catch. | 5.2.1 | Review existing UK marine site protection to determine how it might be improved. If appropriate introduce additional protection and emergency designation to benefit the species. (ACTION: DETR, DoE(NI), JNCC, SE) |
| 3.4 Guidelines to minimise the effects of acoustic disturbance from seismic surveys have been agreed with the oil and gas industry and published by DoE. | | |
| 3.5 Post-mortem and tissue studies of stranded corpses are carried out on stranded specimens to establish the | | |

5.3 Species management and protection

5.3.1 Work with fishers with the aim of reducing and avoiding by-catches in active and passive gear, and to dispose of discarded gear safely. (ACTION: DANI, MAFF, NAW, SE)

5.3.2 Introduce codes of practice to reduce disturbance from whale-watching. (ACTION: CCW, DoE(NI), EN, JNCC, SNH)

5.4 Advisory

5.4.1 None proposed.

5.5 Future research and monitoring

5.5.1 Expand research on the areas frequented by harbour porpoise to identify waters which may qualify for further protection as SACs or Marine Nature Reserves. (ACTION: DoE(NI), JNCC)

5.5.2 Establish long-term research on population and conservation needs of all small cetaceans in UK waters, co-ordinated through ASCOBANS. (ACTION: DETR, DoE(NI), JNCC)

5.5.3 Subject to the results of the research at 3.2, consider the monitoring of the UK population and reporting of by-catches of small cetaceans (including observers on vessels, where feasible). (ACTION: DANI, JNCC, MAFF, SE)

5.5.4 Seek to minimise the by-catch of small cetaceans by promoting research into fishing gear and other possible mechanisms. (ACTION: DANI, MAFF, SE)

5.5.5 Promote research into the causes of death of the harbour porpoise within UK waters to determine the context and need for future conservation action. (ACTION: CCW, DANI, DoE(NI), EN, JNCC, MAFF, NAW, SE, SNH)

5.5.6 Pass information gathered during survey and monitoring of this species to JNCC or BRC in order that it can be incorporated in a national database and contribute to the maintenance of an up-to-date Red List. (ACTION: CCW, DoE(NI), EN, SNH)

5.6 Communications and publicity

5.6.1 Subject to the results of research at 3.2, consider the need to encourage fishermen to report sightings and by-catches through an awareness programme. (ACTION: DANI, DETR, MAFF, SE)

5.6.2 Encourage international exchange of information to assess and, if appropriate, reduce by-catches. (ACTION: DANI, DoE, JNCC, MAFF, SE)

5.6.3 Continue to publicise reporting schemes for strandings and live-sightings. (ACTION: CCW, DoE(NI), EN, SE, SNH)

Baleen whales

Grouped Species Action Plan

1. Current status

1.1 Six species of baleen whale need to be considered in this grouped action plan. Special reference is made to Minke Whale (*Balaenoptera acutorostrata*).

1.2 **Blue whale *Balaenoptera musculus*.** Mainly a deep-water migratory species present in all oceans at all latitudes. Whaling during the late 19th and 20th century greatly reduced its abundance. Scottish catches from the whaling station at Bunavoneader in Harris between 1908 and 1927 amounted to 308 individuals, mostly taken in July, August and September. There is some evidence of recovery from this and other whaling in the central-north Atlantic. Although rarely seen in UK waters except along the shelf edge, sightings data and recent studies using bottom-mounted hydrophone arrays indicate their presence in waters to the west and north of the UK for most of the year.

1.3 **Fin whale *Balaenoptera physalus*.** Mainly a deep-water migratory species present in all oceans at all latitudes. Abundance has been much reduced in the north Atlantic by late 19th and 20th century whaling. Scottish catches from Harris accounted for more than 4000 fin whales between 1908 and 1927. In UK waters sightings data and recent studies using bottom-mounted hydrophone arrays indicate that fin whales are generally confined to the shelf edge and are most frequently seen in summer.

1.4 **Sei whale *Balaenoptera borealis*.** Mainly a deep-water migratory species in warm and temperate waters of all oceans. Abundance was certainly reduced in the north Atlantic by late 19th and 20th century whaling, although current status is uncertain. Generally considered rare in UK waters, the whaling station at Bunavoneader nevertheless took 1722 between 1908 and 1927, though most of these were in just a few years, suggesting episodic movements closer to shelf waters. Recent sightings data have added to our knowledge of the distribution and abundance of sei whales off the UK although confusion in identification may occur with fin whales.

1.5 **Minke whale *Balaenoptera acutorostrata*.** A common migratory species present in all oceans. Fairly common in UK waters north of about 55° and in the South-West Approaches, particularly in summer. The abundance was estimated at 8500 in the North Sea and adjacent waters in summer 1994 and at 110,000 in the eastern north Atlantic in summer 1995. Recent sightings data have added to our knowledge of the distribution

and abundance of minke whales in UK waters and adjacent offshore areas.

1.6 **Humpback whale *Megaptera novaeangliae*.** A migratory species present in all oceans. In the north Atlantic humpback whales feed mainly in coastal waters in high latitudes, including off Norway and Iceland in summer. All north Atlantic humpbacks are believed to breed in the West Indies in winter but there is also a remnant breeding area off North Africa about which little is known. The largest numbers of animals were taken in the north Atlantic during the 19th century, but 35 were taken between 1908 and 1927 from UK whaling stations. There is evidence of recovery from whaling, and abundance in the north Atlantic has been estimated at 10-15,000 in 1992/93. The few but regular sightings in recent years combined with data from bottom-mounted hydrophone arrays could be indicative of a return of the humpback whale to UK waters.

1.7 **Northern right whale *Eubalaena glacialis*.** A very rare species in the North Atlantic as a result of human hunting beginning in the 11th century, continuing through to the 20th century. The Harris station accounted for 69 northern right whales between 1908 and 1927. It is believed to number no more than 300 animals currently and there is no evidence of recovery. Ship strikes and fisheries entanglements cause mortality off North America. Extremely rare or possibly extinct in the eastern north Atlantic.

1.8 All baleen whales are protected under schedule 5 in both the Wildlife and Countryside Act 1981 and the Wildlife (Northern Ireland) Order 1985. All whales are listed on Annex A of EU Council Regulation 338/97 and therefore treated by the EU as if they are on CITES, Appendix I, thus prohibiting their commercial trade. They are listed in Appendix I of CITES (except for *Balaenoptera acutorostrata* population of West Greenland which is on Appendix II), Appendix II of the Bern Convention and Annex IV of the EC Habitats Directive. Whaling is illegal in UK waters (Fisheries Act 1981) but neighbouring countries maintain the right to hunt. The UK recognises only the authority of the International Whaling Commission (IWC) in matters concerning the regulation of whaling.

2. Current factors causing loss or decline

2.1 A current factor causing loss or decline is the continuing commercial whaling for minkes in the north Atlantic by Norway. Norway resumed commercial whaling in

1993 under formal objection to the IWC moratorium which was introduced in 1986. Norway set quotas of 425, 580 and 671 minke whales for the north Atlantic in 1996, 1997 and 1998 respectively, with 178 of the 1998 quota allocated to the northern North Sea (outside UK waters).

2.2 Other factors causing loss or decline are not well understood. Concerns have been raised about acoustic disturbance and contaminants. Contaminants, including organochlorines, may affect the reproductive potential or cause immune suppression in marine mammals, including baleen whales. Demonstrating such effects is extremely difficult, as controlled experiments are generally impossible. Concerns have also been expressed that intensive levels of fishing round the UK may have affected the abundance or availability of marine mammals' prey species, especially for the more piscivorous species, including minke whales. Again, the difficulty in obtaining experimental evidence of such effects means that they are at present speculative.

2.3 Seismic survey activity in the Atlantic Frontier (continental shelf break north and west of the British Isles) has increased since 1994. This is also an area frequented by many whale species. Most of the seismic sound energy generated is at frequencies below the main hearing range of whales, but nevertheless there is overlap and potential harm may be caused by direct auditory damage at close distances and interference with navigation, food-finding, and communication further away. Entanglement in fishing gear is known in western Atlantic (right and humpback) and has been recorded recently in Scottish waters (humpback). It is not, however, believed to be a major problem.

2.4 In the North Atlantic, collisions with shipping are thought to be one of the most significant factors impeding the recovery of the northern right whale population. Although currently extremely rare in the eastern North Atlantic, the possibility of right whale collisions with shipping could be a potential cause for concern if recovery seems possible. Other species of baleen whale seem not to be significantly affected in this way although there are recent records of at least two minke whales being killed as a result of collisions with shipping in UK waters.

2.5 Global climate change may also have an effect on whales, but any impacts are difficult to predict.

3. Current action

3.1 Three international North Atlantic Sightings Surveys to estimate abundance were conducted in 1987, 1989 and 1995. The Sea Mammal Research Unit coordinated the international SCANS survey in the

North Sea and adjacent waters in 1994. Norway continues to conduct abundance surveys in the eastern north Atlantic. Distribution surveys around the British Isles have been conducted by JNCC since 1980. The Sea Watch Foundation collects distributional information from a broad range of individuals and organisations. Sightings surveys from seismic survey vessels have also given a good number of new records and the data from the hydrophone arrays are adding significantly to our knowledge of the numbers and distribution of baleen whales.

3.2 Before licences are awarded by the Department of Trade and Industry (DTI) to offshore blocks for oil and gas exploration, operators are required to conduct a preliminary assessment of the impact of their proposed operations. In addition, restrictions on operating practices are included in the conditions attached to each licence to protect areas of sensitivity. For example, this may restrict the undertaking of seismic surveys to months when cetacean activity is known to be at its minimum. Following the award of licences, under the regulations implementing the 1997 Environmental Assessment Directive, operators are required to assess the potential impact of their actions. In cases where there is the possibility of significant impact they may be required to undertake a full environmental assessment seeking advice from consultees, both statutory and non-statutory. If the operation cannot be conducted without causing significant environmental impact, the operation may not be allowed to proceed.

3.3 Guidelines to minimise the effects of acoustic disturbance from seismic surveys have been agreed with the oil and gas industry and were published by the then Department of the Environment in 1995. These Guidelines were revised in April 1998. Application of the Guidelines is required in blocks awarded to operators under the 16th and 17th Offshore Licensing Rounds. However, member companies of the UK Offshore Operators Association (UKOOA) have indicated that they will comply with these Guidelines in all areas of the UK Continental Shelf and, in some cases, elsewhere. Under the guidelines there is a requirement for visual and acoustic surveys of the area prior to seismic testing to determine if cetaceans are in the vicinity, and a slow and progressive build-up of sound to enable animals to move away from the source.

3.4 In June 1998, JNCC organised a workshop on the potential impacts of seismic activities on marine mammals. The workshop was attended by representatives from the oil and gas industry, geophysical and environmental contractors. They identified information and concerns and discussed possible research needs and regulatory mechanisms.

- 3.5** In 1999 DETR produced two sets of guidelines aimed at minimising disturbance to cetaceans: *Minimising disturbance to cetaceans from whale watching operations*, and *Minimising disturbance to cetaceans from recreation at sea*. The first set of guidelines is aimed at those involved in whale, dolphin and porpoise watching - both tour operators and members of the public who participate in tours. The second is aimed at those involved in any recreational activity in UK coastal waters who may incidentally encounter cetaceans.
- 3.6** Post-mortem and tissues studies of stranded carcasses are carried out to establish body condition and cause of death by the Scottish Agricultural College in Scotland, and the Institute of Zoology in collaboration with the Natural History Museum in England and Wales under contract to the Department of the Environment, Transport and the Regions (DETR).
- 4. Action plan objectives and targets**
- 4.1** In the short term, maintain the current range and abundance of baleen whales.
- 4.2** In the long term (over the next 20 years), seek to increase the baleen whale population ranges and sizes around the UK.
- 5. Proposed action with lead agencies**
- 5.1 Policy and legislation**
- 5.1.1** Seek to improve coastal water quality to standards set in EC Directives and international conventions by reducing the discharge of substances which are toxic, infectious, persistent or liable to bioaccumulate. (ACTION: DETR, EHS, EA, MAFF, NAW, SEPA, SE)
- 5.1.2** Continue to improve agreed codes of conduct to reduce disturbance from physical and acoustic sources. (ACTION: CCW, DETR, EHS, EN, JNCC, SNH)
- 5.1.3** Incorporate international objectives of ASCOBANS, IWC, OSPAR and MARPOL as appropriate into UK legislation. (ACTION: DETR, NAW, NIO, SE)
- 5.2 Site safeguard and management**
- 5.2.1** Determine sites and times which may be critical to the life history of baleen whales and implement specific protective measures as appropriate. (ACTION: DANI, DETR, MAFF, JNCC, NAW, SE)
- 5.2.2** Support attempts to identify and protect the breeding sites of any remnant eastern Atlantic right whale or humpback whale population. (ACTION: DANI, DETR, MAFF, JNCC, NAW, SE)
- 5.3 Species management and protection**
- 5.3.1** Review DETR guidelines for minimising disturbance to cetaceans from whale watching operations and from recreation at sea by 2001. (ACTION: CCW, DETR, EHS, EN, JNCC, NERC, SNH)
- 5.4 Advisory**
- 5.4.1** Provide advice, as appropriate, to international fora involved in the conservation of North Atlantic baleen whales (eg IWC, CITES, ICES). (ACTION: DANI, DETR, JNCC, MAFF, NAW, NERC, SE)
- 5.4.2** Promote among oil and gas and geophysical exploration industries a better understanding of cetaceans and the effects of underwater sounds upon their lives. (ACTION: CCW, DETR, DTI, EN, JNCC, SE, SNH)
- 5.5 Future research and monitoring**
- 5.5.1** Support long-term monitoring of population abundance and distribution to assess recovery from whaling. Consideration is needed of previously unused data on cetacean distributions such as Hydrographic Office surveys. (ACTION: DETR, EHS, JNCC, MAFF)
- 5.5.2** Support appropriate research into population structure and habitat use to identify, by 2009, waters which may be particularly suitable for baleen whales and which may qualify for further protection. (ACTION: CCW, DETR, EHS, JNCC, SE)
- 5.5.3** Support appropriate work into the effects of contaminants on baleen whale populations, including the development of indicators such as biomarkers. (ACTION: EHS, DETR, EA, JNCC, NERC, SE, SEPA)
- 5.5.4** Continue to support appropriate research into the effects of acoustic disturbance. (ACTION: CCW, EHS, NERC, JNCC)
- 5.5.5** Support appropriate research into identifying marine living resources utilised by baleen whales and the environmental changes caused by fishing. (ACTION: DANI, JNCC, MAFF, SE)
- 5.5.6** Support appropriate research into predicting the effects on baleen whales of climate change. (ACTION: EHS, DETR, JNCC, NERC, SE)

5.6 Communications and publicity

5.6.1 Encourage international exchange of information to facilitate assessment of recovery from whaling. (ACTION: EHS, DETR, JNCC, MAFF, SE)

5.6.2 Generate support to phase out the use of PCBs worldwide. (ACTION: EHS, DETR, JNCC, MAFF, SE)

5.6.3 Continue to publicise stranding and sighting schemes. (ACTION: CCW, DETR, EHS, EN, SE, SNH)

5.7 Links with other action plans

5.7.1 Similar actions are proposed in the other Cetacea species action plans. Particular attention should be drawn to interactions with marine operations such as fishing, geophysical exploration and whale-watching.

Small dolphins

Grouped Species Action Plan

1. Current status

1.1 There are six small dolphin species occurring regularly in UK waters.

1.2 **Bottlenose dolphin *Tursiops truncatus*.** Along the Atlantic seaboard of Europe, the bottlenose dolphin is locally frequent nearshore off the coasts of Spain, Portugal, north-west France, western Ireland, north-east Scotland, in the Irish Sea (particularly Cardigan Bay and south-east Ireland), and in the English Channel. The species also occurs offshore in the north Atlantic as far north as the Faroe Islands. Although overall population estimates do not exist, studies indicate a resident population of 130 bottlenose dolphins in the Moray Firth whilst the population in Cardigan Bay has been variably estimated at 130-350 bottlenose dolphins. Neither population is closed, and individuals may join up for periods of time from elsewhere. Numbers at most UK sites are greatest between July and October (with a secondary peak in some localities in March-April).

1.3 **Risso's dolphin *Grampus griseus*.** Although present in UK waters throughout the year, numbers are greatest between May and September. The major UK population occurs around the Hebrides, with a regular presence in the Northern Isles, and in the Irish Sea, particularly around Bardsey Island. Elsewhere, it is fairly common in south-east Ireland and western Ireland, around the Iberian Peninsula and in the Mediterranean. A study in the North Minches of Scotland has identified at least 142 individuals but no population estimate has yet been made.

1.4 **White-beaked dolphin *Lagenorhynchus albirostris*.** This species occurs over a large part of the northern European continental shelf, its distribution extending northwards to Iceland, the Greenland Sea and central-west Greenland. It is common in UK and Irish waters, occurring most abundantly in the central and northern North Sea across to north-west Scotland, although it also occurs occasionally in southern Ireland, the Irish Sea and western Channel. A population estimate of between 4000-13,300 was made in July 1994 for the North Sea and Channel with a further estimate in the same area of 6000 to 18,500 small dolphins (both white-beaked and white-sided dolphins, but not differentiated). In UK waters, the species is most common in late summer (June to September) although present in northern Britain throughout the year.

1.5 **Atlantic white-sided dolphin *Lagenorhynchus acutus*.** This species is widely distributed mainly in offshore waters from central-west Greenland, Iceland and the southern Barents Sea, south to the Bay of Biscay. In UK waters, its distribution is concentrated around the Hebrides, Northern Isles and northern North Sea. The species also occurs regularly off western Ireland and in the south-west approaches to the English Channel, but is rare in the Irish Sea, the eastern Channel and southernmost North Sea. No population estimate exists for the species, although the estimate of 6000 to 18,500 referred to in paragraph 1.4, includes an unknown proportion of white-sided dolphins. In UK waters, the species is most common between July and September although this may reflect favourable observing conditions.

1.6 **Common dolphin *Delphinus delphis*.** The species is abundant and widely distributed in the eastern north Atlantic, mainly in deeper waters from the Iberian Peninsula north to western Scotland. In UK waters, it is common in the western approaches to the English Channel and the southern Irish Sea (particularly around the Celtic Deep, off Pembrokeshire) and around the Inner Hebrides north to Skye. It is also common west of Ireland. In some years, the species occurs further north and east - around Shetland and Orkney, and in the northern North Sea. It is generally rare in the southern North Sea and eastern portion of the Channel. No overall population estimate exists, but the population around the Celtic Deep was estimated to be between 23,000-249,000.

1.7 **Striped dolphin *Stenella coeruleoalba*.** A subtropical and warm temperate species, occurring in the north Atlantic in offshore areas to the west of the Iberian Peninsula and France. Records are also held for this species in the Mediterranean. In UK waters the species is rare, recorded mainly from the south-west approaches to the English Channel and off Southern Ireland, although occasional sightings and strandings have occurred as far north as Shetland. No population estimates exist for the region. Most records, nearshore to the UK, occur between July and December.

1.8 Status changes for all these six species cannot be readily assessed through lack of quantitative data. There is no clear evidence of recent population changes, although records of both striped and common dolphins are more frequent in northern Britain during the 1990s than they were in the 1980s. This suggests a possible recent northward extension of their range, whilst bottlenose dolphins are reported to be less

frequent in the southernmost North Sea than they were in the 1960s and 1970s.

1.9 All species of cetaceans are given protection under the Wildlife and Countryside Act 1981 and the Wildlife (Northern Ireland) Order 1985. All cetacean species are listed on Annex IV (Animal and Plant Species of Community Interest in Need of Strict Protection) of the EC Habitats Directive. All cetacean species are listed on Annex A of EU Council Regulation 338/97 and therefore treated by the EU as if they are on CITES Appendix I thus prohibiting their commercial trade.

1.10 The bottlenose dolphin is listed in Annex II and IV of the EC Habitats Directive. Under Annex IV the keeping, sale or exchange of such species is banned, as well as deliberate capture, killing or disturbance. The Directive requires that member states monitor the incidental capture and killing of all cetaceans. Under Annex II candidate marine SACs (Special Areas of Conservation) for bottlenose dolphins are being established in the Moray Firth, (north-east Scotland) and in Cardigan Bay (west Wales).

1.11 An Agreement on the Conservation of Small Cetaceans in the Baltic and North Seas (ASCOBANS), formulated in 1992, has now been signed by seven European countries, including the UK. Under the Agreement, provision is made for protection of specific areas, monitoring, research, information exchange, pollution control and heightening public awareness. Measures are included aimed specially at protecting dolphins and porpoises in the North and Baltic Seas and cover the monitoring of fisheries interactions and disturbance, resolutions for the reduction of by-catches (below 2% of stock sizes), and recommendations for the establishment of specific protected areas for cetaceans.

1.12 The six dolphin species covered in this plan are protected under ASCOBANS' parent Convention, the Bonn Convention. The North and Baltic Sea populations of the bottlenose, Risso's, white-beaked, Atlantic white-sided and common dolphin are included on Appendix II of the Bonn Convention. The western Mediterranean population of the striped dolphin is included on Appendix II of the Bonn Convention.

2. Current factors causing loss or decline

2.1 The present status for each of the dolphin species occurring in UK waters is not known sufficiently to evaluate properly the extent to which population changes have taken place. However, four main human activities are recognised as currently likely to be detrimental to dolphins: activities leading to ecosystem changes;

interactions with fisheries; boat activities; and contaminant inputs.

2.2 Ecosystem changes resulting from the widespread over-exploitation of marine biological resources in European waters have the potential to affect energy budgets and thence reproduction and survival of all UK dolphin species.

2.3 All the dolphin species considered here have been recorded as by-catches of various fisheries. There is evidence of substantial numbers of dolphins (mainly common and Atlantic white-sided dolphins) caught in pelagic trawls (targeting tuna, hake, bass, horse mackerel, mackerel and herring) in the south-west approaches to the English Channel and Celtic Sea. Annual by-catch estimates of 1200 striped dolphins and 400 common dolphins were obtained in 1992-93 in French drift-net fisheries for albacore tuna operating between the Azores and southern Ireland. The small UK tuna drift net fleet operating in the Bay of Biscay was estimated in 1995 to have a by-catch of 100 striped dolphins and 60 common dolphins in 1995. Post-mortem studies of 138 common dolphins washed ashore on UK coasts (mainly south-west England) between 1990 and 1995 revealed at least 62% of animals died as a result of by-catch.

2.4 Boat activities (merchant shipping, seismic, military and recreational) in coastal waters pose threats to dolphins by direct physical damage (collisions, and propeller damage) and by the sounds introduced into the environment, where potential harm may be caused by direct auditory damage at close distances and interference with navigation, food-finding, and communication further away. The English Channel is one of the most intensively used waterways in the world, and the North and Irish Seas are not far behind. In recent years, seismic activities have started in the Iris Sea, parts of the Channel, and along the Atlantic Frontier, west and north of Scotland and Ireland, following earlier emphasis on the northern and central North Sea.

2.5 Contaminants, including organochlorines, may impact the reproductive potential or cause immunosuppression in marine mammals, including dolphins. High concentrations of bioaccumulating chemicals have been detected in the tissues of marine mammals, and long-lived animals such as cetaceans are more at risk of accumulative heavy pollution burdens than shorter-lived ones. In Cardigan Bay, a few years ago the body of a dead bottlenose dolphin calf was found to have one of the highest levels of contaminants such as PCBs, DDT and mercury ever found in a mammal.

- 2.6** Global climate change may also have an effect on small dolphins but impacts on marine mammals are very difficult to predict.

3. Current action

- 3.1** In 1998, the EU Fisheries Council decided to ban the catching of tuna with drift-nets by 1 January 2002.
- 3.2** Before licences are awarded by the Department of Trade and Industry (DTI) to offshore blocks for oil and gas exploration, operators are required to conduct a preliminary assessment of the impact of their proposed operations using baseline data gathered and provided by government. In addition, restrictions on operating practices are included in the conditions attached to each licence to protect areas of sensitivity. For example, this may restrict the undertaking of seismic surveys to months when cetacean activity is known to be at its minimum. Following the award of licences, under the regulations implementing the Environmental Assessment Directive, operators are required to assess the potential impact of their actions. In cases where there is the possibility of significant impact they may be required to undertake a full environmental assessment seeking advice from consultees, both statutory and non-statutory. If the operation cannot be conducted without causing significant environmental impact, the operation may not be allowed to proceed.
- 3.3** Guidelines for seismic operators to minimise potential impacts of acoustic disturbance from seismic surveys were agreed with the oil and gas industry and published in 1995 by the then Department of the Environment and subsequently revised in April 1998. As a condition of licences awarded under the 16th and 17th Offshore Licensing Rounds, operators are required to conduct seismic activities in accordance with DETR Guidelines for the Minimisation of Acoustic Disturbance to Small Cetaceans. Member companies of the UK Offshore Operators Association (UKOOA) have indicated that they will comply with these Guidelines in all areas of the UK Continental Shelf and, in some cases, elsewhere. Under the guidelines there is a requirement for visual and acoustic surveys of the area prior to seismic testing to determine if cetaceans are in the vicinity, and a slow and progressive build-up of sound to enable animals to move.
- 3.4** A JNCC workshop in 1988 on the potential impacts of seismic activities on marine mammals was attended by representatives from the oil and gas industry, geophysical and environmental contractors, and identified information and concerns and discussed possible research needs and regulatory mechanisms.
- 3.5** Guidance has been drawn up by DETR and JNCC to encourage recreational users (including whale-watching operators) to minimise disturbance to

dolphins. These include avoidance of sudden alteration in vessel speed or direction and pursuit of animals. Recommendations have also been made to limit the number of vessels in close proximity, and length of time of encounter.

4. Action plan objectives and targets

- 4.1** In the short term, maintain the current range and abundance of small dolphins.
- 4.2** In the longer term, seek to increase the ranges of small dolphin populations where appropriate.

5. Proposed action with lead agencies

The main priorities are: gaining a better knowledge about the status, distribution and ecology of all species of small dolphins in UK waters; monitoring and addressing potential threats; and disseminating information to users that may come into conflict - in particular, the fishing, oil and gas industries, military, and recreational operators.

5.1 Policy and legislation

- 5.1.1** By 2001 encourage commercial dolphin-watching and other vessels to follow a code of conduct when operating in the vicinity of dolphins, which minimises the disturbance to these animals and the chance of injury. (ACTION: CCW, DCMS, DETR, EHS, EN, JNCC, SNH)
- 5.1.2** Develop a definition of 'harassment' to be used in the protective legislation for dolphins so that intent to disturb does not have to be proven. (ACTION: DETR, DoE(NI), NAW, SE)
- 5.1.3** Before offshore oil and gas exploration licences are awarded by DTI, include in Environmental Impact Assessments a detailed evaluation of seasonal use to determine dolphin distribution within any proposed licence block. (ACTION: DTI, JNCC)
- 5.1.4** Work towards extending the international objectives of ASCOBANS to cover all UK waters and the legislation to support marine protected areas. (ACTION: DETR, DoE(NI), NAW, SE)

5.2 Site safeguard and management

- 5.2.1** Ensure that SAC management schemes recognise the need for appropriate measures to protect against habitat modification, disturbance, and contaminant inputs which might affect dolphins. The safeguarding of these sites will require monitoring of potential impacts, and regulation of activities. (ACTION: All relevant and competent authorities)

- 5.2.2** Give consideration to the feasibility of marine protected areas for dolphins in the context of the proposed DETR working group on marine protected areas. These should include consideration of the importance of the area for calving, as a nursery ground and for feeding. (ACTION: DoE(NI), DETR, JNCC, NAW, SE)
- 5.2.3** By 2004 establish marine protected areas for small dolphins which take into account the likelihood of human activities that would be harmful to cetaceans living there. (ACTION: DETR, DoE(NI), NAW, SE)
- 5.2.4** Continue to support the EU ban on the use of large pelagic drift-nets (currently more than 2.5 km) throughout the European Union. (ACTION: DETR, DoE(NI), MAFF, SE)
- 5.3 Species management and protection**
- 5.3.1** Since cetacean populations generally range across national boundaries, their long-term conservation interests can only be met through international co-operation in legislation, research, monitoring, and information dissemination. For species in this action plan, promote the targets set by ASCOBANS and encourage partnership activities. (ACTION: DETR, NAW, SE)
- 5.4 Advisory**
- 5.4.1** Review advice on the best measures to avoid disturbance of dolphins. Ensure that this advice, and other on avoiding by-catches and injury, is readily available to all organisations: commercial, military and recreational. (ACTION: CCW, DETR, DoE(NI), EN, JNCC, SNH)
- 5.4.2** Promote among oil, gas and geophysical exploration industries a better understanding of cetaceans and the effects of underwater sounds upon their lives. (ACTION: CCW, DETR, DTI, EN, JNCC, SE, SNH)
- 5.4.3** Improve as necessary seismic guidelines for use by the oil and gas exploration companies. (ACTION: DETR, DTI, JNCC)
- 5.5 Future research and monitoring**
- 5.5.1** Commission acoustic and video research on behavioural aspects of cetacean by-catch to better understand ways to mitigate conflicts from particular fisheries. (ACTION: DETR, MAFF, NERC, SE)
- 5.5.2** Establish independent observer schemes for monitoring by-catches from all fisheries (including drift-net, pelagic trawl, fixed bottom set gill-net) thought to pose a threat to dolphin populations in UK waters. (ACTION: DANI, DETR, JNCC, MAFF, NAW, SE)
- 5.5.3** Commission autecological studies of all UK dolphin species to identify appropriate habitat management needs. (ACTION: CCW, DETR, EN, JNCC, NERC, SE, SNH)
- 5.5.4** Maintain and develop national strandings schemes and integrate with post-mortem studies and analyses of important biological data (life history parameters, genetics, diet, pollutant burdens, and pathogens). Ensure that samples are analysed. (ACTION: DETR, DoE(NI), NAW, SE)
- 5.5.5** Conduct studies of the effects of contaminant uptake on dolphins using biomarkers integrated with other research, and ensure samples are analysed. (ACTION: DETR, DoE(NI), NAW, SE)
- 5.5.6** Conduct experimental studies of both short-term and long-term effects of underwater sound on dolphins, with particular emphasis on seismic exploration and recreational activities. (ACTION: DETR, DoE(NI), DTI)
- 5.5.7** Support research into predicting the effects of climate change on small dolphins. (ACTION: DETR, DoE(NI), JNCC, MAFF, NAW, NERC, SE)
- 5.6 Communications and publicity**
- 5.6.1** By 2002, produce illustrative information material for specific coastal regions emphasising the value of habitats they contain for promoting dolphin biodiversity. (ACTION: CCW, DoE(NI) EN, JNCC, SNH)
- 5.6.2** Consider promoting the use of baffles over propeller blades of whale and dolphin watching boats to safeguard against physical damage. Provide instruction and regulation for the maintenance of propeller blades to reduce high frequency sound generated from cavitation. (ACTION: DETR, DTI, JNCC, SE)
- 5.7 Links with other action plans**
- 5.7.1** Similar actions are proposed in the other cetacean species action plans. It is likely that implementation of species action plans on baleen whales, toothed whales and the harbour porpoise will also be of benefit to small dolphins, as will any action plan relating to commercial fish and some marine habitats. Joint research should be promoted for all small cetaceans in UK waters with regard to population studies and conservation requirements.

Toothed whales (other than small dolphins)

Grouped Species Action Plan

1. Current status

1.1 The beaked whales (northern bottlenose, Cuvier's, Sowerby's and True's beaked whales) are species typical of the north Atlantic, but their status and distribution are poorly known.

1.2 **Northern bottlenose whale *Hyperoodon ampullatus*.** This species is found only in the north Atlantic, this cold-temperate to sub-arctic species occurs mainly in deep water off the continental slope. It is most commonly recorded off western Norway and in the Barents Sea. It also occurs in small numbers around the Northern Isles and Western Isles of Scotland, in the northern North Sea, along the continental shelf break west of Ireland.

1.3 **Cuvier's beaked whale *Ziphius cavirostris*.** A widely distributed species offshore in all oceans, often found in warmer waters. Rarely recorded north of the British Isles whereas it is the most common beaked whale recorded off the Iberian Peninsula and in the Mediterranean. Most records in UK waters come from the south-west approaches to the English Channel, Western Ireland and the Western Isles of Scotland.

1.4 **Sowerby's beaked whale *Mesoplodon bidens*.** This species is only known in cold north Atlantic waters. Recorded mainly in deep offshore waters north and west of the British Isles and Ireland, between Scotland and the Faeroes, and west of Norway, although it occurs at least occasionally south to the English Channel Approaches.

1.5 **True's beaked whale *Mesoplodon mirus*.** The distribution is very poorly known, but the few records that exist indicate that it occurs in the Atlantic Ocean west of the Outer Hebrides and Ireland and southwards at least as far as the Canaries.

1.6 For most beaked whale species there are too few records to indicate seasonality in UK waters, but northern bottlenose whales are recorded mainly between April and September. No numerical population estimates exist for any of the beaked whale species, but hunting of northern bottlenose whale between the 1880s and 1970s is believed to have resulted in population declines.

1.7 The **killer whale *Orcinus orca*** is a cosmopolitan species in all marine regions, and is widely distributed in the north Atlantic and in northern European coastal waters particularly around Iceland and western

Norway. In the UK, it is most common in northern and western Scotland, rare in the Irish, central and southern North Seas, and English Channel. In UK waters, killer whales occur in all months of the year, but are recorded near shore mainly between May and October. No overall population estimates exist, but recent sightings surveys in the eastern north Atlantic (mainly from Iceland to the Faroes) indicate a population in that region of between 3500 and 12,500 individuals.

1.8 The **long-finned pilot whale *Globicephala melas*** is found in both hemispheres, in oceanic temperate and sub-polar waters, although may be absent from the north Pacific. It is common and widely distributed in deep north Atlantic waters, but seasonally enters coastal areas such as the Faroes, northern Scotland, western Ireland and the south-west English Channel Approaches; it also occurs south to the Iberian Peninsula and is common in the Mediterranean. Although recorded in UK waters in all months of the year, it occurs in northern Britain mainly between June and September and between November and January further south. Sightings surveys in the eastern north Atlantic in the late 1980s estimate the population at over 700,000 but the difficulties of estimating pod size from survey vessels impose serious limitations to such estimates.

1.9 The **sperm whale *Physeter macrocephalus*** is found throughout both hemispheres. Widely distributed in small numbers throughout deep waters of the north Atlantic, from Iceland and Norway south to the Iberian Peninsula and east into the Mediterranean. It also occurs along the shelf break north and west of the British Isles and Ireland. In northern European waters, sperm whales are usually either adult or adolescent males which have undergone extensive latitudinal migrations from subtropical and tropical breeding areas. Sightings occur mainly between July and December, and there is evidence suggesting that, increasingly, small groups are remaining at high latitudes into winter months, and mass-strandings may take place. However, the cause of these strandings is unknown. There are no population estimates for sperm whales in the north Atlantic, but past hunting is believed to have depressed population size.

1.10 All species of cetaceans are given protection under the Wildlife and Countryside Act 1981 and the Wildlife (Northern Ireland) Order 1985. All cetacean species are listed on Annex IV (Animal and Plant Species of Community Interest in Need of Strict Protection) of the EC Habitats Directive. All whales are listed on Annex A of EU Council Regulation 338/97 and therefore treated by the EU as if they are on CITES Appendix I

thus prohibiting their commercial trade. Whaling is illegal in UK waters (Fisheries Act 1981), but neighbouring countries maintain the right to hunt. The UK recognises only the authority of the IWC in matters concerning the regulation of whaling.

- 1.11** An Agreement on the Conservation of Small Cetaceans in the Baltic and North Seas (ASCOBANS), formulated in 1992, has now been signed by seven European countries, including the UK. Under the Agreement, provision is made for protection of specific areas, monitoring, research, information exchange, pollution control and heightening public awareness. Although aimed primarily at dolphins and porpoises, ASCOBANS includes all toothed whales except the sperm whale. The northern bottlenose whale is also listed on Appendix II of the Bonn Convention, as are eastern north Atlantic populations of the killer whale and the North Sea and Baltic Sea populations of the long-finned pilot whale.

2. Current factors causing loss or decline

- 2.1** The present status of each of the cetacean species considered here is unknown. It is therefore difficult to properly evaluate whether major population changes have taken place. All the whale species considered in this plan spend most of their time offshore where they are likely to be relatively little affected by human disturbance, coastal fisheries and pollution. In general, factors affecting loss or decline are not well understood. However, concerns have been raised about contaminants, traditional drive fisheries, acoustic disturbance and interactions with fisheries.
- 2.2** Contaminants, including organochlorines, may impact the reproductive potential or cause immune suppression in marine mammals, including toothed whales. Demonstrating such effects is extremely difficult, as controlled experiments are generally impossible. Since 1972, oil and gas exploration has used seismic surveys offshore. Seismic survey activity has increased since 1994, and is now used in the Atlantic Frontier - the continental shelf break north and west of the British Isles where many large and medium sized toothed whales occur. Most of the sound energy generated is at frequencies below the main hearing range of toothed whales, but nevertheless there is overlap and potential harm may be caused by direct auditory damage at close distances and interference with navigation, food-finding, and communication further away. Global climate change may also have an effect on toothed whales, although impacts on marine mammals are very difficult to predict.
- 2.3** Although once common in the north Atlantic, drive fisheries now continue only in the Faeroe Islands. Pilot whales may be particularly vulnerable as their social behaviour makes them suitable for herding. Around

22,000 pilot whales were taken in the Faeroe Islands drive fishery between 1970 and 1992.

- 2.4** Killer whales in particular enter nearshore UK waters during the summer, where they may be exposed to a number of human activities that may be detrimental to them, for example disturbance from recreational craft including whale-watching vessels. At present, this is not a serious problem, but such activities are increasing steadily and may pose a threat in the future.
- 2.5** Fisheries, particularly for cephalopods, may affect the abundance or availability of prey species for toothed whales, as may fisheries for other deep-water species. Again, the difficulty in obtaining experimental evidence of such effects means that concerns are at present speculative. There have also been cases of sperm whale, Cuvier's beaked whale, killer whale, and long-finned pilot whale becoming entangled in fishing gear, but the scale of the problem is unknown. Killer whales in winter commonly associate with the mackerel purse seine fishery north of Shetland. During the 1970s, the mackerel fishery (purse seine and midwater trawls) in the western English Channel was reported to have occasionally caught pilot whales. In the UK, only one Cuvier's beaked whale and no sperm whales have been recorded as definitely entangled in fishing gear, but both species form by-catches of the Italian swordfish driftnet fishery in the Mediterranean. Pilot whales have been caught in pelagic trawls in the northern North Sea.

3. Current action

- 3.1** The most obvious negative influence upon some large and medium sized toothed whales species has been hunting. The International Whaling Commission imposed an indefinite moratorium on commercial whaling in 1986, by which time the species under consideration here had already been receiving protection. Traditional Faeroese drive fisheries for pilot whales still take place.
- 3.2** Three international north Atlantic Sightings Surveys to estimate abundance were conducted in 1987, 1989 and 1995. The Sea Mammal Research Unit coordinated the international SCANS survey in the North Sea and adjacent waters in 1994. Norway continues to conduct abundance surveys in the eastern north Atlantic. Distribution surveys around the British Isles have been conducted by the JNCC since 1980. The Sea Watch Foundation collects distributional information from a broad range of individuals and organisations. Sightings from seismic survey vessels and hydrophone arrays provide valuable data on the numbers and distribution of cetaceans.

- 3.3** Before licences are awarded by the Department of Trade and Industry (DTI) to offshore blocks for oil and gas exploration, operators are required to conduct a preliminary assessment of impact of their proposed operations. In addition, restrictions on operating practices are included in the conditions attached to each licence to protect areas of sensitivity. Following the award of licences, under the regulations implementing the Environmental Assessment Directive, operators are required to assess the potential impact of their actions. In cases where there is the possibility of significant impact they may be required to undertake a full environmental assessment seeking advice from statutory and non-statutory consultees. If the operation cannot be conducted without causing significant environmental impact, it may not be allowed to proceed.
- 3.4** Guidelines for seismic operators to minimise potential impacts of seismic surveys were agreed with the oil and gas industry, published in 1995 by the then Department of the Environment and subsequently revised in April 1998. Under the guidelines there is a requirement for visual and acoustic surveys of the area prior to seismic testing to determine if cetaceans are in the vicinity, and a slow and progressive build-up of sound to enable animals to move away from the source. Timing conditions may also be imposed on seismic surveys if this will reduce disturbance to known, regularly occurring concentrations of whales.
- 3.5** A JNCC workshop in 1998 on the potential impacts of seismic activities on marine mammals was attended by representatives from the oil and gas industry, geophysical and environmental contractors. They identified information and concerns and discussed possible research needs and regulatory mechanisms.
- 3.6** ASCOBANS has recommended measures in the North and Baltic Seas aimed at protecting dolphins and porpoises, which at the same time would benefit larger toothed whales. Most relevant are the monitoring of fisheries interactions, cetacean health and reduction of by-catches.
- 3.7** Post-mortem and tissues studies of stranded carcasses are carried out to establish body condition and cause of death by the Scottish Agricultural College, and the Institute of Zoology in England and Wales under contract to the Department of the Environment, Transport and the Regions.
- 4. Action plan objectives and targets**
- 4.1** In the short term, maintain range and numbers of toothed whales.
- 4.2** In the longer term, increase abundance by seeking to optimise conditions enabling their populations to increase.
- 5. Proposed action with lead agencies**
- The main priorities are better knowledge about the status, distribution and ecology of all species of toothed whales, monitoring of potential threats, and dissemination of information to offshore users - in particular, the fishing, oil and gas industries, military, and recreational operators - with possible safeguards that could be adopted. Recreational nearshore users should be educated with guidelines of how to behave in the vicinity of coastal whales.
- 5.1 Policy and legislation**
- 5.1.1** Continue support for IWC moratorium on commercial whaling. (ACTION: DETR, MAFF, SE)
- 5.1.2** Seek to improve coastal water quality to standards set in EC directives and International conventions by reducing the discharge of substances which are toxic, persistent and liable to bioaccumulate, giving priority to the discharge and leaching of PCBs and organochlorines. (ACTION: EHS, EA, MAFF, NAW, SE, SEPA)
- 5.1.3** Support and continue to improve agreed codes of conduct to reduce disturbance from acoustic sources (see 3.2). (ACTION: DTI, DETR, JNCC)
- 5.1.4** By 2001 encourage commercial dolphin-watching and other vessels to follow a code of conduct when operating in the vicinity of toothed whales, which minimises the disturbance to these animals and the chance of injury. A definition of harassment, which did not require proof of intent to disturb, should be considered. (ACTION: CCW, DCMS, DETR, EHS, EN, JNCC, SNH)
- 5.1.5** Incorporate international objectives of ASCOBANS, IWC, OSPAR and MARPOL as appropriate into UK legislation. (ACTION: DETR, MAFF, NAW, SE)
- 5.2 Site safeguard and management**
- 5.2.1** Identify important sites used by toothed whales for breeding and feeding. Area protection measures should then be sought for these locations. (ACTION: CCW, DANI, DETR, DoE(NI), EN, MAFF, JNCC, NAW, SE, SNH)

5.3 Species management and protection

5.3.1 As cetacean populations generally range across national boundaries, their long-term conservation interests can only be met through international co-operation in legislation, research, monitoring, and information dissemination. For most of the smaller toothed whales considered in this action plan, the targets set by ASCOBANS and others (eg OSPAR) should be promoted, and partnership activities encouraged. (ACTION: DETR, NAW, SE)

5.4 Advisory

5.4.1 Continue to promote among oil and gas and geophysical exploration industries a better understanding of cetaceans and the effects of underwater sounds upon their lives. (ACTION: DTL, JNCC)

5.4.2 Provide advice, as appropriate, to international fora involved in the conservation of north Atlantic toothed whales (eg IWC, CITES, ICES). (ACTION: DANI, DETR, JNCC, MAFF, NAW, SE)

5.5 Future research and monitoring

5.5.1 Support long-term monitoring of population abundance and distribution via dedicated surveys and platforms of opportunity. (ACTION: CCW, DETR, EHS, JNCC, MAFF, SNH)

5.5.2 Support research into population structure and habitat use to identify waters which may be particularly suitable for toothed whales and which may qualify for further protection. (ACTION: CCW, EHS, DETR, JNCC, SE)

5.5.3 Support work into the effects of contaminants on toothed whale populations, including the development of indicators such as biomarkers. (ACTION: EHS, DETR, EA, JNCC, MAFF, NERC, SE, SEPA)

5.5.4 Support research into predicting the effects of climate change on toothed whales. (ACTION: DETR, EHS, JNCC, MAFF, NERC, SE)

5.5.5 Investigate access to and consider the use of previously unused data on cetacean distributions, eg Hydrographic Office surveys. (ACTION: DETR, EHS, JNCC, MAFF, NERC, SE, SNH)

5.5.6 Continue to support research into the effects of acoustic disturbance. (ACTION: DETR, JNCC, NERC)

5.5.7 Support research into identifying marine living resources utilised by toothed whales and the environmental

changes related to fishing. (ACTION: DANI, JNCC, MAFF, SE)

5.6 Communications and publicity

5.6.1 By 2004, produce illustrative information material emphasising the value of particular offshore habitats for a diversity of toothed whale species. This should be directed at the fishing industry, oil and gas industry, merchant shipping and ferry operators. (ACTION: CCW, EN, JNCC, SNH)

5.6.2 Promote wider dissemination of Codes of Conduct for recreational users to minimise human disturbance in coastal waters through production of material at strategic coastal sites. Recommendations in the Codes of Conduct should be consistent between regions although adaptations to local circumstances and species may be required. (ACTION: CCW, DETR, EN, JNCC, LAs, SE, SNH)

5.6.3 Continue to publicise stranding and sighting schemes. (ACTION: CCW, EHS, EN, SE, SNH)

5.7 Links with other action plans

5.7.1 Similar actions are proposed in the cetacea species action plans for baleen whales and dolphins. It is likely that implementation of species action plans on baleen whales, dolphins and the harbour porpoise will also be of benefit to these species, as will the action plans for commercial fish and marine offshore habitats.

Reptiles

Marine turtles

Grouped Species Action Plan

1. Current status

- 1.1** The five (of the seven) species of marine turtle to have been recorded in UK waters are leatherback turtle *Dermochelys coriacea*, loggerhead turtle *Caretta caretta*, Kemp's ridley turtle *Lepidochelys kempii*, green turtle *Chelonia mydas* and hawksbill turtle *Eretmochelys imbricata*. However, there is some doubt as to whether reports of hawksbills can be confirmed.
- 1.2** Over the last 100 years there have been around 500 records of marine turtles from UK waters, particularly along the western coast, the large majority of those which can be identified being adult leatherbacks. The majority of these records are from the last 40 years and sightings are continuing to increase. In addition, large numbers of turtles are seen in waters above the shelf break in the Celtic Sea. Adult leatherbacks are regularly recorded in cool temperate waters around the world. They are endothermic and able to cope with cool water conditions, unlike the cheloniid or 'hard-shelled' species.
- 1.3** In UK waters the leatherback has a distinct, seasonal occurrence with the majority of sightings being recorded between August and October. It is likely that those individuals recorded around the UK follow the great oceanic gyre of the north Atlantic, travelling from and returning to the nesting beaches of the tropical and sub-tropical regions of the eastern American mainland coast and Caribbean islands. Although the cheloniid species are believed to arrive in UK waters accidentally (with the possible exception of the loggerhead which may be at the extreme limit of its range), the occurrence of the leatherback is almost certainly the result of a deliberate, migratory movement.
- 1.4** The conservation status of turtle species around the whole UK is unknown since they are a difficult group of animals to study. The numbers of reported sightings has gone up over recent years but this is likely to be a result of increased publicity and improved rates of record submission. They are all regarded as threatened at a global level.
- 1.5** All five species are listed on Appendix I of the Convention on the International Trade in Endangered Species of Flora and Fauna (CITES) 1975, Appendix II of the Bern Convention 1979, Appendices I and II of the Bonn Convention 1979 and Annex IV of the EC Habitats Directive. The loggerhead is also listed as a priority species on Annex II of the EC Habitats Directive. All five species are protected under Schedule

5 of the Wildlife and Countryside Act 1981 and the Conservation (Natural Habitats & c.) Regulations 1994.

- 1.6** Although some species forage in temperate waters, nesting is restricted to beaches of tropical and subtropical waters. Some species of marine turtle have global distributions and their conservation has to be addressed at a global level. Many of the UK Overseas Territories have important nesting populations.

2. Current factors causing loss or decline

- 2.1** Over-harvesting of turtles for meat or eggs abroad, mainly in the vicinity of nesting areas in tropical and sub-tropical regions. This is the major cause of decline in the waters of UK Overseas Territories.
- 2.2** Detrimental impacts of the tourist industry (such as the construction of tourist developments along egg-laying beaches, the purchase of curios made from turtle products) and other development pressures on turtle populations abroad.
- 2.3** Collisions between turtles and boats and damage caused by propellers.
- 2.4** Incidental capture and drowning of turtles resulting from a range of fishery practices and detrimental impacts of trawling techniques on seagrass beds.
- 2.5** Pollution, particularly marine debris which can be ingested by turtles at sea or which cause obstructions on beaches to nesting females and hatchlings.
- 2.6** Predation on eggs by various species may be increasingly significant on beaches where predator numbers may be increased or concentrated through human activities.
- 2.7** Disease is a major cause of decline for the green turtle.

3. Current action

- 3.1** Legislative measures are in place to protect marine turtles in British waters (but not in Northern Ireland waters) and to control illegal trade (see 1.5). The International Convention for the Prevention of Pollution from Ships 1973, modified by the Protocol of 1978 ('MARPOL 73/78'), includes regulations in Annex V for the prevention of pollution by garbage from ships.

| | | |
|-------|---|--|
| 3.2 | A 'Turtle Code' advice sheet was produced by the Nature Conservancy Council in 1988, aimed at fishing industry and providing advice on identification, legislation, record submission and dealing with entanglements. | practices, possibly at local levels. (ACTION: DANI, MAFF, NAW, SE, SFCs) |
| 3.3 | Revised and bi-lingual 'Turtle Codes' were produced by SNH in 1996 and CCW in 1998. A 'Turtle Code' was also produced by the Cornish Wildlife Trust in 1997. | 5.1.4 Review current levels and effectiveness of legislative protection of marine turtles in all UK waters, particularly Northern Ireland, and all the UK Overseas Territories, and ensure appropriate protection measures are brought in where gaps are identified by 2005. (ACTION: DETR, EHS, FCO) |
| 3.4 | A review of marine turtle records from Scottish waters was produced by SNH in 1996. | 5.1.5 Review the value of the Bonn Convention in providing further protective measures for marine turtles by 2004. (ACTION: DETR, JNCC) |
| 3.5 | An 'Information and Advisory Note' on dealing with live, stranded or entangled marine turtles was produced by SNH in 1997. | 5.1.6 Provide support, in the form of advice, information sharing, and assistance to build capacity and resist detrimental development, to UK Overseas Territories in order to facilitate the conservation of their marine turtle populations at viable and sustainable levels. (ACTION: DfID, FCO) |
| 3.6 | The support of autopsies and biological material distribution has been undertaken on an <i>ad hoc</i> basis. SNH has funded five autopsies undertaken by SAC Veterinary Services between 1994-97. CCW has also provided funds to ensure marine turtles are covered through the cetacean stranding scheme. | 5.1.7 Promote consideration of the impact of EU funded development and activities on marine turtle habitats, in particular on nesting beaches (especially tourist developments affecting southern European nesting beaches), through advice, legislation and requirements for appropriate environmental impact assessments. (ACTION: DETR, DTI, FCO) |
| 3.7 | Marine turtle conservation issues in the UK have been publicised recently through the media, scientific conferences, wildlife group meetings and the production of scientific and popular articles. | 5.1.8 Promote consideration of the impact of UK based investments, industries, trade and activities on marine turtle habitats, in particular nesting beaches, through advice, legislation and guidance on environmental impact assessments. (ACTION: DETR, DTI) |
| 4. | Action plan objectives and targets | |
| 4.1 | Avoid accidental harm to, and by-catch of, marine turtles when present in UK waters. | |
| 4.2 | Contribute to international measures for the conservation of marine turtles. | 5.2 Site safeguard and management |
| 5. | Proposed action with lead agencies | 5.2.1 Ensure enforcement of marine pollution legislation (including that targeted at marine litter) in UK waters and by UK ships outwith UK waters. (ACTION: DETR, DTI, MoD) |
| 5.1 | Policy and legislation | 5.3 Species management and protection |
| 5.1.1 | Continue the duty on sea fisheries regulators to take account of potential wider impacts on wildlife and habitats (in addition to target species) when deciding fishery management measures, including during discussions with relevant EC bodies. (ACTION: DANI, DETR, MAFF, NAW, SE, SFCs) | 5.3.1 For those parts of the UK which have not already done so, produce revised 'turtle codes' by 2001, and distribute widely amongst the sea-going community through contact with appropriate organisations. (ACTION: EHS, EN) |
| 5.1.2 | Seek to improve coastal water quality, in particular by reducing marine debris which may be ingested by marine turtles. (ACTION: DANI, DETR, EA, MAFF, NAW, SE, SEPA) | 5.3.2 Introduce a code of practice for the 'repatriation', where necessary, of cheloniid turtle species which are occasionally stranded live on UK shores by 2002. (ACTION: CCW, EHS, EN, JNCC, SNH) |
| 5.1.3 | Consider, in light of research proposed in action 5.5.3, the need to monitor and control certain fishery | |

- 5.4 Advisory**
- 5.4.1** Provide advice to the fishing industry by 2004 with the aim of reducing and avoiding by-catches in active and passive gear, dealing with turtle entanglements and on disposing of discarded gear safely. (ACTION: DANI, MAFF, NAW, SE)
- 5.4.2** Produce and disseminate information (which could be based on the SNH advice note) for conservation agencies, veterinary surgeries, relevant public bodies and other organisations, to help them deal with enquiries relating to stranded marine turtles by 2001. (ACTION: CCW, EHS, EN, SNH)
- 5.5 Future research and monitoring**
- 5.5.1** Set up a central UK database for marine turtle records by 2002. (ACTION: JNCC)
- 5.5.2** Pass on all records to the central UK database and ensure marine survey projects (eg by-catch surveys, seabirds at sea surveys) record and submit any marine turtle information. (ACTION: CCW, DANI, EHS, EN, JNCC, MAFF, NAW, SE, SNH)
- 5.5.3** Encourage projects involved with the study of by-catch to include assessments of impacts on marine turtle populations. (ACTION: CCW, DANI, EHS, EN, JNCC, MAFF, SE, SNH, NAW)
- 5.5.4** Seek to minimise any by-catch of marine turtles by promoting research into fishing gear and other possible mechanisms, in conjunction with similar work proposed for other marine species. (ACTION: DANI, MAFF, NAW, SE)
- 5.5.5** Establish and support by 2004 a system for undertaking autopsies on dead turtle specimens and distributing biological material to specialists, including those working abroad, in order to determine causes of death, to improve knowledge of marine turtle biology and the threats to turtles in UK waters. (ACTION: CCW, DETR, EHS, EN, JNCC, SNH)
- 5.5.6** Further promote a system for undertaking surveillance of marine turtles in UK waters and reporting results. (ACTION: CCW, DANI, DETR, EN, EHS, JNCC, MAFF, NAW, SE, SNH)
- 5.5.7** Further promote a system for monitoring and reporting incidental capture and killing of marine turtles. (ACTION: CCW, DANI, DETR, EN, EHS, JNCC, MAFF, NAW, SE, SNH)
- 5.5.8** Encourage and support projects which add to knowledge and understanding of the biology of turtles and the threats they face, when in UK waters. (ACTION: CCW, EHS, EN, JNCC, NERC, SNH)
- 5.5.9** Consider contributing to marine turtle conservation activities of British Overseas Territories through the support of data gathering, collation and exchange. (ACTION: DETR, FCO, NHM)
- 5.6 Communications and publicity**
- 5.6.1** Encourage the submission of old and new records of living, entangled or dead stranded turtles through appropriate publications and the media. (ACTION: CCW, EHS, EN, JNCC, NHM, SNH)
- 5.6.2** Publicise marine turtle conservation issues, in particular raising awareness of how the UK public and tour operators may have impacts on turtle populations overseas. (ACTION: CCW, DETR, DTI, EHS, EN, FCO, HMCE, JNCC, SNH)
- 5.6.3** Promote the need of global conservation through local action using these truly transglobal species as champions. (ACTION: CCW, DETR, DTI, EHS, EN, FCO, JNCC, SNH)
- 5.7 Links with other action plans**
- 5.7.1** It is advised that this action plan is taken forward in conjunction with those for basking shark, common skate, toothed whales, baleen whales, dolphins and commercial marine fish.

Fish

Basking shark (*Cetorhinus maximus*)

Species Action Plan

1. Current status

- 1.1** A very large, plankton-feeding pelagic shark, the basking shark is the largest fish in UK waters (*ca.* 10-11 m maximum length), and the second largest in the world. It occurs in temperate waters circumglobally (temperature range 8-14°C). In the UK, it has been mainly recorded in surface waters from April to September, when mostly immature females are seen. It is possibly migratory with seasonal population movements inshore to feed on high abundances of zooplankton near tidal fronts in coastal areas. Migrations may be age- and sex-segregated. In late summer, in the north-east Atlantic, basking sharks are thought to disperse offshore. The winter distribution and the location of pregnant females year-round remains unknown, but is thought to be in deep water. There has been considerable variation in the numbers of sightings reported this century and in numbers taken by north-east Atlantic fisheries which indicates longer-term, perhaps cyclical changes in summer distribution patterns.
- 1.2** The basking shark is thought to be ovoviviparous, but the life-cycle is poorly known. The only litter recorded was of six young 1.5 to 1.7 m long, larger than any other known shark. Information on length at age (growth) for male and female basking sharks is not known precisely and estimates are based on few data from a Scottish fishery (93 individuals). These data suggest males mature between 4.5-6 m (estimated 12-16 years) and females at a length of 8-10 m (possibly 20 years). Estimates for gestation period are 1-3 years. Females may, like some other Lamniformes species, 'rest' between pregnancies. Longevity is not known. Like other lamniform shark species, it is slow to reach maturity and apparently has a reproductive capacity that is relatively low even for an elasmobranch, making it potentially vulnerable to exploitation. The unexploited population increase may be some 2-10% per annum, calculated for other large, slow-growing sharks. Recovery after exploitation and other population fluctuations will therefore operate over a time-scale of decades.
- 1.3** Although widely distributed in both hemispheres, basking sharks appear to be most regularly recorded in coastal areas of the UK with seasonally persistent tidal fronts (eg western Scotland, Clyde area, central Irish Sea and the western approaches to the English Channel). In these areas, during summer they are usually seen in relatively large numbers feeding at the surface.

This 'basking' behaviour enables sightings to be made. The absence of surface sightings has been equated with the absence of basking sharks. They may, however, be present, but feeding deeper in the water column. Although sightings have regularly been recorded in UK and Irish territorial waters, no reliable population estimates are available as it is difficult to relate surface sightings to actual population size. Detailed records are only available for a few areas. Available evidence over longer time periods suggests fluctuations in summer incursions and numbers of basking sharks are unpredictable. Sightings around the British Isles generally appear to fluctuate, although this probably reflects inter-annual variations in observer effort, weather and other factors determining the probability of sightings in addition to population trends themselves. It is not known if local or discrete stocks occur.

- 1.4** The basking shark is protected under Schedule 5 of the Wildlife and Countryside Act 1981. They are also protected within the territorial waters of the Isle of Man and Guernsey, in the Mediterranean under the Bern Convention (with EU reservation) and Barcelona Convention (unratified), and in US Atlantic waters. Directed fisheries are prohibited in New Zealand, but by-catch is landed.

- 1.5** The global status is assessed as Vulnerable (A1a,d, A2d) in the 1996 IUCN Red List.

2. Current factors causing loss or decline

- 2.1** Habitat constraints and food availability are likely to be important factors regulating distribution and population size. Recent studies in the English Channel show that they exhibit selective foraging behaviour on productive zooplankton patches along thermal fronts, track tidally-controlled movements of patches, and follow frontal boundaries as they move. These findings and the apparent unpredictability in surface sightings suggest basking sharks to be dependent on enhanced productivity found near transient oceanographic features. Consequently, population trends in the north-east Atlantic will be linked with broad-scale changes in secondary production and controlling factors (eg summer stratification, North Atlantic Oscillation (NAO)).
- 2.2** Capture in directed and by-catch fisheries are a potential threat to populations, although few are now caught commercially. The Achill Island fishery (western Ireland) declined after only 10 years of peak catches. However, the decline in surfacing sharks was

paralleled by a decline in zooplankton in the north-east Atlantic over the same 38 year period, emphasising the broad-scale importance of food availability controlling the numbers of sharks sighted at the surface and hence potentially available to harpoon fisheries. This species may spend at least 50% of its time in deep water beyond the scope of directed or intensive by-catch fisheries. Part of this time may be spent mating and giving birth. Future risk could possibly arise from a combination of coastal and deep-water fisheries.

2.3 Liver oil was traditionally the main product derived from basking sharks, but prices are now very low. Today fins are valuable in the Far East, both at first sale and dried. Meat and cartilage are also utilised, but are less valuable.

2.4 A directed fishery by a small Norwegian fleet, has an annual quota in EU waters of 100 tonnes of basking shark liver. In recent years, very little or none of the quota has been taken.

3. Current action

3.1 The recent listing on Schedule 5 of the UK Wildlife and Countryside Act 1981 makes the deliberate killing of basking sharks an offence. This extends the protection already provided around the Isle of Man and Guernsey.

3.2 Ratification of the Barcelona Convention and removal of the EU reservation on the Bern Convention could improve the status of the population visiting UK waters, if the Mediterranean and Atlantic populations are not separate.

4. Action plan objectives and targets

4.1 Maintain the current basking shark population.

5. Proposed action with lead agencies

Elucidating the life-cycle of this species is essential, in order to construct a sound management plan aiming to assess whether minimising potential mortality is necessary or indeed possible. Sharks outwith the protection of territorial waters remain vulnerable to fisheries mortality, but before threats to this species across national and international boundaries can be appraised fully, scientific studies to determine population demography and dynamics are required. Commercial fisheries are subject to the EU Common Fisheries Policy (CFP) and there is little that the UK can do unilaterally to conserve fish stocks which are of interest to both the UK and other EU fleets. Even within the 6 nautical mile coastal zone, where the UK fishes exclusively and can exercise greater autonomy,

most fishery management measures would be of limited value as most stocks are not confined to the inshore area. Effective measures must be aimed mainly at modifying the way fisheries are managed under the CFP. Nevertheless, some unilateral action by the UK is possible, as this species is listed under the 1981 Wildlife and Countryside Act.

5.1 Policy and legislation

5.1.1 Consider the possible listing of this species on Appendix II of the Convention on the International Trade in Endangered Species of Flora and Fauna (CITES) to enable monitoring and management of fisheries and international trade. (ACTION: DETR, JNCC)

5.1.2 UK fisheries ministers should consider recommending possible changes to the CFP regulations to require identification of basking sharks by species in by-catch and landing statistics. (ACTION: DANI, MAFF, NAW, SE)

5.2 Site safeguard and management

5.2.1 Develop and implement a code of conduct to reduce levels of harassment, in collaboration with scientists engaged in research on this species. (ACTION: CCW, DANI, DTI, EHS, EN, JNCC, LAs, MAFF, NAW, SE, SFCs, SNH)

5.3 Species management and protection

5.3.1 Extend protection provided in GB waters to Northern Ireland. (ACTION: DoE(NI))

5.3.2 Consider opportunities for the protection of the species within European waters through a listing on Appendix II of both the Bern Convention and the Bonn Convention. (ACTION: DETR, JNCC)

5.4 Advisory

5.4.1 Develop and publish a code of conduct regarding interactions with basking sharks to reduce levels of harassment (see 5.2.1). (ACTION: CCW, EHS, EN, JNCC, MAFF, NAW, SE, SFCs, SNH)

5.5 Future research and monitoring

5.5.1 Commission research to elucidate the life-cycle of this poorly understood species. (ACTION: CCW, EHS, EN, SNH)

5.5.2 Quantify and monitor population size, structure, dynamics and movement patterns and range of

individuals occurring in UK waters. (ACTION: CCW, EHS, EN, JNCC, NERC, SNH)

- 5.5.3** Improve long-term studies to: assess scientifically the population trends; elucidate migration and overwintering areas which may identify locations where basking sharks mate and the pregnant females reside; and minimise unnatural mortality in these areas. Genetic studies may help determine the degree of mixing between populations. (ACTION: CCW, EHS, EN, JNCC, NERC, SNH)

5.6 Communications and publicity

- 5.6.1** Distribute and disseminate a code of conduct to maritime users. (ACTION: CCW, EHS, EN, SFCs, SNH)

5.7 Links with other action plans

- 5.7.1** Action plans for some other species (marine mammals, turtles, and other elasmobranches) identify similar requirements regarding codes of conduct that could be addressed on a similar basis.
- 5.7.2** The UK is limited by the role of the CFP regarding regulation of fisheries, and any proposed changes to the CFP for conservation of commercial fish should also be considered in respect to this species.

Common skate (*Raja batis*)

Species Action Plan

1. Current status

1.1 The common skate is the largest European batoid fish. Females can reach lengths of 285 cm and males 205 cm. They are found in the north-east Atlantic from Madeira and northern Morocco to Iceland and northern Norway. However, tagging records indicate that the majority of fish spend their entire life within a relatively small coastal area.

1.2 It is a demersal, ie bottom dwelling, species, usually found in shallow coastal waters and shelf seas to 200 m, but occasionally down to 600 m. They hunt crustaceans and fish both in mid water and on the seabed. Males mature at a length of 125 cm (over 10 years old). Size and age at maturity for females is unknown. Longevity is estimated at 50 years. Mature females can produce up to 40 large eggs (14-24 cm long) per year, deposited in spring and summer. The young hatch at a length of up to 21-22 cm.

1.3 The common skate is widely distributed, but very scarce, throughout European waters. It has probably been fished to extinction in the Irish Sea and is extremely rare in the central and southern North Sea, the western Baltic and western Mediterranean.

1.4 The status of the stocks is unknown (too few are caught in research cruises to make analysis possible). However, its life-history makes it extremely vulnerable to fisheries, compared to other faster growing rays. Immature fish (<125 cm and <10 years old) are vulnerable to capture in many fisheries and very few juveniles can survive to maturity. Estimates of current fishing pressure on North Sea rays indicate that populations of such a slow-reproducing fish would decrease by about 35% per year, explaining the disappearance of the species here and in many other areas. Nevertheless, it is a relatively robust fish that occasionally survives the rigours of capture in fishing gear and release. It is a popular target for recreational anglers in areas where it still occurs.

1.5 The provisional IUCN Red List assessment for the species is *Endangered*.

2. Current factors causing loss or decline

2.1 The common skate is vulnerable to capture by many static and towed fishing gear; it is taken both in target fisheries for rays and as by-catch in other fisheries. Its slow growth and large size at maturity mean that

juveniles have little or no chance of surviving to maturity in heavily fished areas. Although no longer targeted where it is very scarce, the common skate continues to be caught as by-catch in fisheries for other species, including more fecund rays. Under these conditions commercial extinction can readily be followed by biological extinction.

2.2 It is doubtful that habitat constraints and food availability are of significance in the decline of this species, compared with fishing pressure.

3. Current action

3.1 In 1997, the EU Council of Ministers agreed a precautionary Total Allowable Catch for all skates and rays (combined) in the North Sea. This does not distinguish between species, and is not based on any analytical stock assessments.

3.2 In response to the increasing rarity of the species, the Irish Specimen Fish Committee has removed the species from listings. This has reduced the incentive for anglers to land and kill large individuals in order to enter the record book. UK recreational anglers are encouraged to return skate live to the sea by their national representative organisations.

3.3 The Glasgow Museum tagging programme targeting a resident population in the Sound of Mull area encourages visiting anglers to return tagged common skates unharmed to the sea.

4. Action plan objectives and targets

4.1 In the short term (up to five years), stabilise refuge populations by minimising fishing mortality and legally protecting the species in at least five key centres of abundance.

4.2 In the long term, facilitate the migration of common skate from refuge populations to areas within which they are either scarce or have been fished out by minimising fishing pressure on the species. Inevitably, this will take not less than one or two decades due to the species slow rates of reproduction and growth.

5. Proposed action with lead agencies

Fishing for common skate is subject to the EU Common Fisheries Policy (CFP) and there is nothing

that the UK can do unilaterally to conserve this, or other commercial fish stocks that are of interest to both the UK and other EU fleets. Even within the 6 nautical mile coastal zone, where the UK fishes exclusively and can exercise greater autonomy, most fishery management measures would be of limited value as common skate is not confined to the inshore area. Effective measures must be aimed mainly at modifying the way fisheries are managed under the CFP. Nevertheless, some unilateral action by the UK is possible. In particular, there is a need for increased knowledge of the skate's biology and exploitation, and for improved fisheries statistics. Most existing data are derived from commercial fisheries statistics collected during the period that the species was fished to near extinction from UK waters. These data now need to be augmented by fisheries-independent research data.

5.1 Policy and legislation

5.1.1 Make all skate and ray landings 'skin on' to facilitate species identification and record all species in landing statistics. (ACTION: DANI, MAFF, NAW, SE, SFCs)

5.1.2 Ensure that the necessary research and monitoring programmes are undertaken to provide the basis for analytical stock assessments. (ACTION: DANI, MAFF, NAW, SE, SFCs)

5.1.3 Obtain European Union approval for the introduction of Sea Fisheries Committee bye-laws and Scottish Executive legislation banning landings or imposing minimum landing sizes for common skate taken in UK coastal waters. (ACTION: DANI, MAFF, NAW, SE, SFCs)

5.1.4 Investigate alterations required in European legislation which would enable commercial fish species to be listed under Appendix II and III of the Bern Convention. (ACTION: JNCC)

5.2 Site safeguard and management

5.2.1 Designate at least five refuge areas (see 5.5.1) within which common skate are given legal protection from commercial fishing and deliberate killing or retention by anglers. (ACTION: CCW, DANI, EN, MAFF, NAW, SE, SNH)

5.3 Species management and protection

5.3.1 Seek protection of the species within UK coastal waters under appropriate fisheries legislation (see 5.1.3). (ACTION: DANI, MAFF, SE, SFCs)

5.3.2 Investigate opportunities for the management or protection of the species within European waters by listing on the appropriate Annex of the Bern Convention. (ACTION: DETR, JNCC)

5.3.3 Protect the species within at least five designated refuge areas using appropriate legislation (see 5.2). (ACTION: CCW, DANI, EN, MAFF, NAW, SE, SNH)

5.4 Advisory

5.4.1 Develop and publicise a code of conduct for the live release of immature common skate by all fishermen, both commercial and recreational. (ACTION: CCW, DANI, DETR, EN, JNCC, MAFF, NAW, SE, SNH)

5.4.2 Develop and publicise a code of conduct for the careful handling (including tag reporting) and live release of all common skate by sports anglers. (ACTION: CCW, DoE(NI), EN, JNCC, SNH)

5.5 Future research and monitoring

5.5.1 Initiate research programmes to monitor life-cycles, growth, reproductive capacity and population dynamics (including immigration and emigration); identify centres of distribution of relict populations as locus for refugia; improve fisheries-independent research and data collection. (ACTION: DANI, DETR, JNCC, MAFF, NERC, NAW, SE, SNH)

5.5.2 Improve data collection from remaining commercial landings to improve knowledge of fisheries statistics and exploitation status. (ACTION: DANI, MAFF, NAW, NERC, SE)

5.5.3 Initiate new long-term tagging programmes for the species and DNA studies to determine the extent of exchange between populations. (ACTION: NERC)

5.5.4 Promote research into the survival of common skate released after capture by commercial fishing gear (eg trawls). (ACTION: DANI, JNCC, MAFF, NAW, NERC, SE)

5.6 Communications and publicity

5.6.1 Publicise the vulnerability and threatened status of the common skate to commercial and sports fishermen, to minimise mortality in fisheries. (ACTION: CCW, DANI, EN, JNCC, MAFF, NAW, SE, SNH)

5.7 Links with other action plans

- 5.7.1** Reference should be made to the commercial fish, basking shark and marine turtles action plans. These plans are similar in their recommended conservation aims and objectives. Particular attention is drawn to the issue of by-catch in fisheries.

Commercial marine fish

Grouped Species Action Plan

1. Current status

1.1 Very few, if any of the marine fish species exploited commercially by UK fishermen are in immediate danger of biological extinction as they are found across wide geographic areas. For example, the mackerel and hake are found from Morocco in the south to Norway in the north while the cod spans the North Atlantic from the North Sea to the Grand Banks of North America and the Arctic. Within these wide distributions, however, there are local stocks of fish subject to excessive exploitation and risk of collapse even though the species itself may not be in immediate danger. Such a collapse would represent a reduction in the natural range of the species and effective action to minimise this risk is required under the UK BAP. For these reasons, this action plan is aimed at particular stocks rather than the species as a whole.

1.2 The stocks of immediate relevance are those for which the International Council for the Exploration of the Seas (ICES) scientists' assessment is that they are below Safe Biological Limits (SBL). SBL is an assessment based on a range of biological reference points varying according to the quantity and quality of the scientific data available. Furthermore, this grouped action plan reflects the fact that the majority of species are caught in mixed, ie multi-species, fisheries rather than directed single species fisheries. It also recognises that individual stocks can fluctuate around SBL in response to inter-annual variations in fishing activity and natural processes.

1.3 The fish with stocks close to or below SBL, in the most recent years for which information is available, are listed below. It is these stocks which are regarded as priority stocks for the purposes of this action plan.

1.4 North Sea

| 1995 | 1996 | 1997 |
|--|--|--|
| cod, hake, herring, mackerel, plaice, saithe | cod, hake, herring, mackerel, plaice, saithe | cod, hake, herring, mackerel, plaice, saithe, sole |

Each of these stocks was subject to an analytical assessment. The roundfish assessments indicate an apparent decline in fishing mortality in recent years for

cod, haddock and whiting, possibly due to a diversion of effort to other stocks. The fishing mortality on both plaice and sole has been varying at a high level over a long period. Most roundfish and flatfish stocks' spawning biomass are low, although they may have recovered somewhat from the lowest recorded levels of the early 1990s. Recruit surveys indicate that there is a strong 1996 year-class of cod, plaice, sole and whiting which may help rebuild stocks above SBL.

1.5 English Channel east

| 1995 | 1996 | 1997 |
|------|------|-------------------|
| cod | cod | cod, plaice, sole |

Cod, whiting, sole and plaice stocks were subject to an analytical assessment. For the first time, the cod (and whiting) assessments were integrated with those for the North Sea stocks (see above). Following a period of strong recruitment 1989-91, the spawning stock biomass of sole has fallen for two years and at the current very high level of fishing mortality is likely to fall to an historic observed minimum in 1999.

1.6 English Channel west

| 1995 | 1996 | 1997 |
|--------------|--------------|--------------|
| plaice, sole | plaice, sole | plaice, sole |

Both the plaice and sole stocks were subject to an analytical assessment. High fishing mortality and a succession of poor recruitment have contributed to a progressive decline in plaice stock size which is close to its minimum recorded level. In contrast, recent recruitment to the sole stock has been above average and the fishing mortality on the sole stock has declined recently. However, it is still high and the stock remains close to SBL.

1.7 Bristol Channel

| 1995 | 1996 | 1997 |
|-------------------|--------------|--------------|
| cod, plaice, sole | plaice, sole | plaice, sole |

Plaice and sole are taken in the same fishery. The plaice stock has declined steadily since a peak in the late 1980s in response to high fishing mortality and below (long-term) average recruitment. The same pattern affects the sole stock except that in this instance the decline can be traced back a further decade to the late 1970s. Both stocks require strong recruitment as well as reduced fishing mortality to show significant increase in stock size.

1.8 Irish Sea

| 1995 | 1996 | 1997 |
|-------------------|-------------------|------|
| cod, plaice, sole | cod, plaice, sole | sole |

Although neither the cod nor the plaice stocks are strong, both are currently considered to be above SBL. This improvement over the recent past is partly a response to reduced fishing mortality as demersal trawlers turn their attention to the *Nephrops* fishery. The sole stock, however, continues to show a decline largely in response to sustained high fishing mortality and an absence of a strong recruiting year-class. The spawning stock biomass reached the lowest recorded level in 1996 and is not expected to recover at all in the immediate future.

1.9 Celtic Sea

| 1995 | 1996 | 1997 |
|---------------------|---------------------------|--------------------|
| cod, hake, mackerel | cod, hake, horse mackerel | cod, whiting, hake |

Both the cod and the whiting spawning stock biomass fluctuate widely in response to the size of the recruiting year-class. There has been no strong recruitment for a number of years and fishing mortality continues to be high. The spawning stock biomass of the Western mackerel, which dominates mackerel stocks around the UK, appears to have stabilised above 2.3 million tons and is currently considered to be above SBL.

1.10 West of Scotland

| 1995 | 1996 | 1997 |
|---|-------------------|-------------------|
| cod, hake, herring (Clyde), saithe, whiting | cod, hake, saithe | cod, hake, saithe |

The spawning stock biomass of the saithe stock is at an all-time recorded low and there is a high probability that the same will be true for the cod stock within the medium-term. The recent high levels of fishing mortality are the principal cause for concern, masking such small benefits as might have been gained from slightly above average 1991 and 1993 year-classes of recruiting cod. The Northern hake stock is thought to be close to SBL. Long-term recruitment appears to have been relatively stable and the spawning stock biomass increased slightly during 1995 and 1996.

1.11 The European Union has complete authority for the conservation and management of marine fish and their fisheries; fisheries measures are implemented through Regulations of the Common Fisheries Policy. For this reason, the opportunities for the UK government to initiate unilateral marine fisheries management measures are limited. However, derogations which currently form a part of the CFP allow individual states limited powers.

2. Current factors causing loss or decline

2.1 The principal factor causing the decline in spawning stock biomass is summarised simply, but effectively, as 'too many boats chasing too few fish', ie the collective fishing power of the EU nations' fishing fleets is much greater than the productivity of the stocks can support. Hitherto, the methods available under the CFP have proved ineffective in controlling the deployment of this fishing power. One contributory factor to this ineffectiveness has been that decommissioning has removed the smaller and least efficient vessels from the fishing fleet. In addition, there are socio-economic pressures to maintain employment in the fishing industries of the EU nations. These pressures also contribute to the widespread practice of illegal, unreported landings which are excess to quotas (so-called 'blackfish').

2.2 These factors together result in overfishing of many stocks with the consequence that most stocks of the species listed above are close to or below SBL.

3. Current action

3.1 The principal current management action aimed at protecting these species is implementation of the Regulations underpinning the CFP. These require:

3.1.1 Annual agreement on the level of Total Allowable Catches (TAC) from each stock (from which national quotas are allocated by fixed proportion);

- 3.1.2** application and enforcement by all EU fishing states of technical measures such as net mesh sizes and minimum landing size;
- 3.1.3** observation by all EU states' fishing fleets of closed areas and seasons (to protect spawning or immature fish).
- 3.2** There is also a requirement through the EU multi-annual guidance programme (MAGP) to reduce the amount of fishing effort deployed. At the close of MAGP III (1992-96) the UK had met its global target for reduced engine power and was within 3% of the global tonnage target. Under MAGP IV (1997-2001) member states have to reduce their fishing of high risk stocks by 30% and on less threatened stocks by 20%. This can be done either by reducing capacity (decommissioning) or by restricting time at sea (effort control). The effect of decommissioning might be partly offset through technical improvement by the remaining vessels.
- 3.3** Around the coast of England and Wales, fishing activity is highly restricted (either by fishing method or vessel size) within the six nautical mile jurisdiction of the local Sea Fisheries Committees (SFCs). Fishing is similarly restricted in the 34 designated bass nursery areas. Neither Scotland nor Northern Ireland has SFCs, in both cases coastal fisheries are managed directly by the territorial fisheries departments (SOAEFD and DANI). However, a process of partial decentralisation of inshore fisheries is currently underway in Scotland with the formation of area management groups similar in constitution to SFCs. Other UK areas in which fishing is either prohibited or restricted, are found in the approaches to major ports and harbours, in proximity to historic wrecks, offshore gas and oil installations, military ranges and explosives dump sites.
- 3.4** Pelagic fisheries and trawling are restricted at certain seasons and in some areas by EU Regulation. For example, in an extensive area around Cornwall (The 'Mackerel Box') restrictions protect juvenile mackerel and in a similar extensive area around Shetland (the 'Shetland Box') the number of larger vessels allowed to fish at any one time is limited to prevent excessive mortality in the area. Access to fish in the 6 nautical mile belt of UK Territorial Seas is limited to UK vessels and access by non-UK fishing vessels to the 6-12 nautical mile belt of the UK Territorial Sea is limited to nations with 'historic rights'. Since the ratification of the CFP (1983 and 1996), only coastal states (including Norway) have fished in the North Sea. Some North Sea coastal states also fish in the Irish Sea but Spain and Portugal fish only in waters to the south and west of the British Isles.
- 3.5** The three Marine Nature Reserves (MNRs) designated in UK waters since 1986 are unlikely to have had a measurable effect on finfish stocks as no management measures were introduced with these stocks in mind. The same will probably be true for the greater number of *Natura 2000* sites as they become operative. (It is possible, however, that they may contribute to shellfish conservation and management).
- 3.6** Fisheries departments are consulted as part of the Crown Estates' - DETR 'Government View' procedure for assessing the potential environmental effects of marine aggregate extraction. Historically, the balance of decisions has favoured safeguarding known and probable herring spawning and important shellfish grounds. More recently the aggregate industry has requested (and funded) detailed studies to assess the facts of each case. Similar consultations take place with respect to gas and oil exploration (DTI) and pipeline waste discharges to tidal waters (territorial environment protection agencies).
- 4. Action plan objectives and targets**
- 4.1** Bring all stocks identified in the plan within precautionary reference points as defined by ICES within 5 years.
- 5. Proposed action with lead agencies**
- The fish stocks covered by this action plan span the fisheries limits of several countries and are subject to the EU Common Fisheries Policy. It is possible for the UK to introduce limited fisheries management measures (applicable solely to UK fishermen), subject to compatibility with the CFP and approval by the European Commission. However, most measures require international co-operation and are therefore subject to negotiation.
- 5.1 Policy and legislation**
- 5.1.1** During the forthcoming review of the CFP (2002), UK Fisheries Ministers should seek to:
- (a) Ensure that the EU publishes and pursues clearly defined management plans aimed at the recovery of all commercially important stocks, identifying appropriate biological reference points, sustainable fishing mortality rates and a timescale within which to attain these targets. Similar management plans should be pursued for new fisheries to avoid stocks being put at risk. (ACTION: DANI, MAFF, NAW, SE)

| | | |
|--------------|---|---|
| | <p>(b) Build clearly defined environmental objectives into the CFP; objectives which include retention of the full geographical distribution and genetic variability of each commercially exploited finfish species and the assessment of the environmental impact of new and existing fisheries. (ACTION: MAFF)</p> <p>(c) Match the level of deployed fishing effort to the productivity which the stocks can sustain by 2008. (ACTION: MAFF)</p> <p>(d) Ensure that all EU fishing nations contribute effectively to the pursuit of, and monitoring the achievement of, the management objectives. (ACTION: MAFF)</p> <p>(e) Ensure full implementation of Council Regulation 850/98 to minimise the current high level of discarding in many fisheries. (ACTION: MAFF)</p> <p>(f) Engender a greater commitment among all fishing nations to reducing the deployed fishing effort of the EU fishing fleet, not least through the full implementation of MAGP IV. (ACTION: MAFF)</p> | <p>designated 'non-trawling/shrimping nursery areas'. (ACTION: DANI, MAFF, NAW, SE, SFCs)</p> |
| 5.1.2 | <p>Steps which can be taken by the UK alone should include:</p> <p>(a) Increase UK Government commitment to decommissioning and ensure that additions to, and modernisation of, the fishing fleet does not confound the objective of reducing total fishing power. (ACTION: DANI, MAFF, NAW, SE, SFIA)</p> <p>(b) Seek to provide retraining and alternative employment for displaced fishermen. (ACTION: D/EE, DETR, DTL, NIO, NAW, SE, SFIA)</p> <p>(c) Encourage the sustainability of community-based fisheries through, for example, the operation of local management or 'stewardship' schemes. (ACTION: DANI, MAFF, NAW, SE, SFCs)</p> <p>(d) Consider introducing management measures to support finfish conservation in both MNRs and European Marine Sites. (ACTION: CCW, EHS, EN, SNH)</p> <p>(e) Review the Sea Fisheries Regulations Act 1966 to improve the effectiveness of SFCs to fulfil their fisheries and environmental roles. (ACTION: MAFF)</p> | |
| 5.2 | Site safeguard and management | |
| 5.2.1 | Where a stock is known to be less than SBL, the principal nursery areas supporting that stock should be | |
| 5.3 | Species management and protection | |
| 5.3.1 | Changes in the way commercial fisheries are managed will require changes in legislation (ie the CFP) or changes in UK Government policy towards fisheries in the 6 nautical mile coastal belt. Recommendations for such changes are included in sections 5.1.1 and 5.1.2 respectively. (ACTION: DANI, MAFF, NAW, SE) | |
| 5.4 | Advisory | |
| 5.4.1 | The success of this action plan in achieving its objectives will be determined largely by the success in influencing others to take the necessary action. The advice and recommendations given above are targeted at UK government departments and gaining their commitment will be important. However, it is also important to influence corresponding departments in other EU countries. (ACTION: DANI, FCO, MAFF, NAW, SE) | |
| 5.4.2 | UK statutory and voluntary environmental groups, and international NGOs, (eg WWF, FoE, BirdLife International, Greenpeace) should endeavour to persuade environmental organisations in other EU countries to put pressure on their own ministers to modify the CFP. (ACTION: JNCC) | |
| 5.5 | Future research and monitoring | |
| 5.5.1 | Review the status of all commercially exploited stocks in UK and adjacent waters using the principles and time scales set out at the North Sea Intermediate Ministerial Meeting. (ACTION: DANI, MAFF, NAW, SE) | |
| 5.5.2 | Prepare descriptions of the population biology and demography of commercial species, by stocks, to assist the identification of potential closed areas, together with the formulation of technical management measures and the establishment of a methodology for assessing their effectiveness (ACTION: DANI, MAFF, NAW, SE) | |
| 5.5.3 | Increase research into the biological interactions affecting fish species and seek to improve modelling of multi-species interactions. (ACTION: DANI, MAFF, NAW, NERC, SE) | |
| 5.5.4 | Increase research into the biological and environmental factors determining variations in fish recruitment and sustainability. (ACTION: DANI, NERC, MAFF, NAW, SE) | |

5.5.5 Revive and maintain long-term fisheries and environmental monitoring time series data. (ACTION: DANI, EA, Fisheries Departments, NERC, SEPA)

5.5.6 Determine the risk that modern fishing techniques could result in shoaling (ie pelagic) species being fished to extinction by removal of the last shoal. (ACTION: Fisheries Departments, JNCC, NERC, SFIA)

5.5.7 Establish 'designated ports' for all landings by larger (>20 m) fishing vessels to help eliminate 'blackfish' landings and improve the quality of fish landing statistics. (ACTION: DANI, MAFF, NAW, SE)

5.5.8 Maintain or increase monitoring of fishing activity and landings at the level necessary to establish whether or not management targets recommended in 4 (above) are being met. (ACTION: DANI, MAFF, NAW, SE)

5.5.9 Undertake research to improve the measurement of fishing effort and the understanding of its relationship to fishing mortality. (ACTION: DANI, MAFF, NAW, SE)

5.6 Communications and publicity

5.6.1 Promote the message and explain to the public and the fishing industry the need to reduce fishing effort to get more stable and greater long-term yields for less effort. (CCW, DANI, EN, MAFF, SE, SNH)

5.7 Links with other action plans

5.7.1 The following species action plans are of relevance: common skate, deep-water fishes, dolphins, basking shark and toothed whales. Within these action plans attention is drawn to the conservation needs of these species in regard to fishing activity. The sublittoral sands and gravels habitat action plan should also be consulted given the potential impact of aggregate extraction.

Deep-water fish

Grouped Species Action Plan

1. Current status

1.1 For this action plan, deep-water fishes are considered to be those species that live at depths greater than 400 m. They comprise three main categories: mesopelagic, bathypelagic and benthopelagic. Mesopelagic and bathypelagic species are true pelagic fish, generally of small adult size and unlikely to be commercially exploited. Mesopelagic fishes, such as lantern fishes (Myctophidae) and cyclothoids (Gonostomatidae) live beneath the photic zone to approximately 1000 m depth. Many species migrate toward the surface at night and descend to depth during the day thereby forming a trophic link between surface waters and the benthopelagic fishes. Bathypelagic fishes live below 1000 m and are usually highly adapted to life in a food-poor environment. Examples are the deep-water angler fishes (eg Ceratidae) and the gulper eels (Eurypharyngidae). The benthopelagic species live on or close to the bottom. Among the more important commercially exploited species are the roundnose grenadier *Coryphaenoides rupestris*, blue ling *Molva dypterygia* and orange roughy *Hoplostethus atlanticus*, but the ubiquitous shelf sea monkfish or anglerfish (*Lophius piscatorius* and *L. budegassa*) are also taken with the deep-water species.

1.2 The bottom trawl fisheries of the Atlantic slope can be divided into three broad types: an upper slope (c. 400-800 m) fishery targeting blue ling and monkfish and prosecuted mainly by French and UK vessels; a mid-slope fishery (800-1200 m) by mainly French vessels targeting blue ling and roundnose grenadier; a deep French fishery (1200-1700 m) targeting orange roughy.

1.3 The longline fisheries on the Atlantic slope are essentially confined to Spanish and UK registered vessels landing in Spain, and Norway. The main target species for the Spanish market is hake *Merluccius merluccius*, with deep-water sharks as a by-catch. Depending on prices, sharks can sometimes be the target species. The Norwegian fishery is centred on blue ling, ling *Molva molva* and tusk *Brosme brosme*.

1.4 Bottom gillnets have been used by Spanish vessels to target monkfish *Lophius* spp in international waters to the west of the Rockall Plateau. A by-catch is the deep-water crab *Chaceon (Geryon) affinis*.

1.5 The bottom trawl fishery west of Shetland has two main components. The fishery on the upper slope (c. 400-800 m) targets blue ling and monkfish with a by-catch

of species such as redfish *Sebastes* spp. Lower down the slope is a relatively new fishery for Greenland halibut *Reinhardtius hippoglossoides*, mainly undertaken by Norwegian and in recent years Scottish vessels, in which redfish, roughhead grenadier *Macrourus berglax* and the Arctic skate *Raja hyperborea* form a by-catch. Little is known of the stock structure for any of these species.

1.6 There are also seasonal fisheries on spawning aggregations of argentine or greater silver smelt *Argentina silus* and blue whiting *Micromesistius poutassou* across the upper slope from Spain north to Faeroe-Shetland. The fishery for blue whiting takes place to the west of the British Isles and is mainly carried out by Norway, but Russia, the UK and Netherlands also have significant catches. However, neither of these species nor the angler fishes are cause for concern compared to the other, true deep-water species named here. Consequently, they are not included in this action plan.

1.7 Much of the available information on the deep-water fish and their fisheries, has been assembled by the International Council for the Exploration of the Sea (ICES) Study Group on the Biology and Assessment of Deep-Sea Fisheries Resources. The group does not cover monkfish, redfish *Sebastes* spp or Greenland halibut as these are assessed by other ICES Working Groups.

1.8 The majority of deep-water species are covered by the international definition of 'highly migratory and straddling stocks; ie they range across one or more international boundaries. Responsibility for their management falls to the North East Atlantic Fisheries Commission (NEAFC). For some years past, NEAFC has requested the ICES Study Group to 'update descriptions of deep-water fisheries in waters inside and beyond coastal state jurisdiction south of 63° N', 'especially catch statistics by species, fleets and gear: and if possible, indicate the biological status of the stocks'. However, it has not been possible to make such divisions in the landings statistics with the information available to the Study Group.

1.9 The lack of detailed information on the biology of deep-water species, especially age structure, has precluded age-based stock assessment such as is carried out on many other commercially exploited fish stocks around the UK. The time series of catch and catch per unit effort are also too short for rigorous

analysis. However, in 1998 the Study Group took the view that alternative assessment techniques should be employed, at least to indicate the current status of the stocks. The following table summarises the possible state of the stocks for some of the exploited species.

| Species | State of stock to the west of the British Isles |
|---------------------|---|
| Blue ling | Biomass considered to be below U_{pa} and at or slightly below U_{lim} |
| Roundnose grenadier | At present considered to be within safe biological limits |
| Black scabbardfish | Unknown |
| Orange roughy | Biomass considered to be outside safe biological limits (below U_{lim}) in ICES area VI and below U_{pa} in area VII |

U_{pa} = The exploitable biomass below which the stock would be regarded as potentially depleted or overfished.

U_{lim} = The limit of exploitable stock biomass which indicates considerable depletion.

- 1.10** At present, the only management measure applied to the deep-water fisheries is the regulation of total fishing effort by EU vessels and Total Allowable Catch for monkfish/angler fish.

2. Current factors causing loss or decline

- 2.1** The current fisheries are largely unregulated (except for the general effort restrictions) and there is a major problem in recording what is actually being caught and landed. Misidentification of catches and landings by grouped categories such as 'deep-water sharks' make the situation more difficult.
- 2.2** The bulbous heads and elongate bodies of many deep-water fish means that bottom trawls with mesh sizes appropriate for shallow-water fishing are likely to retain a higher proportion of juvenile fish or smaller non-commercial species. In common with most other fish with gas filled swimbladders, few survive being hauled to the surface following capture and are already dead when discarded.

- 2.3** Deep-water fish also have large scales and are almost devoid of mucus. Fish that are caught by the trawl but escape through the meshes while the trawl is being towed are, therefore, likely to sustain considerable external damage and probably suffer a high mortality.

- 2.4** Although many aspects of the biology of deep-water species are poorly understood, the general consensus is that they are long-lived, slow-growing species with a relatively high age at first maturity. This is a characteristic of stocks that can only sustain a low level of exploitation. It makes them particularly vulnerable to overfishing from which they are likely to take a long time to recover.

- 2.5** The food-webs in the deep-sea are complex, but all the evidence suggests that the commercial species are top-level predators on benthopelagic fish and invertebrates. The indiscriminate mortality of their food, in the form of bycatch in trawls, is likely to have an effect on exploited stocks.

- 2.6** In addition, bottom trawling for deep-water fish can damage reefs of the cold water coral *Lophelia pertusa* and thereby reduce the habitat for their associated communities. Norwegian research has indicated that some of the deep-water fishes form part of these communities and may be affected adversely.

3. Current action

- 3.1** The European Union (EU) has complete authority for the conservation and management of marine fish and their fisheries; fisheries measures are implemented through Regulations of the Common Fisheries Policy (CFP). For this reason, the opportunities for the UK government to initiate unilateral marine fisheries management measures are limited. However, derogations that currently form part of the CFP allow individual states limited powers to apply additional measures to their national registered vessels.

- 3.2** Fishing for deep water species within the EU 200 mile fishing limit, including UK waters, is subject to restrictions on effort under the 'Western waters regime' (Council Reg. (EU) No 2027/95).

- 3.3** **Total Allowable Catch (TAC) on monkfish.** The monkfish landings from ICES sub-Areas IV (North Sea) and VI (west of Scotland) are covered by precautionary TACs. The fishing industry is now calling for an increase to allow for expansion of the monkfish fishery into deeper water.

- 3.4 Greenland halibut.** The relatively new fishery for Greenland halibut, primarily in ICES Division IVa (northern North Sea), is not yet subject to regulation.
- 3.5 ICES Study Group on the Biology and Assessment of Deep-Sea Fisheries Resources.** In 1998 the Group was asked to:
- i) compile the available data on landings of deep-water species by ICES sub-Area or Division;
 - ii) update descriptions of deep-water fisheries in waters inside and beyond coastal state jurisdiction south of 63°N, especially catch statistics by species, fleets and gear and, if possible, the biological status of these stocks;
 - iii) update the data on relevant biological information on deep-water species;
 - iv) update information on quantities of discards of deep-water species by gear type for the stocks and fisheries with a view to establishing a time series;
 - v) consider the possibility of carrying out assessments of fisheries for deep-sea resources and developing advice consistent with the precautionary approach.
- 3.6 ICES Advisory Committee on Fisheries Management (ACFM).** ACFM has identified that some deep-water stocks are probably outside safe biological limits while the status of the others is unknown. Therefore, it recommends immediate reductions in fisheries that cannot be shown to be sustainable. All remaining fishing activity should be conducted in the context of effective management which emphasises documentation of fishing activity, and which can react appropriately to biological characteristics of the population.
- 3.7 European Commission FAIR Project (95/655) *Developing deep-water fisheries:*** data for their assessment and for understanding their interaction with and impact on a fragile environment. The objectives of the three year project, which began in December 1995 and is co-ordinated by the Scottish Association for Marine Science (SAMS), Dunstaffnage, are to:
- i) describe in detail the European deep-water fisheries with particular reference to geographic area, depth of occurrence, distribution, gear types and other parameters;
 - ii) make an inventory of existing survey data, support the working up of the data and ensure that these data sets are archived;
 - iii) describe and quantify the discards in the commercial fishery;
 - iv) carry out market sampling to accurately record the quantities of species landed, especially for those fishes that are not presently identified to species level;
 - v) investigate the biological parameters (eg age, growth and reproduction) of both target and by-catch species, which will be of value for the assessment and management of the resource.
- 3.8** The project covers a wide area of the continental slope from Iceland to Greece, but six of the 13 partners are either exclusively or partly working on the fish and fisheries of the continental slope to the Rockall Trough and cover all five objectives. A considerable amount of the new data provided to the ICES Study Group originates from this project. The project is not confined to marketable species but places considerable emphasis on non-target species and the total fish assemblages.
- 3.9** Before licences are awarded by the Department of Trade and Industry (DTI) for exploration of offshore blocks for gas and oil, operators are required to undertake an environmental impact assessment. If these assessments identify an unacceptable risk to the fauna in the area, including deep-water fish communities, the DTI will not issue a licence for exploration to proceed.
- 4. Action plan objectives and targets**
- 4.1** Stabilise all stocks of commercially exploited deep-water species at or above safe biological limits by 2005.
- 5. Proposed action with lead agencies**
- The EU exercises absolute competence in the conservation and management of marine fish and their fisheries, and represents member states in NEAFC. Fisheries management measures are implemented through Regulations of the CFP. For this reason, the opportunities for the UK government to initiate unilateral marine fisheries management measures are limited. Consequently, effective measures must be aimed at modifying the way fisheries are managed under the CFP. It has to be recognised that little is known of the stock identification of the deep-water species and that it is very probable that all are shared between the area of EU jurisdiction, international waters, the territorial waters of the Faroe Islands, Norway and perhaps also Iceland. The UK powers to act unilaterally in this fishery are limited to management of UK registered vessels.

- 5.1 Policy and legislation**
- 5.1.1** UK Fisheries Ministers should press the European Commission to initiate action in NEAFC to regulate these fisheries in line with the scientific advice of ICES. (ACTION: MAFF, SE)
- 5.2 Site safeguard and management**
- 5.2.1** Little is known about stock identification and life history patterns of deep-water fishes. Indeed, the early life histories of many species are virtually unknown. It is, therefore, inappropriate to consider specific site safeguard measures at the present.
- 5.3 Species management and protection**
- 5.3.1** The UK Fisheries Ministers should press the Council of Ministers to support fully any management or protection plans promulgated by the EU or NEAFC. (ACTION: MAFF, SE)
- 5.4 Advisory**
- 5.4.1** The advice from ICES ACFM on management within the context of the precautionary approach is clear and concise. The UK government should put pressure on the European Commission to implement management measures that will ensure a sustainable fishery. (ACTION: MAFF, SE)
- 5.4.2** UK statutory and voluntary environmental groups should encourage their international partners to persuade their national governments to apply similar pressure to the EU Commission. (ACTION: JNCC)
- 5.5 Future research and monitoring**
- 5.5.1** The UK government should continue to support UK participation in the ICES Study Group on the Biology and Assessment of Deep-Sea Fisheries Resources. (ACTION: DANI, MAFF, NERC, SE)
- 5.5.2** Carry out research into: the likely sustainable catch levels; technical measures to minimise damage to non-target and juvenile deep-water fish and associated species and habitats; and the importance of deep-water fish in the food chains to other marine organisms. (ACTION: DANI, MAFF, NERC, SE, SFIA)
- 5.5.3** Carry out research into the possible impacts of deep-water fishing on the total fish assemblage using datasets which pre-date the fisheries. (ACTION: JNCC, MAFF, NERC, SE)
- 5.5.4** Implement a programme of routine monitoring of landings to species level. (ACTION: DANI, MAFF, SE)
- 5.5.5** Improve methods of monitoring catches, such as satellite tracking of vessels, to minimise the risk of area mis-reporting. (ACTION: DANI, MAFF, NERC, SE, SFIA)
- 5.6 Communications and publicity**
- 5.6.1** Educate the public and the fishing industry on the special features of the deep-water fisheries and the fragility of the resource. (ACTION: DANI, JNCC, MAFF, SE, SFIA)
- 5.7 Links with other action plans**
- 5.7.1** Attention should be given to the proposed conservation actions and objectives, with particular regard to fishing activity, in the following species action plans: common skate, commercial fish, toothed whales, dolphins. The plan should also be considered in conjunction with the *Lophelia pertusa* habitat action plan.

Molluscs

Atrina fragilis (a fan shell)

Species Action Plan

1. Current status

- 1.1** *Atrina* (= *Pinna*) *fragilis* (Pennant) is one of the largest (30-48 cm long) European bivalve molluscs. It is commonly known as a fan shell due to the thin, fragile, triangular shaped shells that are a light yellow-brown to darker brown colour, occasionally with black patches. A series (sculpture) of raised fine concentric lines run across the shell while a variable number (< 20) of low, smooth, wavy ridges radiate from the umbones, sometimes with delicate, fluted spines. The interior of the shell is glossy and the margin of the shell is smooth but often fragmented. When the shell dries out, it becomes very brittle and cracks. As the thin edge of the posterior margin of most species of fan shells can cut the feet of bathers, they are also known as 'razorfish'.
- 1.2** Due to the scarcity of specimens in collections and the variations in the sculpture and thickness of the shell, this species has been described under numerous names in the past by British workers, including *fragilis*, *borealis*, *pectinata*, *muricata*, *ingens*, *laevis*, *rudis*, *papyracea*, *rotundata* and *elegans*.
- 1.3** *A. fragilis* occurs from just below Low Water of Spring Tides (LWST) to a depth of 400 m, in mud, sand or fine gravel. The shell is vertically embedded in the soft substrate. The pointed anterior end of the shell is attached to small stones or pieces of shell in the sediment, by numerous, long byssus threads which emerge from the ventral gape. Between a third and two-thirds of the length of the shell can be buried below the sediment surface.
- 1.4** *Atrina* and *Pinna* spp exist as metapopulations, where the population is patchy, composed of small groups or patches of individuals. *Atrina* and *Pinna* spp have external fertilisation and the chances of successful fertilisation are dependent on the proximity of other spawning individuals as well as other factors, including water movement. Where the population is very sparse, fertilisation failure can be significant.
- 1.5** Recruitment to local populations is highly variable. The combination of limited, irregular larval dispersal and variable larval survival are the likely factors that result in the known sporadic recruitment. Mortality in the larvae of these species is unknown but food supply is crucial for planktonic larvae and peaks in plankton density may determine larval survival. Occasionally, due to variations in local conditions, the food supply may be favourable

for both adults and survival of the larvae and newly settled juveniles. This may lead to a good recruitment that supports the population for a long time, known as the 'storage effect'. It is likely that *A. fragilis* is a species that recruits when conditions are favourable for the survival of larvae. *A. fragilis* larvae may enter southern and western waters from areas to the south and recruitment may be very infrequent. Dispersal between different patches is variable and the nature of the dispersal between the patches is crucial to understanding the dynamics within any patch as well as that of the whole population system.

- 1.6** Estimates of the shell growth of *A. fragilis* specimens from Valentia Bay, Ireland, based on annular growth rings, suggest that growth is relatively slow (around 3-4 cm per year) in comparison to other species of fan shell. The large size of *A. fragilis*, suggests that this is long-lived species.

- 1.7** *A. fragilis* is predominantly a southern and western species, whose distribution extends from north Scotland down to the Iberian Peninsula. Jeffreys (1863) reported it did not occur north of Shetland. Seaward (1982) mapped the records of *A. fragilis* for the British Isles according to sea areas. *A. fragilis* has been recorded occurring off Shetland, Orkney, the east coast of Scotland in the Moray Firth, down the west coast of Scotland, off the north and west coasts of Ireland, the Irish Sea (Dublin Bay, Liverpool Bay and the Bristol Channel), the Scilly Isles, the Channel Isles and along the south coast of England. In Scottish waters, *A. fragilis* appears to be most commonly encountered amongst the Western Isles, particularly around Mull. In the south-west of England, it is thought that *A. fragilis* has largely disappeared from inlets where it was once common.

- 1.8** It is a widespread species but is rarely encountered and records generally relate to single specimens, accidentally collected through benthic fishing activities. A study in 1863 reported that *A. fragilis* was sometimes gregarious. However, the majority of UK records relate to single specimens and it does not appear that many aggregations of *A. fragilis* have been encountered around the UK. Six specimens were brought up on lines off Aberdeen during the winter of 1841-42. However, aggregations have been encountered in recent years off the Atlantic coasts of Ireland, such as within Valentia Harbour, County Kerry.

- 1.9** Virtually all of the information on *A. fragilis* relates to the few records of specimens. There are no records for *A. fragilis* on the Marine Nature Conservation Review database. There is almost no information concerning the population status of *A. fragilis* within the UK. It has been suggested that the populations of *A. fragilis* around the UK and Ireland have declined since the turn of the century due to the impacts of demersal fishing activities and, in some areas, sand and gravel extraction. It is possible that direct removal by collectors may have contributed to the apparent decline.
- 1.10** The cost of rapid growth during the first few years of life and the ability to rapidly repair the shell throughout its life, might be a reduction in gamete production. The infrequency of suitable conditions for the survival and dispersal of the larvae and the survival of the juvenile stage may contribute to the sporadic recruitment of *Atrina* and *Pinna* species. Recruitment is more successful in embayments and inlets where presumably a high proportion of the larvae are entrapped, but otherwise it is poor and variable in comparison with other bivalves such as scallops, in the same location.
- 1.11** These factors make these species particularly vulnerable to exploitation and natural populations will not survive heavy exploitation. Consequently, human activities that shorten the adult life of *Atrina* and *Pinna* species cannot be compensated for by an immediate reproductive response of the population and increased recruitment.
- 1.12** *A. fragilis* is protected under Schedule 5 of the Wildlife and Countryside Act 1981 and the Wildlife (NI) Order 1985. *A. fragilis* is not listed on Annexes II, IV or V of the EC Habitats Directive.
- 2. Current factors causing loss or decline**
- 2.1** Demersal fishing, using trawls and dredges, can remove or damage *A. fragilis* and cause disturbance to the seabed where *A. fragilis* occurs. As much as 70% of the shell length of *A. fragilis* can be buried below the surface and the posterior portion of the shell that projects above the surface is vulnerable to benthic fishing gear, particularly dredges. While live animals can withdraw the mantle towards the anterior of the shell and can repair considerable damage to the posterior edge of the shell, they cannot survive being uprooted from the seabed.
- 2.2** As *A. fragilis* is considered to be a long-lived species and since aggregations are now rarely encountered, this species is particularly vulnerable to damage and removal caused by demersal fishing. Around the UK and Ireland, the numbers of *A. fragilis* found in scallop grounds that have been dredged have declined and few specimens remain. Most recent *A. fragilis* specimens have been found in areas adjacent to dredged scallop beds or in areas seldom dredged. The *A. fragilis* population found in a *Pecten maximus* bed off Glengad Head was not subjected to dredging before 1975. When dredging of these beds began, many live specimens and shells of *A. fragilis* were found in the scallop dredges but it is thought that this population has been destroyed by the subsequent dredging.
- 2.3** Sand and gravel extraction may remove or damage *A. fragilis* and anchoring in shallow water may cause disturbance to the seabed where *A. fragilis* occurs.
- 2.4** A number of environmental changes may affect *A. fragilis*, including increases in turbidity, sedimentation and certain pollutants, such as TBT (tri-butyl tin). Changes in seawater temperature and current patterns may affect the recruitment pattern of *A. fragilis* larvae.
- 3. Current action**
- 3.1** Oil and gas operators are required to assess the potential impacts of their actions in relation to *Atrina fragilis*. If the operation proposed cannot be conducted without causing significant damage then the operation may not be allowed to proceed.
- 3.2** New records of *A. fragilis* are collected and published as and when specimens are donated to museums and research institutions.
- 3.3** Members of the family Pinnidae have not been the subject of major ecological or physiological research programmes.
- 4. Action plan objectives and targets**
- 4.1** Maintain and, if possible, enhance the distribution and status of *A. fragilis* within the UK.
- 5. Proposed action with lead agencies**
- 5.1 Policy and legislation**
- 5.1.1** None proposed.

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| 5.2 | Site safeguard and management | 5.5.5 | Investigate the population genetics, to evaluate the extent of larval dispersal and recruitment and the gene flow between populations. (ACTION: NERC) |
| 5.2.1 | None proposed. | | |
| 5.3 | Species management and protection | 5.6 | Communications and publicity |
| 5.3.1 | When the Annexes of the Habitats Directive are reviewed by the EC, consider proposing inclusion of <i>A. fragilis</i> as appropriate. (ACTION: DETR, JNCC) | 5.6.1 | Instigate a national programme to raise awareness of <i>A. fragilis</i> by providing general information to fisheries organisations, fishermen and divers, on the sensitivity, conservation importance and ecological requirements of <i>A. fragilis</i> . (ACTION: CCW, EHS, EN, SNH) |
| 5.3.2 | Promote the protection of <i>A. fragilis</i> under the Convention on the International Trade in Endangered Species of Flora and Fauna (CITES). (ACTION: JNCC) | 5.7 | Links with other action plans |
| 5.3.3 | Encourage divers to 'look but not touch' these large, rare bivalves and to report all occurrences to ensure that they are recorded. (ACTION: CCW, EHS, EN, SNH) | 5.7.1 | The actions and objectives of this action plan are relevant to the habitat action plans for sheltered muddy gravels, mud in deep water and offshore sands and gravels. Particular attention is drawn to the damage that may be caused to benthic organisms by demersal fishing, dredging and aggregate extraction. |
| 5.4 | Advisory | | |
| 5.4.1 | Provide advice and information on <i>A. fragilis</i> in regard to CITES and the Habitats Directive. (ACTION: JNCC) | | |
| 5.4.2 | Advise, through the conservation objectives and advice on operations likely to damage or disturb, of the importance of this species in terms of marine biodiversity in Special Areas of Conservation (SAC) management plans. (ACTION: All relevant and competent authorities) | | |
| 5.5 | Future research and monitoring | | |
| 5.5.1 | Collate all the UK distribution records of <i>A. fragilis</i> to provide an indication of historical and current distribution and status. (ACTION: JNCC) | | |
| 5.5.2 | Instigate a national reporting scheme to ensure that all new records from fishermen, divers and others are added to the distribution database, to allow key sites to be identified, particularly where any aggregations of <i>A. fragilis</i> occur. (ACTION: JNCC) | | |
| 5.5.3 | In the future, when any sites are discovered where significant aggregations of <i>A. fragilis</i> occur, take action to maintain and enhance the population by excluding demersal fishing and dive collection. (ACTION: CCW, DANI, EHS, EN, MAFF, SE) | | |
| 5.5.4 | Establish the biological and ecological requirements of both the larval and adult stages of <i>A. fragilis</i> . (ACTION: CCW, EHS, EN, NERC, SNH) | | |

Native oyster (*Ostrea edulis*)

Species Action Plan

1. Current status

1.1 The native or flat oyster (*Ostrea edulis* L.) is a sessile, filter-feeding, bivalve mollusc. It is associated with highly productive estuarine and shallow coastal water habitats with sediments ranging from mud to gravel. *Ostrea edulis* is widely distributed around the British Isles, the North Sea, Mediterranean and Black Sea. Along with other oyster species, it is also cultivated in North America, Australasia and Japan. Stock abundance was probably greatest in the 18th and 19th centuries, when there were large offshore oyster grounds in the southern North Sea and the Channel producing up to 100 times more than today's 100-200 tonnes. During the 20th century its abundance declined significantly in European waters. The main UK stocks are now located in the rivers and flats bordering the Thames Estuary, The Solent, River Fal, the west coast of Scotland and Lough Foyle.

1.2 Native oyster fisheries are subject primarily to UK shellfisheries conservation legislation; the species is not named in any national or international nature conservation legislation or conventions.

2. Current factors causing loss or decline

2.1 The dramatic reduction in stock abundance seen in the middle of the last century is attributed mainly to over-exploitation following the increased demand that accompanied improved rail transport.

2.2 The American oyster drill *Urosalpinx cinerea* and the slipper limpet *Crepidula fornicata* were introduced with *Crassostrea virginica* from North America around 1900. *Urosalpinx* is a predator alongside indigenous species such as crabs, starfish, dog whelks, shell boring worms and sponges. *Crepidula* is a filter feeder that deposits pseudofaeces and creates 'mussel mud'. This mud degrades the grounds and hinders recruitment, but dead *Crepidula* shell provides culch upon which oyster settle.

2.3 Severe winters, such as those experienced in 1947 and 1963, caused high mortalities in the UK, particularly on the east coast where stock levels have not recovered to the pre-1963 levels.

2.4 The parasitic protozoan *Bonamia ostreae* has caused massive mortalities in France, from whence it was introduced, and in the Netherlands, Spain, Iceland and England. Another protozoan parasite, *Marteilia*

refringens, has also been found in French stocks but hitherto it has not affected UK stocks.

2.5 TBT (tri-butyl tin) anti-fouling paints used on ships and leisure craft in the early 1980s caused stunted growth and probably affected reproductive capacity.

2.6 There are many other factors that affect oyster stock abundance, most contributing to the high variability of recruitment: temperature, food supply, hydrodynamic containment in a favourable environment, anthropogenic effects (eg coastal development, waste disposal). Also spawning stock density or biomass may be too low in many areas to ensure synchronous spawning or sufficient larval production for successful settlement.

3. Current action

3.1 Native oyster fisheries in the UK are managed by a mixture of national legislation (eg in Great Britain by the Sea Fisheries (Shellfish) Act 1967) and, in England and Wales, local Sea Fisheries Committees (SFC) bye-laws. Almost all naturally occurring oysters in Scotland belong to the Crown Estate, except where the rights have been specifically granted to others. Many of the principal oyster fisheries in England and Wales are managed through Regulating or Several Orders (the latter extinguish the public right to fish). There are also some private oyster fisheries based on historic rights. There is a national closed season (14 May to 4 August) to protect native oysters during the spawning season, though a dispensation exists for cultivated stocks.

3.2 The EC Directive 95/70/EC, which forms part of the EU fish and shellfish health regime, sets Community-wide rules to prevent the introduction and spread of the most serious diseases affecting bivalve molluscs. This is implemented in Great Britain through the Fish Health Regulations 1997 (SI 1997 No. 1881).

3.3 The use of TBT-based paints on vessels less than 25 m in length was banned in 1987 (Food and Environment Protection Act 1985, Part III). Oyster growers believe this ban is helping to reduce the adverse effects on oysters.

3.4 The Shellfish Hygiene Directive (91/492/EEC), implemented through the Food Safety (Fishery Products and Live Shellfish) (Hygiene) Regulations 1998, requires that all production areas must be classified according to the degree to which samples of shellfish from those areas are contaminated by coliform

bacteria. The classification is a public health measure and determines whether the shellfish can go directly for human consumption or need to be treated beforehand by relaying in cleaner water or by depuration.

- 3.5** Shellfish are monitored for marine biotoxins so that if Diarrhetic Shellfish Poison (DSP) is detected or if Paralytic Shellfish Poison (PSP) exceeds the maximum permitted level considered safe for human consumption, affected fisheries can be closed.

4. Action plan objectives and targets

This action plan is influenced by the fact that for centuries this species was, and continues to be, subject to husbandry and cultivation practices as well as fishing. It is debatable whether there are any truly natural UK stocks, ie stocks whose genetic structure has not been modified by the addition of animals from non-local stocks.

- 4.1** Maintain and, where possible, expand the existing geographical distribution and abundance of the native oyster within UK inshore waters.

5. Proposed action with lead agencies

There has been, and continues to be, considerable public and private-sponsored research and development on oyster species throughout the world because of its importance as a fishery. Most of this effort is directed at increasing production by improving cultivation and hatchery techniques, and disease and pest control. Much of it also contributes to maintaining the biodiversity of oyster stocks.

5.1 Policy and legislation

- 5.1.1** Assess whether the existing EU Directives and UK legislation provide sufficient controls to minimise the risk of introducing new diseases and pests into the UK. (ACTION: DANI, MAFF, NAW, SE)

- 5.1.2** Recognising that EU legislation only covers disease controls, consider re-establishing pest controls equivalent to the Molluscan Shellfish (Control of Deposit) order 1974 which could aid pest control by prohibiting the movement of shellfish. If considered necessary to prevent recontamination or the introduction of alien species, UK fisheries ministers should encourage new controls on the use of seaweed and other natural products used as packing for live transport. (ACTION: DANI, DETR, MAFF, NAW, SE)

5.2 Site safeguard and management

- 5.2.1** Oyster grounds, and hence oyster abundance, require suitable surfaces for spat settlement. Slipper limpets have degraded some and made them difficult to re-establish. Consider whether appropriate mechanisms are available to encourage oyster farmers to carry out an environmental impact assessment and, if appropriate and feasible, to rework derelict areas to increase both oyster distribution and abundance and benthos diversity. (ACTION: DANI, MAFF, NAW, SE)

- 5.2.2** Integrate oyster habitat safeguards into Marine Nature Reserves, Special Areas of Conservation and estuary management plans where relevant to the site's conservation objectives. (ACTION: All relevant authorities)

5.3 Species management and protection

- 5.3.1** Define clearer, tighter objectives, and apply specialist advice, in managing the UK regulated fisheries. (ACTION: Carrick District Council, DANI, MAFF, NAW, NIO, SE, Southern SFC)

- 5.3.2** Maintain the existing stock abundance in the main self-regenerating fisheries. (ACTION: DANI, MAFF, SE, SFCs, NAW)

- 5.3.3** Ensure adequate recruitment to maintain stock abundance. Target to be defined following a review (see 5.5.1). (ACTION: DANI, MAFF, NAW, SE, SFCs)

- 5.3.4** Endeavour to stop the spread of the introduced pests *Urosalpinx cinerea* and *Crepidula fornicata* beyond their existing distribution. (ACTION: DANI, MAFF, NAW, SE, SFCs)

- 5.3.5** Control stock density to reduce the risk of transmission of disease. (ACTION: DANI, MAFF, NAW, SE, SFCs)

- 5.3.6** Endeavour to prevent the introduction of the oyster disease marteiliosis, limit the spread of bonamiosis. (ACTION: DANI, MAFF, NAW, SE, SFCs)

- 5.3.7** Maintain genetic variability. Target to be defined (see 5.5.5). (ACTION: DANI, MAFF, NAW, SE, SFCs)

5.4 Advisory

- 5.4.1** Produce guidance notes and a code of practice on habitat restoration and species protection. (ACTION: CCW, DANI, EHS, EN, MAFF, NAW, SE, SNH)

5.5 Future research and monitoring

- 5.5.1** Review the evidence of a relationship between spawning stock biomass and recruitment, and define safe biological reference points. (ACTION: DANI, EN, MAFF, NAW, SE)
- 5.5.2** Provide managers of several and regulated fisheries with guidelines and code of practice for habitat protection, stock management and species protection. (ACTION: DANI, MAFF, NAW, SE)
- 5.5.3** Continue and extend surveys of all wild stocks and fisheries to establish stock biomass, distribution and spatfall variability including assessments of any recovery in areas previously contaminated by TBT. (ACTION: DANI, MAFF, NAW, SE, SFCs)
- 5.5.4** Assess and report on the implications for genetic variability and biodiversity of using hatchery brood stock to produce seed for stock replenishment. (ACTION: CCW, DANI, EHS, EN, MAFF, NAW, SE, SNH)

5.6 Communications and publicity

- 5.6.1** To raise awareness and provide information about the Biodiversity Action Plan, write articles on progress with the plans for appropriate trade journals (eg Fishing News, Fish Farming International) explaining the action plan. (ACTION: CCW, DANI, EN, MAFF, NAW, SE, SNH)

5.7 Links with other action plans

The habitat action plans for mudflats and sheltered muddy gravels are of relevance to this plan.

Northern hatchett shell (*Thyasira gouldi*)

Species Action Plan

1. Current status

- 1.1** The northern hatchett shell *Thyasira gouldi* (Philippi) is a small (< 1 cm) bivalve mollusc, with rounded, dull white shells, that belongs to the relatively small family, Lucinacea. It is generally found at depths between a few to several hundred m and lives in anoxic soft mud, silt clay or clay mud sediments, generally characterised by a relatively high organic matter content.
- 1.2** This species has not been extensively studied and it appears that there may be only one or two populations remaining in the British Isles.
- 1.3** *Thyasira flexuosa* (Montagu) is often mis-identified as *Thyasira gouldi*. Although a variety of taxonomic differences exist, both in shell features and in the soft parts, field identification is difficult as the most reliable differentiating features relate to egg size and sperm shape and length.
- 1.4** The most southerly European populations of *T. gouldi*, considered to be relic since the last Ice Age, are in Borgen Fjord, off the Trondheim Fjord and in upper Loch Etive, on the west coast of Scotland. Populations have also been recorded in two other Scottish sea lochs: upper Loch Eil, off Loch Linnhe and in upper Loch Sunart. The Loch Eil population recorded in 1970 appears to have become extinct, possibly as a result of the discharge of pulp mill effluent. The current status of the Loch Sunart population is unknown.
- 1.5** The Marine Nature Conservation Review records of the northern hatchett shell from Portland Harbour in England and Sullom Voe, Shetland, as well as the records from the Forties oil-field are considered to be dubious and likely to be misidentified specimens of *T. flexuosa*.
- 1.6** Research in the early 1970s found that the population in upper Loch Etive was not randomly distributed but occurred as a series of patches, where the density varied between 100 m⁻² and 1000 m⁻². The total population was estimated to be at least 1,500,000 individuals. However, in 1989, when attempts were made to collect specimens from this population, it was found that the density had 'decreased disastrously'. Three specimens were found in twelve 0.1m² van Veen grab samples and 'even dead shells were scarce'.

- 1.7** The northern hatchett shell is protected under Schedule 5 of the Wildlife and Countryside Act 1981 and the Wildlife (Northern Ireland) Order 1985. It is not listed on Annexes II, IV or V of the EC Habitats Directive. Loch Etive is not designated as a Marine Nature Reserve, marine Special Area of Conservation (SAC) or a Marine Consultation Area.

2. Current factors causing loss or decline

- 2.1** The factors affecting the species are not clear. One or a combination of any of the factors listed below may be enough to reduce reproductive success in a population that can only reproduce by direct development. When population levels do decline, recovery is not assisted by recruitment from other populations, as this species does not exhibit a pelagic phase.
- 2.2** There do not appear to have been any marked environmental changes in upper Loch Etive that could have caused the reported apparent decline in the population. This genetically isolated population may have developed into a physiologically different race in the lower salinity conditions (23 – 27 ‰) of upper Loch Etive. Research has suggested that the species may not be able to tolerate sudden changes in salinity, such as a freshwater washout. As a northern species, the northern hatchett shell normally occurs in areas with low water temperatures but it has acclimatised to the warmer, bottom water temperature range (7 – 13 °C) of upper Loch Etive. Research has suggested that the species may not be able to tolerate rapid increases in water temperature.
- 2.3** The northern hatchett shell has specific sediment requirements, related to its ability to burrow. It occurs in muds that have a high organic content, as this prevents compaction of the sediment, and where the faeces of other infauna aggregating around the mud particles effectively increase the particle size. If sediments become coarser, the species is unable to burrow, as the foot cilia cannot penetrate compacted large grains. If the size of the organic matter increases from finely divided material, the living chamber of the animal becomes blocked.
- 2.4** High levels of infestation by the copepod parasite *Axinophilus thyasirae* can prevent gonad development and result in indirect castration, affecting the reproductive success of the species.

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| 2.5 | Recent research has suggested that small, dense particles within the chemoautotrophic gill bacteria of the northern hatchett shell were viral and that an infection may have contributed to the population decline in upper Loch Etive. | the inclusion of the northern hatchett shell in order to protect sites where this species occurs. (ACTION: CCW, DETR, DoE(NI), EN, JNCC, NAW, SE, SNH) |
| 2.6 | The species' low oxygen consumption allows it to live in anoxic mud, and other <i>Thyasira</i> species are abundant in North Sea oil-fields. Despite this, discharge of pulp mill effluent has been suggested as a possible cause in the apparent extinction of the Loch Eil population. In addition, although salmon and mussel farms in Loch Etive are not located near the population, it is possible that the species may be affected by some treatments and chemicals used in these farms. | 5.2.2 When the Annexes of the Habitats Directive are reviewed by the EC, consider proposing inclusion of <i>A. fragilis</i> as appropriate. (ACTION: DETR, JNCC) |
| 2.7 | As the northern hatchett shell tends to occur in dense patches and populations appear to make a slow recovery from the direct removal of individuals, destructive sampling may have a significant impact. It is not known how many grab samples and specimens were collected for research between the 1950s and 1980s from upper Loch Etive. | 5.2.3 Confirm the importance of Loch Etive, Scotland as the site of a relic population of <i>T. gouldi</i> , by determining the distribution and status of this population. (ACTION: SE, SNH) |
| 3. | Current action | 5.2.4 Seek to identify any other key sites for this species within the UK, concentrating initial efforts on Loch Eil and Loch Sunart, Scotland. (ACTION: CCW, EHS, EN, SNH) |
| 3.1 | All samples of the northern hatchett shell are currently being re-examined at Cardiff Museum to confirm their identification. This will assist in determining the known distribution in the UK. | 5.2.5 Within key sites, ensure that human activities do not have a detrimental effect upon the northern hatchett shell populations. (ACTION: All relevant authorities) |
| 4. | Action plan objectives and targets | 5.3 Species management and protection |
| 4.1 | Maintain and where possible, enhance the distribution of the northern hatchett shell within the UK. | 5.3.1 Review the schedule status of <i>T. gouldi</i> under the Wildlife and Countryside Act 1981 and the Wildlife (Northern Ireland) Order 1985. (ACTION: CCW, DETR, DoE(NI), EN, JNCC, SE, SNH) |
| 4.2 | Maintain and where possible, enhance the status of the population in Loch Etive, Scotland. | 5.3.2 As the populations of the northern hatchett shell in the UK are considered to be relic populations, management action is likely to be site based, rather than on a more broadscale species basis. Initial focus will be on Loch Etive. (ACTION: SE, SNH) |
| 4.3 | Ensure no further declines in the population(s) of the species due to anthropogenic factors. | 5.4 Advisory |
| 4.4 | Provide adequate legal status for the species to facilitate its effective protection. | 5.4.1 For key sites, provide advice to local authorities and others on the sensitivity, conservation importance and ecological requirements of the species, to raise awareness and to ensure that all relevant authorities are aware of the distribution in their areas. (ACTION: CCW, EN, SNH) |
| 5. | Proposed action with lead agencies | 5.4.2 For key sites, provide advice to local authorities and others on avoiding any impacts of operations and new developments on populations of the species. (ACTION: SE, SEPA, SNH) |
| 5.1 | Policy and legislation | 5.5 Future research and monitoring |
| 5.1.1 | None proposed. | 5.5.1 Within key sites, ensure that the ecological requirements of the species are maintained. (ACTION: SE, SEPA, SNH) |
| 5.2 | Site safeguard and management | |
| 5.2.1 | Review existing UK legislation relating to marine site protection and conservation designations to facilitate | |

- 5.5.2** Develop a non-destructive sampling and survey methodology for assessing the distribution and status of the species. (ACTION: JNCC)
- 5.5.3** Determine the status of the population of Loch Etive, Loch Eil and Loch Sunart, Scotland. (ACTION: SNH)
- 5.5.4** Review the validity of records of *T. flexuosa* and other *Thyasira* spp in UK collections. (ACTION: JNCC)
- 5.6 Communications and publicity**
 - 5.6.1** Provide information, in the form of leaflets or articles, for local bodies, interests and communities, to raise awareness of this relic species, whose UK distribution is limited to a very few sites. (ACTION: CCW, EN, EHS, SNH)
- 5.7 Links with other action plans**
 - 5.7.1** This plan should be taken forward in conjunction with the habitat action plan for mud habitats in deep water.

Sea anemones

Sea-fan anemone (*Amphianthus dohrnii*)

Species Action Plan

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| <p>1. Current status</p> <p>1.1 The sea-fan anemone <i>Amphianthus dohrnii</i> is found attached to particular benthic organisms in a few locations in south-west Britain (on the pink sea fan <i>Eunicella verrucosa</i>) and in western Scotland (on the northern sea fan <i>Swiftia pallida</i>). The sea-fan anemone has also been recorded on hydroids, especially the oaten-pipes hydroid <i>Tubularia indivisa</i>. It also occurs in south-west Europe and the Mediterranean, although recently the anemone appears to have become rare over its entire range. Historical records, however, suggest that it was 'not uncommon' off Plymouth in the 1920s and 30s.</p> <p>1.2 The anemone is about 10 mm across the disc, has a short column and approximately 80 tentacles. The colour is buff, pink, orange or red usually streaked or splashed with white. The anemone wraps its base around the branch of the species to which it is attached. Reproduction is by basal laceration, often building-up large aggregations of closely packed individuals, although sexual reproduction is also likely. The sea-fan anemone is recorded most often on the pink sea-fan <i>Eunicella verrucosa</i> (a BAP priority species).</p> <p>1.3 The sea-fan anemone may be found in the following JNCC Marine Nature Conservation Review (MNCR) biotopes where sea-fans are present: <i>Alcyonium digitatum</i> with massive sponges (<i>Cliona celata</i> and <i>Pachymatisma johnstonia</i>) and <i>Nemertesia antennina</i> on moderately tide-swept exposed circalittoral rock (ECR.AlcMaS) (usually in local shelter); <i>Phakellia ventralabrum</i> and axinellid sponges on deep exposed circalittoral rock (MCR.PhaAxi); Erect sponges, <i>Eunicella verrucosa</i> and <i>Pentapora foliacea</i> on slightly tide-swept moderately exposed circalittoral rock (MCR.ErSEun); Cushion sponges (<i>Polymastia boletiformis</i>, <i>Tethya</i>), branching sponges, <i>Nemertesia</i> spp and <i>Pentapora foliacea</i> on moderately exposed circalittoral rock (MCR.ErSPbolSH).</p> <p>1.4 The sea-fan anemone is not protected or listed under any statutes, conventions or directives. The pink sea-fan <i>Eunicella verrucosa</i>, its main host, is protected under Schedule 5 of the Wildlife and Countryside Act 1981 against killing, injuring, taking possession and sale.</p> | <p>2.1 Historical records of declines in abundance are anecdotal, but acknowledged as correct. However, it appears that the species has never, in recent times, been abundant as it was not described until 1878 and did not feature in P.H. Gosse's <i>Actinologia Britannica</i> of 1860. The following suggestions are made of possible reasons for the decline in abundance.</p> <p>2.2 Change in water masses. Since the mid-1970s, water masses have been colder and of a different character seeming not to favour species near the northern limits of their distribution. This is believed to be part of a natural cycle.</p> <p>2.3 Poor larval supply. The supply of larvae may be from south of the British Isles and dispersal to the north and east would require strong south-westerly currents.</p> <p>2.4 Contamination of water quality by human activities affecting survival of larvae and possibly adults.</p> <p>3. Current action</p> <p>3.1 There is no current action aimed directly at the sea-fan anemone.</p> <p>4. Action plan objectives and targets</p> <p>4.1 Maintain the distribution and abundance of known viable populations and of those identified from a baseline to be established by 2004.</p> <p>5. Proposed action with lead agencies</p> <p>5.1 Policy and legislation</p> <p>5.1.1 None proposed.</p> <p>5.2 Site safeguard and management</p> <p>5.2.1 Ensure that the management of Special Areas of Conservation (SACs) and Marine Nature Reserves (MNRs) takes account of the sea-fan anemone. (ACTION: EN, SNH)</p> <p>5.2.2 Ensure that locations with populations of sea-fan anemones in statutory and non-statutory (voluntary) marine protected areas are identified as being of appropriate sensitivity within management zoning schemes. (ACTION: EN, SNH)</p> |
| <p>2. Current factors causing loss or decline</p> | |

5.2.3 Undertake management measures to ensure human activities do not compromise known populations of the species. (ACTION: EN, SNH)

5.3 Species management and protection

5.3.1 None proposed.

5.4 Advisory

5.4.1 Include information on the sea-fan anemone in publicity stemming from the pink sea-fan action plan. (ACTION: EN, SNH)

5.5 Future research and monitoring

5.5.1 Establish the current distribution and abundance of sea-fan anemones on various substrata within its geographical range. Volunteer surveyors should be used where possible and effort should be combined with studies of the pink sea-fan. Report by the end of 2004. (ACTION: EN, SNH)

5.5.2 Direct research at examining the factors that affect recruitment, survival and reproduction of the sea-fan anemone. Information will be obtained from studies of other *Amphianthus* species, including deep-water species currently being studied. Work also requires a programme of *ex situ* studies of reproduction to include establishing 'triggers' to larval production, nature of the larva, dispersal, time to settlement and factors affecting successful establishment. Data is also required on the occurrence of *Eunicella verrucosa* on which *Amphianthus dohrnii* is often found attached. Sites at the present limit of its distribution should also be included. This can be linked to long-term monitoring of climate change. Further study is also needed of reproduction by basal laceration. Report by the end of 2004. (ACTION: NERC)

5.6 Communications and publicity

5.6.1 Produce a poster of seabed species with species action plans or a separate poster with the pink sea-fan and distribute as appropriate. (ACTION: EN, SNH)

5.6.2 Seek distribution data through articles in diving magazines. (ACTION: EN, SNH)

5.6.3 Consider including pink sea-fan in public aquaria (with educational materials) to increase general awareness of marine biodiversity. (ACTION: EN, SNH)

5.7 Links with other action plans

5.7.1 The successful conservation of the pink sea-fan, through its own action plan, is part of the requirement for conservation of the sea-fan anemone and studies of the two species could be carried out simultaneously.

Ivell's sea anemone (*Edwardsia ivelli*)

Species Action Plan

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| 1. Current status | 5.4 Advisory |
| 1.1 Ivell's sea anemone is known from only one location in the world - Widewater Lagoon in West Sussex. It was last seen in 1983 and is now possibly extinct. | 5.4.1 None proposed. |
| 1.2 It is as a globally threatened species listed by IUCN/WCMC and is protected under Schedule 5 of the Wildlife and Countryside Act 1981. | 5.5 Future research and monitoring |
| 2. Current factors causing loss or decline | 5.5.1 Continue to search for this species through surveys of brackish lagoon habitat. (ACTION: EN, JNCC) |
| 2.1 Reduced seawater penetration and water infusion from adjacent marshes. | 5.5.2 Pass information gathered during survey and monitoring of the species to JNCC or BRC so that it can be incorporated in national databases. (ACTION: EN) |
| 2.2 Pollution, especially agrochemical run-off from gardens. | 5.5.3 Provide information annually to the World Conservation Monitoring Centre on the UK status of the species to contribute to maintenance of up-to-date global red lists. (ACTION: JNCC) |
| 3. Current action | 5.6 Communications and publicity |
| 3.1 A management plan has been drafted for Widewater Lagoon and will be implemented in the context of the site being a proposed SAC under the EC Habitats Directive. | 5.6.1 None proposed. |
| 4. Action plan objectives and targets | |
| 4.1 Establish whether the species survives at its sole recorded site. | |
| 4.2 Restore the habitat through improvement of water quality and quantity. | |
| 4.3 If the species is re-discovered, consider translocating individuals to other sites. | |
| 5. Proposed action with lead agencies | |
| 5.1 Policy and legislation | |
| 5.1.1 None proposed. | |
| 5.2 Site safeguard and management | |
| 5.2.1 Implement the management plan for the site. (ACTION: EN, LA) | |
| 5.3 Species management and protection | |
| 5.3.1 Survey Widewater Lagoon by 1998 to find out whether the species still survives. If it does, restore the habitat and consider translocating the species to other sites. (ACTION: EN) | |

Starlet sea anemone (*Nematostella vectensis*)

Species Action Plan

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| 1. Current status | 5.2.2 | Promote the implementation of practices to encourage the formation and development of brackish lagoons and sheltered brackish water habitats at suitable sites. (ACTION: EA, EN, LAs) |
| 1.1 The starlet sea anemone occurs in only a few coastal lagoons in the Isle of Wight, Sussex, Hampshire, and in Dorset and along the East Anglian coast. It may also occur in some brackish ponds and ditches. | 5.2.3 | Continue the programme to conserve lagoon habitats under the EC Habitats Directive, to benefit this species. (ACTION: DETR, EN, JNCC) |
| 1.2 The species is listed as vulnerable by IUCN/WCMC and rare on the GB Red List and is protected under Schedule 5 of the Wildlife and Countryside Act 1981. | 5.2.4 | Consider the need to notify sites for this species as SSSI. (ACTION: EN) |
| 2. Current factors causing loss or decline | 5.3 | Species management and protection |
| 2.1 Loss and damage to lagoon and other sheltered brackish water habitats caused by pollution, drainage and other activities. | 5.3.1 | Following feasibility assessment and the identification of suitable sites, seek to reintroduce at least five populations to formerly occupied localities, once conditions are suitable. (ACTION: EN) |
| 2.2 Isolation of pools leading to fragmentation of populations. | 5.4 | Advisory |
| 2.3 Coastal defence works and associated infilling. | 5.4.1 | None proposed. |
| 3. Current action | 5.5 | Future research and monitoring |
| 3.1 Saline lagoons are a priority habitat under the EC Habitats Directive. | 5.5.1 | Promote surveys to determine the full extent of the species' distribution, especially in brackish ponds and ditches. (ACTION: EN) |
| 4. Action plan objectives and targets | 5.5.2 | Seek to identify former sites suitable for re-introduction. (ACTION: EN) |
| 4.1 Maintain and protect viable populations at all known localities. | 5.5.3 | Encourage regular monitoring of existing populations and identify any further threats to the species. (ACTION: EN) |
| 4.2 Assess status in brackish ponds and ditches. | 5.5.4 | Pass information gathered during survey and monitoring of this species to JNCC or BRC so that it can be incorporated in national databases. (ACTION: EN) |
| 4.3 If feasible, reintroduce to five sites by the year 2005. | 5.5.5 | Provide information annually to the World Conservation Monitoring Centre on the UK status of the species to contribute to maintenance of an up-to-date global red list. (ACTION: JNCC) |
| 5. Proposed action with lead agencies | 5.6 | Communications and publicity |
| 5.1 Policy and legislation | 5.6.1 | Use this species to highlight the conservation value of lagoons. (ACTION: EN) |
| 5.1.1 Seek to ensure that sea defence strategies and structures take account of the requirements of the anemone, including opportunities to create brackish lagoons and ditches. (ACTION: EA, EN, LAs, MAFF) | | |
| 5.2 Site safeguard and management | | |
| 5.2.1 Maintain and, where possible, increase the amount of brackish lagoon habitat and ditches in occupied areas and in areas within the dispersal range of this species, to encourage expansion of existing colonies. (ACTION: EA, EN, LAs, MAFF) | | |

Corals

Pink sea-fan (*Eunicella verrucosa*)

Species Action Plan

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| <p>1. Current status</p> <p>1.1 The pink sea-fan <i>Eunicella verrucosa</i> is widely distributed in south-west Britain between north Pembrokeshire and Portland (Dorset). In the Bristol Channel the eastward extent is to approximately Combe Martin (north Devon). The pink sea-fan also occurs on the west coast of Ireland and southwards into the Mediterranean.</p> <p>1.2 Sea-fans attach to the rocky seabed usually on upward-facing bedrock or stable boulders at depths below the limit of algal domination (as shallow as 3 m in the turbid waters of north Devon, but more generally deeper than about 15 m). The sea-fan, a passive suspension feeder, is attached to the seabed by a broad base extending to a column. The column may be up to 8 mm in diameter and branches profusely from approximately 20 to 40 mm above the base. The thickness of the branches increases with age and annual growth rings are present in the axis. Branching is usually in one plane, which is orientated at right angles to predominant water currents. At some locations in south-west England, sea-fans occur in 'forests' but in most locations, individuals are widely separated. The species appears to recruit infrequently and large specimens may be as much as 40 years old.</p> <p>1.3 The pink sea fan may be found in the following JNCC Marine Nature Conservation Review (MNCR) biotopes: <i>Alcyonium digitatum</i> with massive sponges (<i>Cliona celata</i> and <i>Pachymatisma johnstonia</i>) and <i>Nemertesia antennina</i> on moderately tide-swept exposed circalittoral rock (ECR.AlcMaS) (usually in local shelter); <i>Phakellia ventilabrum</i> and axinellid sponges on deep exposed circalittoral rock (MCR.PhaAxi); Erect sponges, <i>Eunicella verrucosa</i> and <i>Pentapora foliacea</i> on slightly tide-swept moderately exposed circalittoral rock (MCR.ErSEun); Cushion sponges (<i>Polymastia boletiformis</i>, <i>Tethya</i>), branching sponges, <i>Nemertesia</i> spp and <i>Pentapora foliacea</i> on moderately exposed circalittoral rock (MCR.ErSPbolSH).</p> <p>1.4 The pink sea-fan is a host species for another BAP priority species: the sea anemone <i>Amphianthus dohrnii</i>.</p> <p>1.5 The pink sea-fan is protected under Schedule 5 of the Wildlife and Countryside Act 1981 against killing, injuring, taking possession and sale.</p> <p>2. Current factors causing loss or decline</p> | <p>2.1 The collection as souvenirs, including commercial collection, occurred during the late 1960s and may have reduced populations in the long term.</p> <p>2.2 The effects that climate change may have on the current UK distribution of this species are not known. Natural environmental factors affecting pink sea-fan populations globally need to be identified in order to differentiate them from local, anthropogenic impacts.</p> <p>2.3 The long-term effects of intensive potting and netting on local populations are not known and need further investigation. However, entanglement in fishing nets and line is a problem in some areas; it is known to damage soft tissue and may ultimately severely damage or kill colonies. Fin-strike damage by scuba divers on pink sea-fan colonies may also be detrimental.</p> <p>2.4 Sea-fans can die whilst still attached to the seabed after becoming smothered by other organisms (such as by ephemeral seaweeds at shallow depths during early summer).</p> <p>3. Current action</p> <p>3.1 The awareness amongst recreational divers of the long life and slow growth of the sea-fan has been promulgated since the mid 1970s and it is important to retain this education.</p> <p>3.2 Part of the study on the impacts of potting was directed at establishing the importance of bottom gear on the survival of the pink sea-fan. This provided valuable information in determining management measures to protect the species.</p> <p>3.3 The zoning schemes for Lundy and Skomer Marine Nature Reserves (MNRs) were both established to, in part, reflect the sensitivity of the pink sea-fan to various factors. This approach should be extended to other marine protected areas.</p> <p>4. Action plan objectives and targets</p> <p>4.1 Ensure that the pink sea-fan maintains its current abundance and distribution from the 1998 baseline.</p> <p>5. Proposed action with lead agencies</p> <p>5.1 Policy and legislation</p> <p>5.1.1 None proposed.</p> |
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- 5.2 Site safeguard and management**
- 5.2.1** Ensure that the management of Special Areas of Conservation (SACs) and Marine Nature Reserves (MNRs) takes account of the pink sea-fan. (ACTION: CCW, EN)
- 5.2.2** Ensure that areas with significant populations of pink sea-fan in non-statutory (voluntary) marine protected areas are identified as being of appropriate sensitivity within management zoning schemes. (ACTION: CCW, EN)
- 5.2.3** Undertake management measures to ensure human activities do not compromise known populations of the species. (ACTION: EN, SNH)
- 5.3 Species management and protection**
- 5.3.1** Investigate causes of decline and take the appropriate management response where human activities are implicated. (ACTION: CCW, EN)
- 5.4 Advisory**
- 5.4.1** Increase awareness among coastal zone management groups, divers and inshore fishermen of the sensitivity of the pink sea-fan in locations where it is known to exist. (ACTION: CCW, EN)
- 5.5 Future research and monitoring**
- 5.5.1** Continue to monitor the abundance and condition of sea-fans as a part of established monitoring work and ensure that they are included in SAC monitoring programmes, where appropriate. (ACTION: CCW, EN)
- 5.5.2** Undertake a programme of spot surveys in three years between 1999 and 2004. The surveys are to be conducted at locations where pink sea-fan are known to occur, from 'forest' areas to areas where abundance is sparse. Sites at the present limit of distribution should also be included. This can be linked to long-term monitoring of climate change. The data to be recorded should include density, size structure, colour, 'fouling', percentage 'infestation' by predators (the seaslug *Tritonia nilsodhneri*, and the prosobranch *Simnia patula*). Data is also required on the occurrence and density of the sea-fan anemone *Amphianthus dohrnii* (often found attached to the pink sea-fan). (ACTION: CCW, EN, NERC)
- 5.5.3** Research the factors which affect recruitment and survival of pink sea-fan. Report by end of 2004. (ACTION: NERC)
- 5.6 Communications and publicity**
- 5.6.1** Provide information on the pink sea-fan and *Amphianthus dohrnii*. Distribute as appropriate to recreational divers and lobster potters through leaflets, posters, displays and talks. (ACTION: CCW, EN)
- 5.6.2** Consider including in public aquaria (with *Amphianthus dohrnii*) to increase general awareness of marine biodiversity. (ACTION: CCW, EN)
- 5.6.3** Synthesise and disseminate data from existing sea-fan monitoring and research programmes as appropriate. (ACTION: CCW, EN)
- 5.7 Links with other action plans**
- 5.7.1** Successful conservation of the sea-fan anemone *Amphianthus dohrnii*, which has a separate action plan, depends on the continued presence of the pink sea-fan. Studies of the two species should be carried out simultaneously.

Sunset cup coral (*Leptopsammia pruvoti*)

Species Action Plan

1. Current status

- 1.1 The sunset cup coral *Leptopsammia pruvoti* occurs in groups of a few tens to several hundred individuals. It is found attached to rock, at a small number of isolated locations, in south-west England. In other parts of the north-east Atlantic it has been recorded in the Channel Isles, Brittany and Portugal and occurs widely in the Mediterranean, especially in caves. It has not been recorded, despite targeted survey, in Madeira and the Azores. It was first recorded in Britain from Lundy in 1969.
- 1.2 The coral is solitary, but occasionally found as small pseudo-colonies. The skeleton is porous and the calice round, becoming elliptical with age. The corallum may be short and cylindrical or tall and inversely conical, up to 60 mm in height, and with a calyx diameter up to 17 mm. The disk and tentacles are usually yellow, sometimes orange. There are about 96 tentacles. Sunset cup coral prefers shaded bedrock habitats (for instance, under overhangs and in caves or gullies).
- 1.3 Populations at Lundy and the Isles of Scilly have been monitored for 12 years and have shown no or negligible recruitment. The Lundy population had declined by 22% between 1993 and 1997. Studies of sunset cup coral in aquaria suggest that both juveniles, settled from planulae, and mature individuals, are very robust and cope well with extremes of temperature, starvation and slight variations in salinity.
- 1.4 The sunset cup coral may be found in the following JNCC Marine Nature Conservation Review (MNCR) biotope: Sponges, cup corals and *Parerythropodium coralloides* on shaded or overhanging circalittoral rock (CR.SCup).
- 1.5 The sunset cup coral is not protected under any UK statutes or listed in Directives and Conventions.

2. Current factors causing loss or decline

- 2.1 There are several possible reasons why sunset cup coral has a restricted distribution and is in decline. They are listed in a suggested priority order, but little observational or experimental work has been undertaken to establish either status or decline.
- 2.2 Populations are at the northern limit of their distribution and may be a relic of a former, more extensive distribution approximately 700 years ago. They are now restricted to 'ideal' locations.

- 2.3 Populations recruit extremely infrequently because of water temperature conditions being inadequate to allow production of gametes or gametes to be produced synchronously. However, viable larvae have been produced from individuals collected from Lundy and successfully placed in aquarium tanks on three occasions.
- 2.4 Adult populations decline because of lack of recruitment. This could be because larvae are swept away by tidal currents and fail to settle on suitable habitats or are consumed by attached carnivorous animals before they settle.
- 2.5 Non-recruiting populations decline because of weakening of the skeleton by boring organisms and subsequent detachment by such agents as foraging wrasse or divers finning.
- 2.6 Recruitment into populations may occur from distant sources such as populations to the south in continental Europe and only when appropriate water bodies move into south-west England. There is evidence that this sort of movement of water bodies might occur every 25-30 years.

3. Current action

- 3.1 The awareness amongst divers of the long life and slow growth of sunset cup coral has been promulgated since the mid 1970s and it is important to retain this education.
- 3.2 Studies of the longevity and persistence of sunset cup coral at monitoring sites at Lundy continue together with observations of degree of infestation with boring species. Aquarium observations are also helping to understand more about reproduction and maintenance of healthy individuals.
- 3.3 The general public's awareness of this species and of more general marine conservation issues has been raised through publicity and educational material associated with the Lundy Marine Nature Reserve (MNR).

4. Action plan objectives and targets

- 4.1 Promote a better understanding of the current distribution, abundance and life history characteristics of

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| | <p>sunset cup coral and create a baseline of information by the end of 2004.</p> <p>4.2 Maintain the distribution and abundance of known viable populations and those identified by the 2004 baseline.</p> | | |
| 5. | Proposed action with lead agencies | | |
| 5.1 | Policy and legislation | 5.5.2 | Undertake work to understand the factors that affect recruitment and survival of sunset cup coral. This requires a programme of <i>ex situ</i> studies of reproduction to include establishing ‘triggers’ to reproductive success, nature of the larva, time to settlement and factors affecting successful establishment and dispersal. Sites at the present limit of distribution should also be included. This can be linked to long-term monitoring of climate change. (ACTION: NERC) |
| 5.1.1 | None proposed. | 5.6 | Communications and publicity |
| 5.2 | Site safeguard and management | 5.6.1 | Ensure that information on the long life and slow growth rates of sunset cup coral continues to be promulgated to divers through leaflets, posters, displays and talks. (ACTION: EN) |
| 5.2.1 | Ensure that the management of Special Areas of Conservation (SACs) and MNRs takes account of sunset cup coral. (ACTION: EN) | 5.6.2 | Use sunset cup coral as an example of a rare, long-lived species to increase awareness of marine biodiversity at public aquaria. (ACTION: EN) |
| 5.2.2 | Ensure that locations with significant populations of sunset cup coral in statutory and non-statutory (voluntary) marine protected areas are identified as being of appropriate sensitivity within management zoning schemes. (ACTION: EN) | 5.7 | Links with other action plans |
| 5.2.3 | Undertake management measures to ensure human activities do not compromise known populations of the species. (ACTION: EN) | 5.7.1 | Sunset cup coral occurs in the same areas as pink sea-fan <i>Eunicella verrucosa</i> and sea-fan anemone <i>Amphianthus dohrnii</i> and so there is a possibility of combining survey and monitoring activities. |
| 5.3 | Species management and protection | | |
| 5.3.1 | Ensure that populations of sunset cup coral are protected through the implementation of management measures in Marine Conservation Areas (MCAs). (ACTION: EN) | | |
| 5.4 | Advisory | | |
| 5.4.1 | Increase awareness among coastal zone management groups of the sensitivity of sunset cup coral in locations where it is known to exist. (ACTION: EN) | | |
| 5.4.2 | Determine the causes of decline and take management action if the decline in the population of sunset cup coral is believed to be due to human factors. (ACTION: EN) | | |
| 5.5 | Future research and monitoring | | |
| 5.5.1 | Continue to monitor the abundance and condition of sunset cup coral as part of established monitoring work and ensure that it is included in SAC monitoring programmes, where appropriate. (ACTION: EN) | | |

Algae

Anotrichium barbatum (a red alga)

Species Action Plan

| 1. Current status | 2. Current factors causing loss or decline |
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| <p>1.1 <i>Anotrichium barbatum</i> (there is no common name, but bearded anotrichium is proposed) is a small filamentous rose-pink seaweed, forming much-branched, extremely delicate tufts 2-6 cm high. Its key diagnostic feature is the presence of a whorl of branched hair-like filaments on younger vegetative cells; these filaments later bear the reproductive structures. The only known extant population grows in one area of Cardigan Bay (between Pwllheli and Abersoch), Wales, where its habitat is on pebbles and gravel in a stabilized gravel bed at a depth of 7 m below Chart Datum. A rough quantification showed individuals to be very sparse outside Abersoch and fairly frequent (c.1 per 10 square metres) on the Oyster Bank outside Pwllheli Marina.</p> | <p>2.1 It is not known whether there are any current causes of decline because only one, previously unknown, population has been located to date, and it has been examined on only one occasion. However, its Oyster Bank site is subject to several potential threats. The most serious of these is the possible dumping of spoil from channel dredging operations. As the population occupies a fairly small area, it could be entirely eliminated by spoil dumping. Bottom trawling is potentially damaging, but the shallow depth makes this unlikely. Pwllheli is being developed as a centre of harbour and watersports facilities, and the Oyster Bank will need appropriate protection.</p> |
| <p>1.2 Nothing is known of current population trends at this site. The habitat is apparently similar to that in northern France where <i>Anotrichium barbatum</i> was reported in the mid 19th century to be attached to shells and small stones in old oyster beds. In the 19th century <i>A. barbatum</i> was 'exceedingly rare' as an epiphyte on small algae in intertidal pools in the Channel Islands; it was known in the UK only on English Channel coasts of Sussex, Hampshire and Dorset. All recent reports for the UK, other than in Cardigan Bay, represent misidentifications of the introduced species <i>Anotrichium furcellatum</i>, which lacks the whorls of hair-like filaments. <i>Anotrichium</i> (A.) <i>barbatum</i> is reported to occur from England to northern Spain, in the Canary Islands and west Africa, and in the Mediterranean, but there are apparently no recent records (last 20 years) from French, Belgian or Dutch Channel coasts.</p> | <p>3. Current action</p> <p>3.1 There are no conservation actions currently underway.</p> |
| <p>1.3 A large number of <i>A. barbatum</i> herbarium specimens were collected in England and the Channel Islands from 1807 until 1900, with the majority of them dating from the 1890s. Most of them came from a few favourite collecting sites (Studland, Swanage and Jersey). Clearly this rare alga was highly desirable for collectors and it is possible that the intense collecting at the small number of sites where it could be found intertidally affected UK populations.</p> | <p>4. Action plan objectives and targets</p> <p>4.1 Maintain the current known population.</p> <p>4.2 Establish the distribution of this species in the UK by 2001. It is not certain at present whether there are populations of this species in England that have remained overlooked due to its inconspicuous habit and relatively poorly sampled habitat.</p> |
| <p>1.4 <i>A. barbatum</i> is not listed in the schedules of the Wildlife and Countryside Act 1981.</p> | <p>5. Proposed action with lead agencies</p> <p>Sites in England (eg Studland) formerly supporting populations of this species should be surveyed; action to be taken subsequently would depend on whether any other populations are discovered. If there are populations on Channel coasts they are probably under pressure from increased marine leisure activities.</p> <p>5.1 Policy and legislation</p> <p>5.1.1 Take into account the conservation of <i>A. barbatum</i> in the management scheme for the Oyster Bank site at Pwllheli (in the Llyn Peninsula and the Sarnau candidate Special Area of Conservation (cSAC)). (ACTION: All relevant and competent authorities)</p> |

5.2 Site safeguard and management

- 5.2.1** Protect the Oyster Bank from damaging construction work and other potential threats. (ACTION: All relevant and competent authorities)

5.3 Species management and protection

- 5.3.1** Establish a culture from Cardigan Bay and deposit it in the Natural Environment Research Council's Culture Collection of Algae and Protozoa where it will be available to phycologists for further study. (ACTION: NERC)

5.4 Advisory

- 5.4.1** Advise local authorities and users of the sea near Pwllheli (eg sailing clubs) of the presence of this species. (ACTION: CCW, LAs)

5.5 Future research and monitoring

- 5.5.1** Establish and monitor the size of the *A. barbatum* population for a few years to determine whether it is stable or fluctuates between years. (ACTION: CCW)
- 5.5.2** Commission research to establish the environmental variables to which the species is most sensitive. (ACTION: NERC)
- 5.5.3** Conduct surveys in locations where the species was formerly present in England and consider the feasibility of re-establishment. (ACTION: EN)

5.6 Communications and publicity

- 5.6.1** Use presentations to draw attention to the need of establishing the status of this species. (ACTION: CCW, JNCC)

5.7 Links with other action plans

- 5.7.1** Given the habitat requirements of this species, reference should be made to the habitat action plan for sheltered muddy gravels, and the species action plan for native oyster.

Ascophyllum nodosum ecad *mackaii* (a brown alga)

Species Action Plan

- | | |
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| <p>1. Current status</p> <p>1.1 <i>Ascophyllum nodosum</i> (egg or knotted wrack) is a common brown seaweed which grows on sheltered rocky shores all around Britain. However the very distinctive free-living ecad <i>mackaii</i> has a very limited distribution, occurring in Scotland, some sites in Northern Ireland and the Irish Republic. The main British (and world) populations are confined to extremely sheltered shores in Scottish sea lochs.</p> <p>1.2 An ecad is a distinctive form of a species which develops in response to environmental conditions rather than genotypic differences. <i>Ascophyllum nodosum</i> ecad <i>mackaii</i> develops initially from broken fragments of the normal attached form of knotted wrack. In particular conditions of extreme shelter and regularly fluctuating salinity, the fragments grow into unattached, often bladderless, wig-shaped masses at upper or mid-tide levels.</p> <p>1.3 Very sheltered sea loch shores where freshwater runs or seeps across the shore can provide suitable conditions. In such sheltered situations, the freshwater forms a brackish layer at the loch surface over the saline water beneath, which moves up and down with the tides and subjects the shores to regularly fluctuating salinities. Once formed, the ecad can proliferate itself vegetatively from its own broken fragments which continue to divide forming new plants. Extensive beds sometimes develop in appropriate conditions, over mud or muddy sand and small stones. More often the beds are very local, often only a few metres across, and typically in small bays between rock outcrops.</p> <p>1.4 The loose mats of <i>Ascophyllum</i> (A.) <i>nodosum</i> ecad <i>mackaii</i> provide a sheltered and humid habitat for many mobile mid-shore animals which would otherwise be unable to live on open sediments or shingle. Gammarid amphipods, shore crabs and littorinid snails hide and feed amongst the weed, while barnacles and mussels are often attached to stones beneath. Fish such as young common eels <i>Anguilla anguilla</i> and viviparous blennies <i>Zoarces viviparus</i> may also shelter in the weed. Because the plants have a relatively open structure which does not smother the sediment beneath, this may contain lugworms <i>Arenicola marina</i>, sandmason worms <i>Lanice conchilega</i> and other infauna. However there are no detailed studies to contrast the fauna associated with <i>Ascophyllum nodosum</i> ecad <i>mackaii</i> beds with that of similar shores lacking them.</p> | <p>1.5 Most <i>A. nodosum</i> ecad <i>mackaii</i> beds are in remote, unpolluted sites, and in a natural condition. However, the rarity of the habitat, the small size of many of the beds and the importance of the UK populations in an international context emphasises the need for action on protecting this habitat.</p> <p>2. Current factors causing loss or decline</p> <p>2.1 Due to the rugged terrain, many roads in the west Highlands run alongside loch shores. Road improvements, or construction of new roads, often involve 'straightening' the shoreline or building causeways across small embayments. This can destroy, or cut off from the sea, typical <i>A. nodosum</i> ecad <i>mackaii</i> beds.</p> <p>2.2 The small embayments and inlets, often enclosed by rocky headlands, which form the typical habitat for <i>A. nodosum</i> ecad <i>mackaii</i>, are vulnerable to infilling for land-based depots for marine industries such as fish and shellfish farms, slipways, car parks and other developments.</p> <p>2.3 The formation and maintenance of the ecad depends on fluctuating salinities, and alterations to freshwater flow across the shore in the vicinity of <i>A. nodosum</i> ecad <i>mackaii</i> may affect it adversely.</p> <p>2.4 The attached form of <i>A. nodosum</i> is still collected on a small scale in western Scotland for the extraction of alginates. The unattached <i>mackaii</i> ecad is easy to collect, requiring no cutting from the rocks and it has been collected along with the attached form in the past. For instance, the <i>Marine Conservation Handbook</i> states that there has been 'decimation' of <i>A. nodosum</i> ecad <i>mackaii</i> in the Uists, where the beds have been removed and the habitats and associated communities destroyed. It is not known if it is possible, or how long it takes, for beds to recover from harvesting.</p> <p>2.5 <i>A. nodosum</i> ecad <i>mackaii</i> is particularly vulnerable to clean-up operations, for example after oil spills, as the plants are easily removed. Local dumping of rubbish on upper foreshore areas could also affect it. Seaweeds are known to accumulate heavy metals and other pollutants, which may have a knock-on effect on animals feeding on the seaweeds. <i>Ascophyllum</i> may be adversely affected by eutrophication of sea lochs such as could result from fish farm activities.</p> |
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3. Current action

- 3.1** The Wildlife and Countryside Act 1981 allows the designation of SSSIs in Scotland and ASSIs in Northern Ireland, for intertidal areas, including the mid- and upper-shore areas occupied by *A. nodosum* ecad *mackaii*. JNCC guidelines for selection of biological SSSIs for marine interest lists 'Ascophyllum nodosum ecad mackaii beds on extremely sheltered, variable salinity, mixed substrata' as a community of 'national or more than national importance', and advises that all highly rated examples should be included in SSSIs. Several SSSIs in Scotland include *A. nodosum* ecad *mackaii* within their boundaries. Several of these are designated for geological interests only, and only one of the others specifies the *A. nodosum* ecad as a feature of interest in the citation.
- 3.2** *A. nodosum* ecad *mackaii* is not protected under Schedule 8 of the Wildlife and Countryside Act.
- 3.3** The plant occurs in Strangford Lough in Northern Ireland, a Marine Nature Reserve and candidate Special Area of Conservation under the EC Habitats Directive. At least three of the Scottish sites which are possible Special Areas of Conservation (pSAC) or candidate Special Areas of Conservation (cSAC) include *A. nodosum* ecad *mackaii*, although the largest Scottish bed, in Loch Duich, is outside the SAC boundary as presently drawn. None of the pSACs or cSACs include whole fjordic loch systems, of which *A. nodosum* ecad *mackaii* beds are a characteristic component. The beds themselves are not listed as an Annex I habitat in the EC Habitats Directive.
- 3.4** Nine of Scotland's 29 Marine Consultation Areas (a non-statutory designation by SNH to denote marine biological interest, particularly in relation to fish farm development) contain *A. nodosum* ecad *mackaii*. This non-statutory designation offers the option of directed management but only through the adoption of the voluntary principle.
- 3.5** In 1957, Dorothy Gibb published the results of a detailed study of Scottish *A. nodosum* ecad *mackaii* which remains the classic work on this ecad, and includes information on distribution and conditions required for the formation of the ecad. Information on its distribution, together with information on associated substrata and species, was collected by the JNCC's Marine Nature Conservation Review. 'Extremely sheltered mid-eulittoral mixed substrata with *Ascophyllum nodosum* ecad *mackaii* beds' (SLR.AscX.mac) was classified as a distinct biotope by the MNCR. Surveys and casework by, and commissioned by, SNH have added to the distributional information, including the detailed

mapping of the beds in Loch Duich. However, as the beds can be very small, it is likely that populations in less well studied parts of the coast still remain unrecorded.

- 3.6** Initial impact assessment on the possible effects of the construction of the Skye Bridge identified small beds of *A. nodosum* ecad *mackaii* at Kyle of Lochalsh, which the contractors were made aware of and which were unaffected throughout the bridge construction period. However, one dense bed was entirely removed during last-minute 'tidying-up' before the bridge opening ceremony, and more than two years after the bridge was opened there was still no sign of recovery of this bed. This incident illustrates the need for awareness and communication between different contractors on developments of this sort and for much more emphasis at all levels on the importance and rarity of these beds.

4. Action plan objectives and targets

- 4.1** Maintain the extent and distribution of *A. nodosum* ecad *mackaii* on UK shores.
- 4.2** If positive results are obtained from research into the re-establishment of recently lost beds, apply targets to further sites.

5. Proposed actions with lead agencies

5.1 Policy and legislation

- 5.1.1** None proposed.

5.2 Site safeguard and management

- 5.2.1** When the Habitats Directive Annexes are reviewed by the EC, consider proposing the inclusion of *A. nodosum* ecad *mackaii* as appropriate. (ACTION: DETR, JNCC)
- 5.2.2** Determine the extent of *A. nodosum* ecad *mackaii* inside protected areas and, where appropriate, notify further sites. Ensure the full range of site types and ecological conditions is represented in the network of protected sites. In particular, the most extensive beds should be adequately protected in their own right, as per JNCC guidelines for the designation of intertidal SSSIs for their marine biological importance (which list *A. nodosum* ecad *mackaii* beds as a community of national or more than national importance). (ACTION: SNH)
- 5.2.3** Include provision for the maintenance of the extent and health of *A. nodosum* ecad *mackaii* beds in

- management plans of SACs where these include such beds. (ACTION: All relevant authorities)
- 5.2.4** Take account of the conservation requirements for *A. nodosum* ecad *mackaii* beds in the development and implementation of coastal zone management plans and ensure they are not managed in isolation from other habitats and communities in these areas. (ACTION: EHS, LAs, Port/Harbour authorities, SE)
- 5.3 Species management and protection**
- 5.3.1** Ensure that advice and information is available to central government roads engineers, local authorities and others on minimising impacts of plans and operations on *A. nodosum* ecad *mackaii* beds. In particular, the value of considering the beds from the planning stage of any project should be emphasised, as there may often be a simple engineering solution to preserving the habitat (such as providing gaps through causeways to allow water flow). Ensure information is provided to all contractors and is carried through to the final stages of the project. Include a map of sites (according to current knowledge) with this advice, so that authorities are aware of the distribution of *A. nodosum* ecad *mackaii* in their own areas. (ACTION: EHS, SE, SEPA, SNH)
- 5.4 Advisory**
- 5.4.1** Advise seaweed harvesters on the importance of the ecad, to ensure beds are not damaged further, and to ensure they allow time for the recovery of any damaged beds. (ACTION: EHS, SNH)
- 5.5 Future research and monitoring**
- 5.5.1** Complete the surveying and recording of the current distribution, extent, quality and associated biota of *A. nodosum* ecad *mackaii*. (ACTION: JNCC)
- 5.5.2** Monitor the extent and health of a sample of *A. nodosum* ecad *mackaii* beds from those identified in the survey above, but including beds within designated ASSIs, SSSIs and cSACs as in 5.2.3. This monitoring should include the best sites, as advised by JNCC. (ACTION: All relevant authorities, EHS, SNH)
- 5.5.3** Commission an information review and further research into the factors required for the formation of *A. nodosum* ecad *mackaii* beds. (ACTION: EHS, NERC, SNH)
- 5.5.4** Commission research on the potential for the recovery of *A. nodosum* ecad *mackaii* beds. (ACTION: EHS, JNCC, SNH)
- 5.5.5** Carry out a survey to compare the fauna associated with *Ascophyllum nodosum* ecad *mackaii* beds with similar shores without the beds, to establish the possible importance of the beds in increasing the abundance and/or diversity of animal species and in harbouring rare species. The effect of the beds on the foodwebs of other marine species, including birds, should also be established. (ACTION: EHS, NERC, SNH)
- 5.6 Communications and publicity**
- 5.6.1** Promote awareness amongst coastal users of the importance of *A. nodosum* ecad *mackaii* beds and how to avoid damaging them. This should be done both by emphasising the beds as an integral part of sea loch communities, and by providing more information on the plant and its ecology. (ACTION: EHS, LAs, SNH)
- 5.6.2** Produce detailed maps of the distribution of *A. nodosum* ecad *mackaii* and distribute these to planners, and provide relevant EHS and SNH staff with details of distribution in their areas. (ACTION: EHS, SNH)
- 5.6.3** Write popular articles on the importance of *A. nodosum* ecad *mackaii* for relevant publications. (ACTION: EHS, SNH)
- 5.6.4** Consider the possible role of Coastal Fora and Minch Project in promoting awareness of and disseminating information about *A. nodosum* ecad *mackaii*. (ACTION: LAs, SE, SNH)
- 5.7 Links with other action plans**
- 5.7.1** Reference should be made to the sheltered muddy gravels habitat action plan, given the degree of similarity in the conditions that favour that habitat and the presence of *A. nodosum* ecad *mackaii*.

Priority Habitat Action Plans and Associated Species Statements

Maritime cliff and slopes

Habitat Action Plan

1. Current status

movement event. Cliff-top habitats can also be transformed by soil erosion processes.

1.1 Physical and biological status

1.1.1 Maritime cliffs and slopes comprise sloping to vertical faces on the coastline where a break in slope is formed by slippage and/or coastal erosion. There appears to be no generally accepted definition of the minimum height or angle of slope which constitutes a cliff, but the zone defined as cliff-top (also covered in this plan) should extend landward to at least the limit of maritime influence (ie limit of salt spray deposition), which in some exposed situations may continue for up to 500 m inland. This plan may therefore encompass entire islands or headlands, depending on their size. On the seaward side, the plan extends to the limit of the supralittoral zone and so includes the splash zone lichens and other species occupying this habitat. Approximately 4000 km of the UK coastline has been classified as cliff.

1.1.2 Cliff profiles vary with the nature of the rocks forming them and with the geomorphology of the adjoining land. While most maritime cliffs have been formed by coastal erosion, steep slopes falling to the sea in mountainous districts may have been formed long before the sea level reached its present position; in such cases only the lower part of the slope will have been steepened by the sea.

1.1.3 Maritime cliffs can broadly be classified as 'hard cliffs' or 'soft cliffs', though in practice there are a number of intermediate types. Hard cliffs are vertical or steeply sloping; they are inclined to support few higher plants other than on ledges and in crevices or where a break in slope allows soil to accumulate. They tend to be formed of rocks resistant to weathering, such as granite, sandstone and limestone, but can be formed of softer rocks, such as chalk, which erode to a vertical profile. Soft cliffs are formed in less resistant rocks such as shales or in unconsolidated materials such as boulder clay; being unstable they often form less steep slopes and are therefore more easily colonised by vegetation. Soft cliffs are subject to frequent slumping and landslips, particularly where water percolates into the rock and reduces its effective shear strength.

1.1.4 The vegetation of maritime cliff and slopes varies according to several factors: the extent of exposure to wind and salt spray, the chemistry of the underlying rock, the water content and stability of the substrate and, on soft cliffs, the time elapsed since the last

1.1.5 Vegetation of a strictly maritime nature occurs where exposure to the waves and winds is at its greatest. In the UK, such conditions are found principally on the northern and south-western coasts. In extreme conditions, such as on the Isle of Lewis, saltmarsh vegetation can occur on cliff-tops. In other areas, where cliffs occur adjacent to sand dunes, sufficient wind blown sand can accumulate on the cliff-tops to allow cliff-top dune vegetation to develop (perched dunes). On exposed hard cliffs giving little foothold to higher plants, lichens are often the predominant vegetation. Ledges on such cliffs support a specialised flora with species such as rock samphire *Crithmum maritimum* and rock sea spurrey *Spergularia rupicola* in the south and Scots lovage *Ligusticum scoticum* and in the north. Seabird nesting ledges enriched by guano support a particular community characterised by oraches *Atriplex* spp and sea beet *Beta vulgaris* ssp *maritima*. Maritime grasslands occur on cliffs and slopes in less severely exposed locations; a maritime form of red fescue *Festuca rubra* is a constant component, together with maritime species such as thrift *Armeria maritima*, sea plantain *Plantago maritima*, buck's-horn plantain *P. coronopus* and sea carrot *Daucus carota* ssp *gummifer*. Species of inland grasslands which also commonly occur in maritime grasslands include ribwort plantain *Plantago lanceolata*, bird's-foot trefoil *Lotus corniculatus*, common restharrow *Ononis repens* and several species of grass.

1.1.6 On cliffs and slopes which are more sheltered from the prevailing winds and salt spray, the vegetation communities are more similar to those found inland, and are increasingly influenced by the chemistry of the substrate. Calcareous grassland communities with a few maritime specialist species occur on sheltered chalk or limestone cliffs. The upper sections and cliff-tops of hard cliffs on acidic rocks may support maritime heaths characterised by heather *Calluna vulgaris*. Mobile soft cliffs support a wide range of vegetation from pioneer communities on freshly exposed faces through ruderal and grassland communities to scrub and woodland. Wet flush vegetation commonly occurs on soft cliffs where groundwater issues as seepage.

1.1.7 Maritime cliffs are often significant for their populations of breeding seabirds, many of which are of international importance. Some 70% of the international population of gannet *Morus bassanus* and

important proportions of the European populations of shag *Phalacrocorax aristotelis*, razorbill *Alca torda* and guillemot *Uria aalge* nest colonially on cliff ledges whilst significant populations of Manx shearwater *Puffinus puffinus* and puffins *Fratercula arctica* nest in burrows in turf on cliff-tops or slopes. Coastal cliffs are also important for crag nesting species, such as raven *Corvus corax* and peregrine *Falco peregrinus*, and cliff-top vegetation may provide important feeding grounds for chough *Pyrrhocorax pyrrhocorax*.

1.1.8 Hard cliffs are widely distributed around the more exposed coasts of the UK, occurring principally in south-west and south-east England (the latter area having the bulk of the 'hard' chalk cliffs), in north-west and south-west Wales, in western and northern Scotland and on the north coast of Northern Ireland. Soft cliffs are more restricted, occurring mainly on the east and central south coasts of England and in Cardigan Bay and north-west Wales. There are also examples on the coasts of Fife and Skye in Scotland and Antrim in Northern Ireland.

1.1.9 Soft cliffs provide important breeding sites for sand martins *Riparia riparia*, which burrow into soft faces exposed by recent slippages, but they are particularly important for invertebrates as they provide a suite of conditions which are rarely found together in other habitats. The combination of friable soils, hot substrates and open conditions maintained by cliff slippages offer a continuity of otherwise very restricted microhabitats and these support many rare invertebrates which are confined to such sites. These include the ground beetle *Cicindela germanica*, the weevil *Baris analis*, the shore bug *Saldula arenicola*, and the Glanville fritillary *Melitaea cinxia*.

1.1.10 Seepages, springs and pools are a feature of many soft cliff sites and these provide the wet muds required by many species of solitary bees and wasps for nest building. They also support rich assemblages of other invertebrates including many rare species which are confined to this habitat. These include the crane flies *Gonomyia bradleyi* and *Helius hispanicus*, and the water beetle *Sphaerius acaroides*.

1.1.11 The hard coastal cliffs of west Britain supports a western oceanic invertebrate assemblage of European significance. Important species include the snail *Ponentina subvirescens*, weevils such as the highly restricted *Cathormiocerus attaphilus* and moths such as Barrett's marbled coronet *Hadena luteago*. Other species are confined to certain rock types. For example, the fiery clearwing *Bembecia chrysidiformis* is restricted to the chalk cliffs of Kent and Sussex and the water beetle *Ochthebius poweri* occurs

predominantly in small seepages on red sandstone cliff faces in south-west England and south Wales.

1.1.12 The supralittoral zone represents the lowest belt of terrestrial vegetation on maritime cliffs and is usually exemplified by a zone of orange and grey maritime lichens. The zone tends to be dominated by species such as *Caloplaca marina*, *Ramalina siliquosa* and *Verrucaria maura*, but may also include uncommon species such as *Roccella filiformis* and *R. phycopsis*.

1.2 Links with other action plans

1.2.1 The lowland heathland and littoral and sublittoral chalk habitat action plans have objectives and actions which are relevant to this plan.

1.2.1 The following BAP priority species have significant populations on maritime cliffs:

Bombus humilis Brown-banded carder bee
Bombus ruderalis Large garden bumble bee
Lasioglossum angusticeps a mining bee
Osmia xanthomelana a mason bee
Cathormiocerus britannicus a weevil
Cicindela germanica a tiger beetle
Caloplaca aractina a lichen
Heterodermia leucomelos Ciliate strap-lichen
Acaulon triquetrum Triangular pygmy moss
Lygephila cracca Scarce blackneck
Polymixis xanthomista statices Black-banded moth
Zygaena loti scotica Slender scotch burnet
Zygaena viciae New Forest Burnet
Asparagus officinalis ssp prostratus Wild asparagus
Coincya wrightii Lundy cabbage
Euphrasia campbelliae an eyebright
Euphrasia rotundifolia an eye bright
Limonium (endemic taxa) Sea lavender
Rumex rupestris Shore dock

2. Current factors affecting the habitat

2.1 Erosion. Erosion is a highly significant factor in soft cliffs. High rates of erosion do not imply a loss of the cliff resource, either in geological or biological terms. Cliff face communities are able to retreat with the cliff line, and erosion is vital for constantly renewing geological exposures and recycling the botanical succession on soft cliffs. However, cliff-top vegetation may be destroyed where it is squeezed between a receding cliff face and cultivated land. Cliff erosion in many places provides an essential supply of sediment to coasts lying down-drift of the cliffs.

- 2.2 Coastal protection.** Coastal protection systems have been built on many soft cliff coasts in order to slow or stop the rate of erosion and thus protect capital assets behind the cliff line. Cliff faces may also be re-profiled and sown with hardy grasses of little value for nature conservation. All such works have the effect of stabilising the cliff face, resulting in geological exposures being obscured, bare soil and early pioneer stages being progressively overgrown, and wet flushes drying out. A MAFF survey in 1994 identified over 90 km of new cliff protection works likely to be needed in the next 10 years, resulting in a potential loss of 36% of the remaining soft cliff resource. Additional effects of such defences include both accelerated erosion and sediment starvation at coastal sites down-drift of defended sites. It has been estimated that sediment inputs may have declined by as much as 50% over the past 100 years due to cliff protection works.
- 2.3 Built development.** There have been many instances in the UK of urban or industrial development and holiday accommodation being built too close to cliff-tops. Where the cliffs are subsequently discovered to be eroding, there is often political pressure to build the type of defensive works described above. Built development also prevents cliff-top biological communities from retreating in response to cliff erosion, subjecting them to a form of ‘coastal squeeze’.
- 2.4 Agriculture.** In traditional low-intensity grazing systems, livestock were grazed on cliff grasslands where they maintained open maritime grassland vegetation. Post-war intensification of agriculture has led to maritime grassland on more level terrain being ploughed out, while that on sloping ground has been abandoned and, where not maintained by exposure, is frequently overgrown by scrub. Localised eutrophication can be caused by fertiliser run-off from arable land above and this encourages coarse, vigorous ‘weed’ species at the expense of the maritime species. Agricultural land drains discharging on the cliff face may cause local acceleration of erosion.
- 2.5 Recreational use.** The siting of holiday accommodation on cliff-tops not only reduces the landscape value of a site, but can also cause heavy localised erosion and disturbance to nesting birds. An increase in the number of walkers and dogs along some coastal footpaths has increased livestock worrying and even losses and forced a number of farmers to remove their stock from these sites. Consequently, some of the sites are now suffering from a lack of appropriate grazing, and scrub encroachment is likely to become a problem.
- 2.6 Introduced species.** Predators, such as cats and rats, can have a significant impact on populations of cliff or

burrow nesting seabirds, particularly on island sites. Also the spread of certain alien, invasive plants, especially members of the flowering plant family Aizoaceae such as the hottentot fig *Carpobrotus edulis*, can have a devastating impact on indigenous maritime plant communities.

3. Current action

3.1. Legal status

- 3.1.1** A high proportion of the hard cliff coast in England has been notified as SSSIs, and in areas such as the south-west of England almost the whole cliffed coast has been notified. Notification of soft cliffs has been less extensive, but areas such as north-west Norfolk and the Isle of Wight have a high proportion of their soft cliffs notified. In Wales approximately half of the total maritime cliff resource has been notified as SSSIs, but as yet only a small proportion has been notified as ASSIs in Northern Ireland. Nine lengths of coastline in the UK have been nominated as ‘Vegetated sea cliffs of the Atlantic and Baltic coasts’ candidate Special Areas of Conservation (SAC) under the EC Habitats Directive for their cliff features (two of which include substantial representation of soft cliffs). Under the EC Birds Directive, 38 Special Protection Areas (SPA) in the UK have been designated which include cliff sites - these comprise 30 sites in Scotland, 5 in Wales, 2 in England, and 1 in Northern Ireland.

3.2. Management, research and guidance

- 3.2.1** The UK Government has set out its commitment to sustainable management of the coast in a number of publications. These include the DETR *Policy Guidelines for the Coast* and *Planning Policy Guidance - Coastal Planning* (PPG 20), the Scottish Office *Coastal Planning* (NPPG 13), and the Welsh Office Technical Advice Note 14 *Coastal Planning*. The DoENI *Planning Strategy for Rural Northern Ireland* has provisions relating to development, access and conservation of the coast. MAFF and the Welsh Office have also produced a *Strategy for Flood and Coastal Defence in England and Wales* and the DETR has produced *Coastal Zone Management - Towards Best Practice*.
- 3.2.2** The DETR Coastal Forum was set up in 1994; similar fora have recently been initiated in Scotland and Wales. Certain coastal fora have also been set up by the country nature conservation agencies. These include the Estuaries Initiative, in England, Focus on Firths in Scotland, and in Wales an independent partnership of coastal practitioners (Arfordir). More general countryside management initiatives (Tir Cymen and the Habitats Scheme in Wales and Countryside

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| | Stewardship in England) offer options applicable to grazing management of cliff grassland. Recent figures show that 104 ha of cliff grassland had been entered into Tir Cymen, and 184 ha in to the Habitats Scheme, but no separate figures are available for cliff land entered into Countryside Stewardship. The Tir Cymen pilot scheme which was restricted to just a few areas in Wales has been superseded by an all-Wales agri-environment scheme (Tir Gofal). | | |
| 3.2.3 | Over 700 km of cliff coastline in England, Wales and Northern Ireland is owned by the National Trust, who are actively reinstating grazing on many of these properties. Other non-governmental organisations, such as RSPB and the Wildlife Trusts, own or manage a number of other important maritime cliff sites. A large proportion of the cliff coast of south-west England and western Wales is within designated Heritage Coasts, while three National Parks (North York Moors, Exmoor and Pembrokeshire Coast) include cliffed coastlines. A number of cliff coasts in western Scotland are within National Scenic Areas. These designated areas often have the benefit of a warden/ranger service which encourages appropriate management and control of damaging activities, and provides interpretative and educational services. | | |
| 3.2.4 | Shoreline Management Plans and the work of their associated Coastal Groups will provide one of the main mechanisms for ensuring that the requirements of this plan are carried forward. | | |
| 3.2.5 | A Sea Cliff Management Handbook was produced jointly by the University of Lancaster, JNCC and the National Trust in 1991, and in 1998 The National Trust produced a report entitled <i>Grazing Sea Cliffs and Dunes for Nature Conservation</i> . | | |
| 4. | Action plan objectives and proposed targets | | |
| | The research and survey outlined in Section 5.5 will provide a basis for developing more specific targets and objectives. In particular, research into the options for removal/abandonment of existing defences may allow further definition of objective 4.3. | | |
| 4.1 | Seek to maintain the existing maritime cliff resource of cliff-top and slope habitat, of about 4000 km. | 4.3 | Seek to retain and where possible increase the amount of maritime cliff and slope habitats unaffected by coastal defence and other engineering works. |
| 4.2 | Maintain wherever possible free functioning of coastal physical processes acting on maritime cliff and slope habitats. | 4.4 | Increase the area of cliff-top semi-natural habitats by at least 500 ha over the next 20 years. |
| | | 4.5 | Improve by appropriate management the quality of at least 30% of the maritime cliff and slope habitats, including cliff-top vegetation, by 2010, and as much as possible before 2015. |
| | | 5. | Proposed action with lead agencies |
| | | 5.1 | Policy and legislation |
| | | 5.1.1 | Promote sea defence and coastal protection policies which encourage the free functioning of the coastal physical processes of maritime cliffs wherever possible. (ACTION: DANI, DoE(NI), EA, LAs, MAFF, NAW, SE) |
| | | 5.1.2 | In the light of research findings, give consideration to how planning policy might discourage new built development within appropriate buffer zones in the vicinity of retreating cliff-tops. (ACTION: CCE, DETR, DoE(NI), EHS, EN, LAs, NAW, SE, SNH) |
| | | 5.1.3 | Look into the feasibility of developing provisions within the planning systems to encourage the re-siting of housing and holiday developments which are vulnerable to cliff erosion. This will be initiated on completion of the research outlined in 5.5.3. (ACTION: DETR, DoE(NI), NAW, SE) |
| | | 5.1.4 | Where appropriate promote agri-environment schemes which encourage management and restoration of maritime grassland, heathland and other cliff-top habitats. (ACTION: CCW, DANI, MAFF, NAW, SE, SNH) |
| | | 5.2 | Site safeguard and management |
| | | 5.2.1 | By 2004 apply conservation designations to all remaining areas of maritime cliff and slopes which meet national or international criteria and ensure appropriate management of all designated sites. (ACTION: CCW, EHS, EN, SNH) |
| | | 5.2.2 | Encourage a presumption against stabilisation of any cliff face except where human life, or important natural or man-made assets, are at risk. (ACTION: DANI, DoE(NI), LAs, MAFF, NAW, SE) |

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| 5.2.3 | Where stabilisation of a cliff face is necessary (as defined in 5.2.2), ensure adequate mitigation and/or compensation to maintain the overall quantity and quality of maritime cliff and slopes habitat. (ACTION: CCW, DANI, DoE(NI), EHS, EN, LAs, MAFF, NAW, SE, SNH) | 5.5 | Monitoring and research |
| 5.2.4 | Encourage the increased use of soft (eg foreshore recharge) rather than hard engineering techniques where some degree of cliff stabilisation is essential. (ACTION: MAFF, DANI, DETR, DoE(NI), LAs, NAW, SE) | 5.5.1 | By 2003 commission a literature review and full survey of the maritime cliff and slope resource in the UK to assess its relative conservation value, how much can be improved by alternative management, and to what extent it is affected by coastal defence and engineering works. (ACTION: CCW, EHS, EN, JNCC, SNH) |
| 5.2.5 | Consider non-replacement of coastal cliff defences which have come to the end of their useful life. (ACTION: MAFF, DANI, DETR, DoE(NI), LAs, NAW, SE) | 5.5.2 | By 2003 commission a study to identify areas in the UK suitable for the re-creation of maritime grasslands and heathlands. (ACTION: CCW, EHS, EN, JNCC, SNH) |
| 5.2.6 | Promote the management of maritime grassland and heath habitats by scrub control and grazing where appropriate, through relevant agri-environment schemes and management agreements. (ACTION: CCW, DANI, EHS, EN, MAFF, NAW, SE, SNH) | 5.5.3 | By 2003 commission a study to identify possible coastal and sea defence strategies that may be more sympathetic to the nature conservation interests of maritime cliffs, and identify stretches of coastline where such sympathetic modifications are feasible. (ACTION: DoE(NI), EA, MAFF, NAW, SE) |
| 5.2.7 | Conduct operations to remove rats, cats or other introduced predators affecting breeding seabirds on maritime cliff and slope sites, identified by 'Seabird 2000' and other surveys. (ACTION: CCW, EHS, EN, SNH) | 5.5.4 | By 2003 implement a baseline study to determine the extent and quality of the maritime cliff and slope resource in the UK in order to enable the effective assessment of progress towards meeting the objectives of this plan. (ACTION: CCW, EHS, EN, JNCC, SNH) |
| 5.2.8 | Assess the impact of agricultural land drainage on maritime cliffs and slopes, especially in SACs, and carry out a review of the effectiveness of the current consents procedure. (ACTION: MAFF) | 5.5.5 | By 2003 complete an assessment of the maritime cliff sites in the UK where the native flora and fauna is being affected by introduced species. (ACTION: CCW, EHS, EN, SNH) |
| 5.3 | Advisory | 5.5.6 | Carry out an evaluation of cliff erosion and how its contribution to the marine sediment budget could be affecting other key habitats. (ACTION: MAFF) |
| 5.3.1 | Encourage by 2002 the adoption of policies and practices in the engineering management of soft cliffs which are sympathetic to the nature conservation interest, by preparing and disseminating 'best practice' guidance material. (ACTION: DANI, EA, MAFF, NAW, SE) | 5.5.7 | Carry out an assessment of how the conservation interest of maritime cliffs may be affected by climate change. (ACTION: CCW, EHS, EN, MAFF, SNH) |
| 5.3.2 | Encourage by 2002 appropriate habitat management of maritime cliff and slope habitats by preparing and disseminating 'best practice' guidance material. (ACTION: CCW, EHS, EN, SNH) | 5.5.8 | By 2003, in order to meet objective 4.3, develop an inventory of coastal defences that impact on maritime cliff and slope habitats and identify the most appropriate defences for removal. (ACTION: CCW, EA, EHS, EN, SNH) |
| 5.4 | International | 5.6 | Communications and publicity |
| 5.4.1 | Promote the exchange of information on maritime cliff ecology and management among European maritime states through the European Union for Coastal Conservation and Eurosite. (ACTION: CCW, EHS, EN, JNCC, SNH) | 5.6.1 | Raise public awareness of the mobile nature of soft cliffs and the value of maintaining unrestricted coastal processes. (ACTION: CCW, EHS, EN, SNH) |
| | | 5.6.2 | Promote awareness of the implications of the policies outlined in this plan among coastal Local Authorities, |

and ensure that the relevant details are incorporated into coastal zone management plans including Shoreline Management Plans. (ACTION: CCW, DETR, EHS, EN, MAFF, NAW, SE, SNH)

- 5.6.3** Raise public awareness of the potential damage that can be inflicted on the native flora and fauna of maritime cliffs by introduced species. (ACTION: CCW, EHS, EN, SNH)

6. Costings

- 6.1** The successful implementation of this habitat action plan will have resource implications for both the public and private sectors. The data in the table below provide an estimate of the current expenditure on the habitat, primarily through agri-environment schemes, and the likely additional resource costs to the public and private sectors. These additional resource costs are based on the annual average over 5 and 10 years. The total expenditure for these time periods is also given. Three-quarters of the additional resources are likely to fall to the public sector.

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Costings for maritime cliff and slopes

| | Current expenditure | 1st 5 yrs to 2004/2005 | Next 10 yrs to 2014/2015 |
|--|---------------------|------------------------|--------------------------|
| Current expenditure /£000/Yr | 416.8 | | |
| Total average annual cost /£000/Yr | | 330.1 | 596 |
| Total expenditure to 2005/£000 | | 1650.5 | |
| Total expenditure 2005 to 2014/£000 | | | 5960 |

Coastal sand dunes

Habitat Action Plan

1. Current status

1.1 Physical and biological status

1.1.1 Coastal sand dunes develop where there is an adequate supply of sand (sediment within the size range 0.2 to 2.0 mm) in the intertidal zone and where onshore winds are prevalent. The critical factor is the presence of a sufficiently large beach plain whose surface dries out between high tides. The dry sand is then blown landwards and deposited above high water mark, where it is trapped by specialised dune-building grasses which grow up through successive layers of deposited sand.

1.1.2 Sand dunes form in relatively exposed locations, and in a number of physiographic situations. The most common are **bay dunes**, where a limited sand supply is trapped between two headlands; **spit dunes**, which form as sandy promontories at the mouths of estuaries; and **hindshore dunes**, which occur in the most exposed locations where large quantities of sand are driven some distance inland, over a low-lying hinterland. This last type forms the largest dune systems in the UK. Less common types are: **ness dunes**, which build out from the coast; **dunes on offshore islands**, which are often superimposed on a base of other material such as shingle; **climbing dunes** where sand is blown up on to high ground adjacent to the beach; and **tombolos**, where a neck of sand is deposited between two islands or between a promontory and an island.

1.1.3 Sand dune vegetation forms a number of zones, which are related to the time elapsed since the sand was deposited, the degree of stability which it has attained, and the local hydrological conditions. **Embryonic and mobile dunes** occur mainly on the seaward side of a dune system where sand deposition is occurring and occasionally further inland in blow-outs. They support very few plant species, the most characteristic being marram grass *Ammophila arenaria*. **Semi-fixed dunes** occur where the rate of sand accretion has slowed but the surface is still predominantly bare sand; marram is still common but there is an increasing number of other species. **Fixed dune grassland** forms largely closed swards where accretion is no longer significant, the surface is stabilised and some soil development has taken place. Calcareous fixed dunes support a particularly wide range of plant species. On dunes which have become acidified by leaching, acid dune grassland or **dune heaths** develop. Dune heaths are usually dominated by heather *Calluna vulgaris*. Acidic dunes which are heavily grazed by rabbits may

support lichen communities. **Dune slack** vegetation occurs in wet depressions between dune ridges; it is often characterised by creeping willow *Salix repens* ssp *argentea* and a number of mosses. Fixed dunes and dune heath are particularly threatened habitats and are regarded as priorities under the EC Habitats Directive.

1.1.4 The fixed dune communities mentioned above are, or have been, maintained by grazing, whether by domestic stock or by rabbits. In their absence, the succession proceeds to rough grass and scrub. Dune scrub can include several species but only one of them, sea buckthorn *Hippophaë rhamnoides*, is largely confined to dunes; it is native to eastern England and south-east Scotland and has been widely introduced elsewhere, where its very invasive nature can cause problems. Wetter parts of dune systems may become colonised by willows *Salix* spp, birches *Betula* spp or alder *Alnus glutinosa*.

1.1.5 Sand dune communities vary geographically: lyme grass *Leymus arenarius* is increasingly common in northern Britain, growing alongside marram grass in mobile dunes; wild thyme *Thymus polytrichus* is characteristic of south-west England; and common juniper *Juniperus communis* occurs on dunes only in two locations, both in Scotland.

1.1.6 Dune grassland and dune slacks, especially on the more calcareous systems, support a wide variety of colourful flowering plants, including a number of species of orchid. Sand dune systems are also very rich in invertebrates, including butterflies, moths and burrowing bees and wasps.

1.1.7 The Sand Dune Survey of Great Britain (1993-1995) gives the total area of sand dunes as 11,897 ha in England and 8101 ha in Wales. The ongoing Sand Dune Vegetation Survey of Scotland indicates that there may be as much as 48,000 ha of dune and machair in Scotland, of which 33,000 ha is dune. There are approximately 3000 ha of dunes in Northern Ireland. Major dune systems are widely distributed within the UK, being found on all English coasts except the English Channel (other than Sandwich Bay) and the Thames Estuary. They occur on the north and south coasts of Wales and in the northern part of Cardigan Bay. In Scotland dunes are found on all coasts but are less frequent in the north-west and in Shetland; they are particularly extensive in the Western Isles and Inner Hebrides where they are associated with machair. In

Northern Ireland the largest dune systems are located along the north and south-east coasts.

1.2 Links with other action plans

1.2.1 The machair habitat action plan is closely related to this plan with regard to western Scotland, where the two habitats frequently occur adjacent to each other, and similar objectives apply to both. The lowland heathland action plan provides objectives and actions which are also relevant to heaths on sand dunes.

1.2.2 The following BAP priority species have significant populations on sand dunes:

Idaea ochrata cantiana Bright wave moth

Evagetes pectinipes a spider wasp

Cicindela hybrida a ground beetle

Panagaeus crux-major a ground beetle

Gentianella uliginosa Dune gentian

Liparis loeselii Fen orchid

Bryum mamillatum Dune thread moss

Bryum neodamense a moss

Bryum warneum a moss

Petalophyllum ralfsii Petalwort

2. Current factors affecting the habitat

2.1 Erosion and progradation. Unless artificially constrained, the seaward edges of sand dunes can be a highly mobile feature, though there is a natural trend to greater stability further inland. Very few dune systems are in overall equilibrium, and a majority of those in the UK demonstrate net erosion rather than net progradation; insufficient sand supply is frequently the underlying cause. There is no particular geographical distribution of either trend, both normally being present along any one stretch of coastline, and often within individual sites. Changes may be cyclical, both seasonally and over longer periods of time. Landward movement of mobile dunes often entails loss of fixed dune and dune heath habitat, as the latter are usually stable, or retreat may be impeded by development; in a few cases dune systems may move inland where not artificially constrained. The net loss of dune habitat in England to erosion has been estimated as not more than 2% of the resource over the next 20 years.

2.2 Falling water tables. Dune slacks support characteristic communities dependent on a seasonally high water table, including the formation of temporary or even permanent ponds. There may be considerable variation in the behaviour of the water table from year to year, resulting in a stressed ecosystem where only specialised species can survive. However in some dune

systems with important slacks, a long term fall in the water table has led to loss of the specialist slack flora and invasion by coarse vegetation and scrub. While unusually dry summers may have contributed to this problem, the long-term causes are believed to be local extraction of water and/or drainage of adjacent land used for agriculture or housing.

2.3 Grazing. In the absence of human interference, most stable dunes, with the exception of those experiencing severe exposure, would develop into scrub and woodland. The preponderance of grassland and heath vegetation on British dunes is due to a long history of grazing by livestock. Continued grazing is normally necessary to maintain the typical fixed dune communities, but over-grazing, particularly when combined with the provision of imported feedstuffs, can have damaging effects. A more widespread problem is under-grazing, leading to invasion by coarse grasses and scrub, though rabbits are locally effective in maintaining a short turf. Parts of some stabilised dune systems have been entirely converted to agricultural use, resulting in almost total loss of the conservation interest.

2.4 Recreation. Recreation is a major land use on sand dunes. Many dune systems are used extensively by holiday-makers, mostly on foot but also for parking cars and in some cases for driving four-wheel-drive vehicles or motorcycles. Moderate pressure by pedestrians may cause little damage, and may even help to counteract the effects of abandonment of grazing. However, excessive pedestrian use, as on routes between car parks and beaches, and vehicular use in particular, have caused unacceptable erosion on many dune sites. Many dune systems also support one or more golf courses. Here much of the original vegetation may be retained in the rough, but the communities of the fairways, and particularly the greens and tees, are often severely modified by mowing, fertilising and re-seeding. Fragmentation of dune systems by golf courses makes grazing management much more difficult.

2.5 Sea defence and stabilisation. Many dune systems are affected by sea defence works or artificial stabilisation measures such as sand fencing and marram planting. These practices are particularly prevalent on the more developed coastlines where drifting sand may be perceived as a threat to urban or holiday developments. While carefully applied dune management measures can help to counteract severe erosion which may threaten the existence of a dune, engineered defence systems usually reduce the biodiversity inherent in the natural dynamism of dune systems, and may cause sediment starvation down-drift. UK dunes as a whole suffer from over-stabilisation and poor representation of the mobile phases.

- 2.6 Beach management.** The seaward accretion of dune systems takes place through the accumulation of wind-blown sand caught by plants or debris along the driftline; the initial accumulations are colonised by pioneer plant species and form embryo dunes. On some heavily used beaches this process is inhibited by pressure of pedestrian or vehicular traffic, or by beach cleaning using mechanical methods, where the organic nuclei for sand deposition may be removed. These factors may remove the minor obstacles which would catch the sand initially, or destroy the embryo dunes at an early stage in their formation. In either case a dune system in a location where the physical conditions exist for accretion may actually be static or eroding.
- 2.7 Forestry.** Afforestation of dunes is not as prevalent in Britain as it is in parts of continental Europe, but in a few locations it has had a major effect on large areas of dune landscape. Some sites hold large conifer plantations which have the effect of suppressing the dune vegetation communities and lowering the water table. However, both routine fellings and permanent removal of conifers have shown that vegetation close to the original can be restored in a relatively short time.
- 2.8 Military use.** During the Second World War the majority of dune systems were used for the construction of defensive installations, for military training or both. The resultant widespread erosion had a severe effect on dune vegetation which has since been reversed by protective measures and natural recovery. A significant number of major dune systems, particularly in Scotland, are still used for military training, but fortunately most retain good dune habitat. Military use can be beneficial in restricting other activities or developments.
- 2.9 Ownership.** A substantial proportion of the UK coast is in the ownership of Government Departments/Agencies or voluntary conservation bodies, though the degree of influence over management is variable due to legal complexities.
- 2.10 Other human influences.** Sand dunes have also been affected in the past by housing developments, industrial development, waste tips on or adjacent to them, fly tipping and sand extraction. Indirect effects on dunes include atmospheric nutrient deposition, and coastal squeeze due to rising sea levels and increased storminess. The potential for dredging and marine aggregate extraction, through the disruption of coastal processes, to have cumulative and long-term effects on sand dunes is an area for further investigation.
- 3. Current action**
- 3.1 Legal status**
- 3.1.1** A large proportion of the sand dune resource in the UK is designated as SSSI, or ASSI in Northern Ireland. Of 121 sites in England surveyed between 1987 and 1990, 56 were wholly or almost wholly designated, and another 23 were partly designated. In a partial survey of Scottish dunes, 24 of the 34 sites surveyed were designated as SSSI. In Wales, 24 of the 49 sites surveyed were designated as SSSI. In Northern Ireland 10 of the 26 sites surveyed were designated as ASSIs with a further 4 sites as pASSIs. Twenty one sites in the UK have been selected as candidate SACs under the EC Habitats Directive for their sand dune features.
- 3.2 Management, research and guidance**
- 3.2.1** The UK Government has set out its commitment to sustainable management of the coast in a number of publications. These include DETR's *Policy Guidelines for the Coast and Planning Policy Guidance - Coastal Planning* (PPG 20), SO's *Coastal Planning* (NPPG 13), and WO's *Coastal Planning* (Technical Advice Note 14). DoE(NI)'s *Planning Strategy for Rural Northern Ireland* has provisions relating to development, access and conservation of the coast. MAFF and NAW have also produced a *Strategy for Flood and Coastal Defence in England and Wales* and DETR has produced *Coastal Zone Management - Towards Best Practice*. Shoreline Management Plans, which have so far been compiled for only part of the UK, are likely to play an increasingly important role in the future management of soft coasts.
- 3.2.2** DETR's Coastal Forum was set up in 1994; similar fora have recently been initiated in Scotland and Wales, and one is expected shortly in Northern Ireland. The country nature conservation agencies have their own coastal fora or initiatives (Estuaries Initiative, England, and Focus on Firths, Scotland). In Wales a partnership of coastal practitioners (Afordir) has been established. More general countryside management initiatives offer sand dune management options. Between 1993 (when separate records for sand dunes began) and the end of 1998, 397 ha were entered into Countryside Stewardship in England.
- 3.2.3** The EU LIFE programme *Implementing strategies in Irish beach and dune management: involvement in sustainable coastal development* forms part of the EU demonstration programme on integrated coastal zone management.

- 3.2.4** Many NNRs, SSSIs and ASSIs with fixed dune vegetation are managed by grazing with domestic livestock. Prominent examples include the Sefton Coast and Sandscale Haws in England, Tentsmuir in Fife, Newborough in Wales and Murlough Dunes in Northern Ireland. Many of the larger and/or more heavily visited dune sites are managed as nature reserves or country parks, or fall within designated Heritage Coasts; such sites usually have the benefit of a warden/ranger service providing positive conservation management such as scrub control, control of damaging activities and interpretive and educational services. Many sand dune sites benefit from protective ownership by NGOs, such as the National Trust. CCW has initiated a draft Site Management Framework in order to rationalise sand dune management on a country-wide basis. There have been recent initiatives to encourage management of golf courses on sand dunes in a way that is sympathetic to the conservation interest. A major dune management initiative financed by the EU LIFE project is currently under way on the Sefton Coast.
- 3.2.5** The networks of the European Union for Coastal Conservation and Eurosite have helped to promote a number of international conferences and field meetings on dune management in recent years, resulting in valuable exchanges of views and experience among dune managers from maritime nations. The European Golf Association Ecology Unit has promoted sympathetic management of dune golf links.
- 3.2.6** The Sand Dune Survey of Great Britain was initiated in 1987 and provides information on the vegetation and current management of all significant dune systems. Full results have been published for England and Wales, while the Scottish survey is currently being completed and final results will be published in 2000.
- 4. Action plan objectives and proposed targets**
- 4.1** Protect the existing sand dune resource of about 54,500 ha from further losses to anthropogenic factors, whether caused directly or indirectly (eg by sea defence schemes affecting coastal processes).
- 4.2** Offset the expected net losses due to natural causes of about 2% of the dune habitat resource over 20 years by encouraging new dunes to accrete and where possible by allowing mobile dune systems to move inland.
- 4.3** Seek opportunities for restoration of sand dune habitat lost to forestry, agriculture or other human uses. A target figure of up to 1000 ha to be reinstated by 2010 (to be reviewed as a result of the inventory proposed in 5.5.1) is suggested.
- 4.4** Encourage natural movement and development of dune systems, and control natural succession to scrub and woodland where necessary.
- 4.5** Maintain dune grassland, heath and lichen communities on the majority of dune systems; Atlantic dune woodland should be created on up to five carefully selected sites.
- 5. Proposed action with lead agencies**
- 5.1 Policy and legislation**
- 5.1.1** Develop and promote planning policies and procedures which will aim to prevent further losses of sand dune habitat to development and exploitation and minimise them where they are unavoidable. (ACTION: DETR, DoE(NI), NAW, SE)
- 5.1.2** Develop and promote agri-environment schemes which will encourage restoration and sustainable management of dune habitats. (ACTION: CCW, DANI, MAFF, NAW, SE)
- 5.1.3** Develop and promote incentives to encourage the management and restoration of landward transitional dune habitats and where appropriate to allow landward movement of dunes, especially where there are seaward losses due to sea level rise. (ACTION: DETR, DoE(NI), MAFF, NAW, SE)
- 5.1.4** Develop and promote coastal zone management policies which allow the maximum possible free movement of coastal sediment and pay full regard to the conservation of sand dunes. Include in Shoreline Management Plans where they have a role to play in flood defence. (ACTION: DETR, DoENI, MAFF, NAW, SE)
- 5.2 Site safeguard and management**
- 5.2.1** Notify by 2004 any remaining areas of sand dune habitat which meet national criteria as SSSI and ASSI and ensure appropriate management of designated sites. (ACTION: CCW, EHS, EN, SNH)

- 5.2.2** Use positive management agreements where appropriate to encourage sustainable grazing of sand dune SSSIs and ASSIs, and other dunes where possible. (ACTION: CCW, DANI, EHS, EN, MAFF, NAW, SE, SNH)
- 5.2.3** Encourage golf course management policies and practices which are sympathetic to the flora and fauna of sand dune systems. (ACTION: CCW, EHS, EN, SNH)
- 5.2.4** Promote and encourage the restoration of open dune vegetation on afforested dune systems. (ACTION: CCW, EN, FA, FE, SNH)
- 5.2.5** Promote and encourage the restoration of dune vegetation on dune systems used for arable farming or agriculturally improved grassland. (ACTION: CCW, DANI, EHS, EN, MAFF, NAW, SE, SNH)
- 5.2.6** Monitor and regulate water abstraction and land drainage schemes which might affect water tables in sand dune systems, and promote remedial action where necessary. (ACTION: EA, DANI, MAFF, NAW, SE)
- 5.2.7** Discourage unnecessary stabilisation of all dunes, and where appropriate promote managed destabilisation measures on over-stabilised dunes. (ACTION: CCW, EHS, EN, SNH)
- 5.2.8** Support beach management strategies which encourage the protection of the seaward fronts of dune systems from unsustainable pressure by pedestrian or vehicular traffic, and discourage the use of mechanical beach cleaning close to dune fronts. (ACTION: CCW, EHS, EN, LAs, SNH)
- 5.3 Advisory**
- 5.3.1** Where appropriate, promote and develop demonstration sites for the restoration of dune vegetation on dune systems which have been converted to forestry or agriculture. (ACTION: CCW, DANI, EHS, EN, FA, FE, MAFF, NAW, SE, SNH)
- 5.3.2** Encourage the appropriate management of sand dunes by preparing and disseminating updated guidance material. (ACTION: CCW, EHS, EN, SNH)
- 5.3.3** Ensure all relevant agri-environment project officers and members of regional agri-environment conservation groups are advised of the location of existing examples of this habitat, its importance and the management requirements for its conservation. (ACTION: DANI, MAFF, NAW, SE)
- 5.3.4** Make use of the potential provided by existing estuary management partnerships in taking forward the actions of this plan (CCW, DETR, EA, EN, LAs, MAFF, SNH)
- 5.4 International**
- 5.4.1** Promote the exchange of information on sand dune ecology and management among European maritime states through organisations such as the European Union for Coastal Conservation and Eurosite. (ACTION: CCW, EHS, EN, JNCC, SNH)
- 5.4.2** Ensure lessons from EU LIFE projects are widely disseminated and incorporated into good practice. (ACTION: CCW, JNCC, EN, Sefton Coast LIFE Project)
- 5.5 Monitoring and research**
- 5.5.1** Compile by 2002 an inventory of the desirability, feasibility and priority of sites for sand dune restoration from forestry and agriculture, and for the development of Atlantic woodland. (ACTION: CCW, EHS, EN, SNH)
- 5.5.2** Identify suitable locations and methods for dune activation (ACTION: CCW, EN, SNH)
- 5.5.3** Co-ordinate information on changes in the extent and quality of the sand dune resource in the UK in order to enable effective monitoring of the objectives of this plan. (ACTION: CCW, EHS, EN, JNCC, SNH)
- 5.5.4** Continue research into the use of remote sensing for monitoring soft coast habitats. (ACTION: EA)
- 5.5.5** Promote research into the causes of falling water tables in sand dune systems. (ACTION: EA)
- 5.5.6** Promote research on the effects on sand dunes of indirect influences such as nitrogen deposition, climate change and sea level rise. (ACTION: CCW, EHS, EN, SNH)
- 5.6 Communications and publicity**
- 5.6.1** Raise public awareness of the essential mobility of soft coasts and the value of maintaining unrestricted coastal processes. (ACTION: CCW, EHS, EN, SNH)

5.6.2 Promote awareness of the implications of the policies outlined in this plan among decision-makers. (ACTION: DETR, DoE(NI), MAFF, NAW, SE)

6. Costings

6.1 The successful implementation of this habitat action plan will have resource implications for both the public and private sectors. The data in the table below provide an estimate of the current expenditure on the habitat, primarily through agri-environment schemes, and the likely additional resource costs to the public and private sectors. These additional resource costs are based on the annual average over 5 and 10 years. The total expenditure for these time periods is also given. Three-quarters of the additional resources are likely to fall to the public sector.

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Costings for coastal sand dunes

| | Current expenditure | 1st 5 yrs to 2004/2005 | Next 10 yrs to 2014/2015 |
|--|---------------------|------------------------|--------------------------|
| Current expenditure /£000/Yr | 19.5 | | |
| Total average annual cost /£000/Yr | | 196 | 410.1 |
| Total expenditure to 2005/£000 | | 980 | |
| Total expenditure 2005 to 2014/£000 | | | 4100.6 |

Machair

Habitat Action Plan

- | | |
|--|---|
| <p>1. Current status</p> <p>1.1 Physical and biological status</p> <p>1.1.1 Machair is a distinctive type of coastal grassland found in the north and west of Scotland, and in western Ireland. It is associated with calcareous sand, blown inland by very strong prevailing winds from beaches and mobile dunes. The Gaelic word <i>Machair</i> is the only name for this major habitat type in Britain.</p> <p>1.1.2 In its strict sense, ‘machair’ refers to a relatively flat and low lying sand plain formed by dry and wet (seasonally waterlogged) short-turf grasslands above impermeable bedrock, a habitat termed ‘machair grassland’. However, <i>machair</i> can also cover the beach zone, mobile and semi-fixed foredunes, dune slacks, fens, swamps, lochs (some of them brackish), saltmarsh, and sand blanketing adjacent hillslopes, together forming the ‘machair system’. It is also often associated with an inland transition to heath and mire termed ‘blackland’ which can include sand-affected peatland. Though this action plan principally addresses the machair grassland, this is an integral part of the wider machair system so the plan must consider the former in the context of the latter.</p> <p>1.1.3 It is estimated that ‘machair grassland’ is restricted to about 25,000 ha in world-wide extent, with 17,500 ha in Scotland and the remainder in western Ireland, so that world distribution is very restricted. The largest extents in Scotland are in the Western Isles (10,000 ha, mainly in the Uists), Tiree and Coll (4000 ha), Orkney (2300 ha) western Scottish mainland (1000 ha) and Shetland (180 ha). The full (global) geographical extent of the wider ‘machair systems’ is believed to be in the region of 40,000 ha, with some 30,000 ha in Scotland and 10,000 ha in Ireland.</p> <p>1.1.4 Machair grassland plains are complex features in terms of origin, development, processes, local habitat types and management. They are formed from sand blown inland following the periodic breakdown of foredunes above the beach and contain a mosaic of wet and dry grassland communities. These are related to grazing and tillage history superimposed upon gradients of surface stabilisation, soil acidity, and salinity which are controlled by local sand blow, water-table fluctuation and micro-topography, giving rise to highly complex habitat mosaics. Some plant communities are largely restricted to western and northern Scotland.</p> | <p>1.1.5 Machair has a very long history of management by local communities over several millennia. In recent times this has involved a mix of seasonal extensive grazing (mainly by cattle, with pastures rested in the summer) and low-input low-output rotational cropping based on potatoes, oats and rye. A very small area of beer barley is also cultivated. This traditional mixed management sustains varied dune, fallow and arable weed communities which offer in some areas superb displays of flowering colour across wide expanses of unfenced land in summer. The periodic ground disturbance and seasonal absence of stock supports very important breeding wader populations. The wider machair system has a rich invertebrate fauna. This traditional agriculture is associated mainly with the Uists and Tiree; outside these areas there has been a marked decline in such land management with a corresponding decline in wildlife.</p> <p>1.1.6 No plant sub-communities of the National Vegetation Classification are confined to machair, but the two most indicative are the <i>Festuca rubra-Galium verum</i> fixed dune grassland, <i>Ranunculus acris-Bellis perennis</i> sub-community of dry machair (SD8d) and the <i>Festuca rubra-Galium verum</i> grassland, <i>Prunella vulgaris</i> sub-community of wet machair (SD8e).</p> <p>1.1.7 Few rare plant species are largely restricted to machair systems. Exceptions are the slender naiad <i>Najas flexilis</i> which is strongly associated with machair lochs, some pondweeds, <i>Potamogeton</i> spp and their hybrids, and the endemic orchid <i>Dactylorhiza majalis scotica</i>. This environment is more important as one of the last areas in Britain supporting old field successions, some of which are a century or more old. The great complexity and diversity of habitats and plant communities within machair systems is also a special feature. Two nationally scarce birds, corncrake <i>Crex crex</i> (which is globally threatened) and corn bunting <i>Miliaria calandra</i>, are noted birds of machair systems. The machair breeding wader populations of the Uists, Tiree and Coll are claimed as the most important in the north-west Palaearctic. Notable invertebrates include the belted beauty moth <i>Lycia zonaria</i>, and the northern colletes <i>Colletes floralis</i>.</p> <p>1.1.8 There is a very strong association between traditional land use andcrofting communities. Machair is a living, cultural landscape and much of its conservation value is dependent on the maintenance of viable crofting agriculture based on low-input shifting cultivation. Machair is highly susceptible to agricultural modification</p> |
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| | and is particularly sensitive to changes in grazing, sand and shingle extraction, and recreational impact. | 2.7 | Coastline retreat due to rising sea levels and possibly increasing storminess, produces extensive slow erosion of the outer dune or machair grassland edge which can be accelerated by stock damage. |
| 1.2 | Links with other action plans | | |
| 1.2.1 | Machair grassland is an integral part of a wider machair system comprising sand dunes, saltmarsh, coastal lagoons, open waters and marshes, and the action plans for these related habitats should be considered when planning management. A degree of sand movement is essential to maintenance of the machair habitat. | 2.8 | Sand extraction from internal dunes and machair disrupts habitat zonations and water-table relationships. |
| 1.2.2 | The following BAP priority species have significant populations on machair: <i>Alauda arvensis</i> Skylark <i>Crex crex</i> Corncrake <i>Miliaria calandra</i> Corn bunting <i>Protopion ryei</i> a beetle <i>Bombus distinguendus</i> Great yellow bumble bee <i>Colletes floralis</i> Northern colletes <i>Najas flexilis</i> Slender naiad <i>Potamogeton rutilus</i> Shetland pondweed | 2.9 | Sand and shingle extraction from the beach zone increases the rate of coastal retreat of the dune edge and reduces available sand for blowing inland. |
| | | 2.10 | Poor recreational management, especially in some areas used for caravanning and camping, initiates erosion and accelerates coastal edge retreat and grassland sward change. |
| 2. | Current factors affecting the habitat | 3. | Current action |
| 2.1 | Earlier cutting of grass for silage rather than hay reduces seeding by flowering plants and destroys the nests of characteristic birds such as the corncrake. | 3.1 | Legal status |
| 2.2 | 'Improvement' of machair grassland by re-seeding, drainage and stock feeding, can reduce sward species diversity as well as habitat diversity over a wider area. | 3.1.1 | Approximately 80% of the Scottish machair area is notified as SSSI and some 50% is notified as or may become Special Protection Area (SPA) under the EC Birds Directive. 'Machair' is listed as a habitat type in Annex 1 of the EC Habitats Directive and 16 SSSIs fall within proposed machair Special Areas of Conservation (SACs), amounting to about half the area of the habitat, and overlapping substantially with SPAs. A few SSSIs are designated as Wetlands of International Importance under the Ramsar Convention, comprising perhaps 5% of the area of the habitat. One site is a Man and Biosphere Reserve. Three sites are managed as NNRs by SNH with further machair in RSPB reserves. The coastal edge of much machair in the Uists is protected as Geological Conservation Review sites, indicating its geomorphological importance. |
| 2.3 | Social changes in crofting, resulting in heavy all-year grazing of machair grasslands as part of a switch from arable to stock grazing, and from cattle to sheep as predominant stock, reduces sward species diversity and the ability of plants to flower, set seed and provide cover for breeding birds. | 3.1.2 | The proportion of protected machair in Scotland is unknown because total machair extent is uncertain. In the Western Isles recent survey shows 4770 ha of designated dune and machair habitat which is 46% of the vegetated blown sand resource (excluding machair loch area). |
| 2.4 | Under-grazing and poor management of seasonal grazing allows rank, weedy and species-poor grassland to develop. | 3.1.3 | Much of the machair area in Scotland is crofted land, enjoying unique forms of management and land tenure since the passing of the Crofting Act of 1886 and subsequent legislation, consolidated under the Crofters (Scotland) Act 1993. Habitat management proposals for conservation must be tailored to crofting requirements to be successful, especially since much of |
| 2.5 | Predation of breeding birds by introduced species (feral mink and feral ferret/polecat in Lewis and Harris, hedgehog and feral ferrets in the Uists). | | |
| 2.6 | Stock-induced erosion due to access to foredunes and beach, creates blow-outs in outer dune crests, on steep slopes, and around areas used for shelter. | | |

the natural heritage interest is dependent on crofting practices.

3.1.4 Commercial extraction of sand from machair is now under planning control, but sand extraction for agricultural use (including the croft house) is 'permitted development' and does not require planning permission, and in some of the more densely populated crofting areas there may be extensive unregulated sand extraction.

3.1.5 Environmental Impact Assessment is a statutory requirement for certain proposed developments where there is likely to be a significant effect on the environment.

3.2 Management, research and guidance

3.2.1 The largest conservation initiative has been under ESA schemes for the Uists, Benbecula, Barra and Vatersay, and the Argyll Islands. Further environmental work is included under the SOAEFD/Objective One Agricultural Business Improvement Scheme. SSSI management agreements are important in most of the best machair areas. Machair outside ESAs may now benefit from the introduction in 1997 of the Countryside Premium Scheme to Scotland.

3.2.2 In 1992 RSPB joined with SNH and the Scottish Crofters Union to set up and administer a Corncrake Initiative which now operates throughout the range of the bird in Scotland, providing financial incentives to delay mowing of meadows containing corncrakes, some of which are on the machair. Incentives are also provided in some areas to encourage early cover.

3.2.3 SSSI and ESA management agreements are used to regulate grazing, sometimes attempting to reduce stocking levels, though this is complicated by rabbits. In some cases, as on some offshore islands, management agreements may be required to ensure that grazing does not cease.

3.2.4 More comprehensive work on machair problems is lacking and there has been a notable lack of applied research on land management. Recent Western Isles initiatives including surveys of environmental archaeology, vegetation and coastal erosion, have started to address this problem.

3.2.5 The Scottish Office has set out its commitment to sustainable management of the coast in its National Planning Policy Guideline 13, *Coastal Planning*.

4. Action plan objectives and proposed targets

The targets set in this plan are judgements based on current but incomplete information.

4.1 Maintain existing extent of machair.

4.2 Restore improved machair grassland to traditional mixed management with no over-grazing. Aim to reduce improved grassland extent by 30% by 2010, with concomitant reductions in stocking levels to avoid over-grazing of machair.

4.3 Promote increased use of cattle as principal stock as part of new practices.

4.4 Apply appropriate remedial methods to 50% of sites currently suffering severe over-grazing by 2005 and 100% by 2010.

4.5 Restore machair habitat and management to large sites degraded by sand extraction in the Western Isles and Orkney by 2010 (for sites with exhausted sand reserves or no further planning permission).

4.6 Restore areas previously cultivated by traditional methods to rotational cultivation in association with cattle production, increasing cultivated area by 20% by 2005.

5. Proposed action with lead agencies

5.1 Policy and legislation

5.1.1 By 2000 (but following the wider evaluation of ESA schemes) evaluate the success of current ESA and other schemes covering machair in maintaining nature conservation interest and assess the need for modifications to measures and payments. (ACTION: SE)

5.1.2 Evaluate the implications of agricultural policies in Less Favoured Areas for machair management and change as appropriate. (ACTION: SE)

5.1.3 Take account of the conservation requirements of machair in developing and adjusting agri-environment schemes. (ACTION: SE)

5.1.4 Promote and develop agri-environment incentive schemes to benefit machair, to enable the targets for management and habitat improvement to be met. (ACTION: LAs, SE, SNH)

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| 5.1.5 | Encourage the adoption of policies in local and regional plans, including coastal zone management strategies and Shoreline Management Plans, which promote the conservation of machair and support sensitive husbandry by the owners and managers of machair land. (ACTION: LAs, SE) | 5.3.2 | Encourage the establishment of strategically located management demonstration projects, including Local Nature Reserves. (ACTION: LAs, SNH) |
| 5.1.6 | Support local initiatives to produce audits of machair condition and conservation development plans by 2010. (ACTION: Crofters Commission (CC), LAs) | 5.3.3 | Encourage the modification of management of existing nature reserves for demonstration purposes. (ACTION: LAs, SNH) |
| 5.1.7 | Monitor the impacts of introduced predators on native machair species. (ACTION: SE, SNH) | 5.3.4 | Initiate and encourage participation in training courses appropriate to the management of machair. (ACTION: SE, SNH) |
| 5.2 | Site safeguard and management | 5.3.5 | Create a Machair Working Group to review best management practices, machair restoration and associated advisory literature. (ACTION: CC, LAs, SE, SNH) |
| 5.2.1 | Designate those machair sites that qualify as Special Protection Areas or Special Areas for Conservation by 2004. (ACTION: JNCC, SE, SNH) | 5.3.6 | Establish good practice guidelines for recreational management, including restoration of current damage and development of new sites. Aim to improve recreational management of machair in at least five demonstration sites currently suffering major damage by 2010. (ACTION: SNH) |
| 5.2.2 | Review the extent of SSSI coverage by 2002 and consider notifying further sites as necessary to fill significant gaps in the range of machair habitat types. (ACTION: SNH) | 5.3.7 | Ensure all relevant SE staff and advisers involved in delivering agri-environment schemes are informed of the location of existing examples of this habitat, its importance and the management requirements for its conservation. (ACTION: SNH) |
| 5.2.3 | Promote the uptake of agri-environment measures and management agreements with owners and occupiers of machair. (ACTION: SE, SNH) | 5.4 | International |
| 5.2.4 | Encourage stock owners on crofting common grazings to co-operate in a review of grazing management and implementation of changes to improve the natural heritage interest. (ACTION: CC, SAC, SE, SNH) | 5.4.1 | Encourage comparison of surveys in Scotland and the Republic of Ireland to determine the extent and status of machair so that the international status of the habitat may be fully determined. (ACTION: JNCC, SNH) |
| 5.2.5 | Implement management measures to control introduced predators where appropriate. (ACTION: SE, SNH) | 5.4.2 | Initiate a comprehensive review of machair habitat, management and conservation in Europe. (ACTION: JNCC, SNH) |
| 5.2.6 | Develop a range of stock grazing practices designed to improve plant, bird and invertebrate diversity. (ACTION: SE, SNH) | 5.4.3 | Support the networking of management techniques, conservation strategies and applied research relating to machair environments. (ACTION: JNCC, SNH) |
| 5.2.7 | Develop demonstration schemes aimed at meeting the objectives identified in 4.2 and 4.3 by 2005. (ACTION: SE, SNH) | 5.5 | Monitoring and research |
| 5.3 | Advisory | 5.5.1 | Clarify the extent, distribution, composition, recent history and status of machair habitats in Scotland through analysis of existing data and further systematic survey work, as necessary to enable effective monitoring of the objectives of this plan. (ACTION: SNH) |
| 5.3.1 | Support and encourage local initiatives to provide advisory booklets, information and other services to owners and managers of machair, including advice on recreational management. Particular attention should be given to information appropriate for crofting, the most important form of machair management. (ACTION: LAs, SE, SNH) | | |

- 5.5.2** Support research into the best ways of integrating agriculture (using crop and stock data at the individual croft and field scale), other herbivores (especially rabbits, geese and deer) and nature conservation on machair for effective conservation management. (ACTION: DCS, SE, SNH)
- 5.5.3** Support research into socio-economic aspects of machair to support crofting communities. (ACTION: SE, SNH)
- 5.5.4** Support research into optimal methods of restoring diversity of the species and communities to 'improved' machair grassland, including grazing management, nutrient stripping techniques and seed-bank manipulation. (ACTION: SE, SNH)
- 5.5.5** Support research into methods of monitoring the conservation quality of major machair habitats based on plant, bird and invertebrate attributes, applying results to sites used for best practice demonstrations, improved management and habitat restoration. (ACTION: JNCC, SE, SNH)
- 5.5.6** Support research into the sediment budget of machair systems, the likely changes in coastal erosion and accretion to result from sea level rise, and the implications of environmental change for machair habitats and their crofting communities to 2050. (ACTION: JNCC, SNH)
- 5.5.7** Monitor restoration of areas with a history of machair erosion, both from excessive grazing and recreational damage. (ACTION: SE, SNH)
- 5.5.8** Evaluate the threat of coastal erosion to machair habitat and management in at least three strategically important sites by 2002. (ACTION: SNH)
- 5.5.9** Implement stock control measures and dune stabilisation in at least 20 sites by 2010 to reduce the role of stock in accelerating the rate of machair retreat. (ACTION SE, SNH)
- 5.6 Communications and publicity**
- 5.6.1** Encourage the making of a documentary and publication of populist articles on the wildlife and management of machair to foster public appreciation of the habitat. These should focus on the interdependence of landscape, wildlife and the crofting/farming communities managing the land. (ACTION: JNCC, SNH)

6. Costings

- 6.1** The successful implementation of this habitat action plan will have resource implications for both the public and private sectors. The data in the table overleaf provide an estimate of the current expenditure on the habitat, primarily through agri-environment schemes, and the likely additional resource costs to the public and private sectors. These additional resource costs are based on the annual average over 5 and 10 years. The total expenditure for these time periods is also given. Three-quarters of the additional resources are likely to fall to the public sector.

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Costings for machair

| | Current expenditure | 1st 5 yrs to 2004/2005 | Next 10 yrs to 2014/2015 |
|--|---------------------|------------------------|--------------------------|
| Current expenditure /£000/Yr | 127.6 | | |
| Total average annual cost /£000/Yr | | 200.8 | 354.8 |
| Total expenditure to 2005/£000 | | 1004 | |
| Total expenditure 2005 to 2014/£000 | | | 3548 |

Coastal vegetated shingle

Habitat Action Plan

1. Current status

1.1 Physical and biological status

1.1.1 Shingle is defined as sediment with particle sizes in the range 2-200 mm. It is a globally restricted coastal sediment type with few occurrences outside north-west Europe, Japan and New Zealand. Shingle beaches are widely distributed round the coast of the UK, where they develop in high energy environments. In England and Wales it is estimated that 30% of the coastline is fringed by shingle. However most of this length consists of simple fringing beaches within the reach of storm waves, where the shingle remains mobile and vegetation is restricted to temporary and mobile strandline communities.

1.1.2 Shingle structures take the form either of spits, barriers or barrier islands formed by longshore drift, or of cusped forelands where a series of parallel ridges piles up against the coastline. Some shingle bars formed in early post-glacial times are now partly covered by sand dunes as a result of rising sea levels leading to increased deposition of sand.

1.1.3 The origin of coastal shingle varies according to location. In southern England, much of it is composed of flint eroded out of chalk cliffs. Shingle deposits of Ice Age origin lying on the sea bed may be reworked by wave action and redeposited or moved by longshore drift along the coast. In northern and western Britain, shingle may derive from deposits transported to the coast by rivers or glacial outwash. Shingle structures are of geomorphological interest.

1.1.4 The vegetation communities of shingle features depend on the amount of finer materials mixed in with the shingle, and on the hydrological regime. The classic pioneer species on the seaward edge include sea kale *Crambe maritima*, sea pea, *Lathyrus japonicus*, Babington's orache, *Atriplex glabriuscula*, sea beet, *Beta vulgaris*, and sea campion *Silene uniflora*; such species can withstand exposure to salt spray and some degree of burial or erosion. Further from the shore, where conditions are more stable, more mixed communities develop, leading to mature grassland, lowland heath, moss and lichen communities, or even scrub. Some of these communities appear to be specific to shingle, and some are only known from Dungeness. On the parallel ridges of cusped forelands, patterned vegetation develops, due to the differing particle size and hydrology. Some shingle sites contain natural hollows which develop wetland communities, and similar vegetation may develop as a result of gravel extraction.

1.1.5 Shingle structures may support breeding birds including gulls, waders and terns. Diverse invertebrate communities are found on coastal shingle, with some species restricted to shingle habitats.

1.1.6 Shingle structures sufficiently stable to support perennial vegetation are a comparatively rare feature even in the UK. The major vegetated shingle structures surveyed in 1987-1991 by Sneddon and Randall totalled some 5000 ha in England, 700 ha in Scotland and 100 ha in Wales. Dungeness, in southern England, is by far the largest site, with over 2000 ha of shingle, and there are only five other structures over 100 ha in extent in the UK. The main concentrations of vegetated shingle occur in East Anglia and on the English Channel coast, in north-east Scotland, and in north-west England and south-west Scotland. The Welsh coast has a number of small sites. This habitat is poorly represented in Northern Ireland, where the key site is Ballyquintin in County Down.

1.2 Links with species action plans

1.2.1 The following BAP priority species have significant populations on vegetated shingle sites: toadflax brocade *Calophasia lunula*, white spot *Hadena albimacula*, stinking hawk's-beard *Crepis foetida*, small-flowered catchfly *Silene gallica*, endemic sea lavenders *Limonium* spp, red hemp-nettle *Galeopsis angustifolia*, brown-banded carder bee *Bombus humilis*, large garden bumble bee *Bombus rudersatus*, short haired bumble bee *Bombus subterraneus*, and the hopper *Aphrodes duffieldi*. Wetlands within shingle sites are also important for the following species: medicinal leech *Hirudo medicinalis*, and great crested newt *Triturus cristatus*.

2. Current factors affecting the habitat

2.1 **Sediment supply.** The health and ongoing development of a shingle feature depend on a continuing supply of shingle. This may occur sporadically as a response to storm events rather than continuously. It is frequently lacking owing to interruption of coastal processes by coast defence structures, by offshore aggregate extraction or by artificial redistribution of material within the site (eg Dungeness). Attempts have been made to rectify the situation by mechanical reprofiling, which is likely to fail in the long run because it does not address the lack of new material, or by beach recharge.

2.2 **Natural mobility.** Shingle features are rarely stable in the long term. Many structures exhibit continuous

longshore drift, and ridges lying parallel to the shoreline tend to be rolled over towards the land by wave action in storm events. This movement has a knock-on effect on low-lying habitats behind the shingle. Movement is likely to be accelerated by climate change resulting in sea level rise and increased storminess.

2.3 Exploitation. Shingle structures have been regarded as a convenient source of aggregates, and have been subject to varying degrees of extraction resulting in severe alteration of morphology and vegetation (eg Dungeness and Spey Bay) or almost total destruction of major parts of the feature (eg Rye Harbour). Industrial plant, defence infrastructure and even housing have been built on shingle structures (eg Dungeness, Orfordness, Spey Bay), destroying vegetation and ridge morphology. At Dungeness water is abstracted from the groundwater system; there is some evidence of drought stress on the vegetation, but it is difficult to distinguish the effects of water abstraction from those of gravel extraction.

2.4 Access. Shingle vegetation is fragile; the wear and tear caused by access on foot, and particularly by vehicles, has damaged many sites. The causes include military use, vehicle access to beaches by fishermen, and recreational use. Such disturbance can also affect breeding birds.

2.5 Grazing. In a few cases areas of shingle were traditionally grazed, but this management has now largely ceased, leading to domination by willow carr on wetlands and changes to vegetation structure. The impacts of removal of grazing on breeding birds and other shingle species are not fully understood.

3. Current action

3.1 Legal status

3.1.1 Vegetated shingle is a rare habitat; all major examples and many minor ones have therefore been notified as SSSIs or ASSIs. Many are also declared as NNRs or LNRs, or are owned by voluntary conservation bodies. Vegetated shingle is listed as a habitat type under Annex I of the EC Habitats Directive ('Perennial vegetation of stony banks'), and five sites in England and two in Scotland are proposed as SACs. Three of the former have also been submitted or classified as SPAs under the EC Birds Directive.

3.2 Management, research and guidance

3.2.1 Shingle sites which are reserves and/or hold designations receive some protection from further damage, but many of them have been damaged in the past, and there is little positive management of the habitat. It is often impossible to control recreational use

by third parties. The main exception is Orfordness, which was acquired by the National Trust in 1993 and is a candidate SAC. Here, EU LIFE funding has been obtained for rehabilitation of the site and experimental re-creation of the ridge system, and public access is being controlled. The management plan for the MoD's holding on Dungeness proposes positive measures for the re-establishment of vegetation.

3.2.2 A survey of the major vegetated shingle structures of Great Britain was commissioned by NCC in 1987. The results were published by JNCC in 1993 and 1994, and comprise a new classification of shingle vegetation and descriptions of all major and many minor vegetated shingle sites.

3.2.3 The UK Government has set out its commitment to sustainable management of the coast in a number of publications. These include DETR's (formerly DoE) *Policy Guidelines for the Coast and Planning Policy Guidance - Coastal Planning* (PPG 20), and SO's *Coastal Planning* (NPPG 13). A *Coastal Planning Technical Advice Note* has been prepared for Wales. DoE(NI)'s *Planning Strategy for Rural Northern Ireland* has provisions relating to development, access and conservation of the coast. MAFF and the Welsh Office have also produced a *Strategy for Flood and Coastal Defence in England and Wales* and DETR has produced *Coastal Zone Management - Towards Best Practice*. DETR's Coastal Forum was set up in 1994; similar fora have recently been initiated in Scotland and Wales, and one is expected shortly in Northern Ireland.

3.2.4 Environmental Impact Assessment is a statutory requirement for certain proposed developments where there is likely to be a significant effect on the environment.

4. Action plan objectives and proposed targets

Targets will depend on the results of research and testing.

4.1 Prevent further net loss of existing vegetated shingle structures totalling about 5800 ha. (However local gains and losses due to storm events occur sporadically and should be accepted provided that the national and regional resources are maintained overall.)

4.2 Prevent, where possible, further exploitation of, or damage to, existing vegetated shingle sites through human activities, and maintain the quality of existing plant and invertebrate communities which are currently in favourable condition.

- 4.3** Achieve the restoration, where possible, of degraded or damaged habitats of shingle structures, including landward transitions, where such damage has been extensive and natural recovery is not likely to be initiated, by 2010.
- 5. Proposed action with lead agencies**
- 5.1 Policy and legislation**
- 5.1.1** Permit as far as possible the natural movement of coastal sediments through coastal processes which maintain shingle structures in favourable condition, including the natural landward movement of shingle banks. (ACTION: CCW, DETR, DoE(NI), EN, MAFF, NAW, SE, SNH)
- 5.1.2** Continue the current presumption against the extraction of the sub-tidal shingle resources unless environmental and coastal impact concerns, including those affecting coastal shingle structures and future supply of material to shingle shorelines, can be satisfactorily resolved. Continue to seek opportunities for the revocation or surrender of existing licences where appropriate. (ACTION: CEC, DETR, DoE(NI), NAW, SE)
- 5.1.3** Subject applications to extract aggregate from coastal shingle structures to the most rigorous examination and, where appropriate, seek opportunities for the surrender or revocation of existing permissions. (ACTION: DETR, DoE(NI), LAs, NAW, SE)
- 5.1.4** Ensure that the importance of shingle structures and offshore shingle resources is recognised in flood and coastal defence strategies and, where appropriate, encourage such strategies to contribute to the objectives and targets of this plan. (ACTION: DANl, DoE(NI), EA, MAFF, NAW, SE)
- 5.2 Site safeguard and management**
- 5.2.1** Apply conservation designations (including NNR status where appropriate) to remaining areas of shingle which meet national or international criteria for site selection, and ensure appropriate management of designated sites by 2004. (ACTION: CCW, EHS, EN, SNH)
- 5.2.2** Negotiate positive management agreements on vegetated shingle SSSIs and ASSIs. (ACTION: CCW, EHS, EN, SNH)
- 5.2.3** If pilot projects (see 5.5.4) are successful, promote the application of techniques, where appropriate, in a wider programme of rehabilitation on major shingle sites suffering from gross and extensive damage. (ACTION: CCW, EHS, EN, MoD, SNH)
- 5.2.4** Encourage reinstatement of wetland vegetation on shingle sites (where appropriate) by scrub clearance and grazing. (ACTION: EN)
- 5.3 Advisory**
- 5.3.1** Promote and develop demonstration sites for the management and rehabilitation of shingle structures and disseminate best practice. (ACTION: CCW, EHS, EN, SNH)
- 5.3.2** Ensure all relevant agri-environment project officers and members of regional agri-environment groups are advised of the location of existing examples of this habitat, its importance and the management requirements for its conservation. (ACTION: CCW, EN, SNH)
- 5.3.3** Allowing natural landward movement of shingle features (see 5.1) will, in some cases, affect other habitats such as saline lagoons, grazing marsh, fens and reedbeds, some of which will be designated sites. The implementation groups for the relevant HAPs should be advised on how to make appropriate provision for habitat creation. In some cases, breaches in shingle banks may lead to the development of saltmarsh habitats and this needs to be taken account of in the respective HAPs. (ACTION: CCW, EA, EN, SNH)
- 5.4 International**
- 5.4.1** Develop international links to promote the exchange of information and development of best practice in the management of coastal vegetated shingle. (ACTION: JNCC)
- 5.5 Monitoring and research**
- 5.5.1** Assess the current extent of damage to shingle vegetation and geomorphology in order to inform the setting of restoration targets within the first three years of this plan. (ACTION: CCW, EHS, EN, SNH)
- 5.5.2** Collate and disseminate information on changes in the extent and quality of the vegetated shingle resource in the UK in order to enable effective monitoring of the objectives of this plan. (ACTION: CCW, EHS, EN, JNCC, SNH)
- 5.5.3** Continue research into the use of remote sensing for monitoring soft coast habitats including shingle structures. (ACTION: EA)
- 5.5.4** Carry out pilot projects to test the methods for the practical restoration of damaged shingle structures and their vegetation and morphology, and disseminate the results. (ACTION: EN)

5.5.5 Initiate research to determine the relationship between offshore shingle banks and onshore shingle structures in relation to aggregate extraction. (ACTION: CEC, DETR, DoE(NI), MAFF, NAW, SE)

5.5.6 Initiate research to assess the likely medium to long-term demand for offshore shingle in order to maintain the current vegetated shingle structures and their associated shingle shorelines. (ACTION: CEC, DETR, DoE(NI), MAFF, NAW, SE)

5.6 Communications and publicity

5.6.1 Increase public awareness of the value and fragility of vegetated shingle through on-site interpretation. (ACTION: CCW, EHS, EN, SNH)

6. Costings

6.1 The successful implementation of the habitat action plans will have resource implications for both the private and public sectors. The data in the table below provide an estimate of the likely additional resource costs to the public and private sectors. These additional resource costs are based on the annual average over 5 and 10 years. The total expenditure for these periods of time is also given. Three-quarters of the additional resources are likely to fall to the public sector.

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Costings for vegetated shingle

| | Current expenditure | 1st 5 yrs to 2004/2005 | Next 10 yrs to 2014/2015 |
|--|---------------------|------------------------|--------------------------|
| Current expenditure /£000/Yr | 0 | | |
| Total average annual cost /£000/Yr | | 102.5 | 128.7 |
| Total expenditure to 2005/£000 | | 512.3 | |
| Total expenditure 2005 to 2014/£000 | | | 1287.3 |

* There is little or no current payment for shingle habitats under agri-environment schemes or other positive management payments.

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Littoral and sublittoral chalk

Habitat Action Plan

1. Current status

1.1 Physical and biological status

1.1.1 Chalk is a relatively soft and friable, easily eroded, sedimentary rock laid down in the Upper Cretaceous period. There are three main types of chalk (Upper, Middle, Lower) which differ in hardness and also content of flint (a siliceous rock deposited along bedding planes or vertical joints in chalk strata). Chalk at Flamborough Head (North Humberside) is notably different in being particularly hard due to compression by overlying strata and by glaciation. On the Isle of Wight and in Dorset, chalk is vertically bedded in contrast to horizontal bedding elsewhere.

1.1.2 Coastal chalk is exposed principally in the south and east of England from Dorset in the west to Flamborough Head in the north. Marine and subaerial erosion of chalk has resulted in the formation of vertical cliffs and gently sloping shore platforms. The most extensive areas of littoral and sublittoral chalk occur in Kent and Sussex. In Britain, chalk forms less than 0.6% (113 km) of the coastline. In Northern Ireland, Upper Cretaceous chalk deposits belong to the Ulster White Limestone Formation with exposures on the County Antrim coast. The Northern Ireland chalk forms extremely hard, low porosity deposits with subsequent erosion forming cliffs and shore platforms, dominated by cobble and boulder spreads with subtidal reefs. Faults on the seabed offshore have also exposed Cretaceous deposits.

1.1.3 The greatest proportion of European coastal chalk (57%) and many of the best examples of littoral and sublittoral chalk habitats are located on the coast of England and the UK has an international responsibility to ensure the conservation of this scarce habitat.

1.1.4 Characteristic features of chalk coastlines are their geomorphological formations, such as cliffs and reefs, which create a range of micro-habitats of biological importance. Littoral-fringe and supralittoral chalk cliffs and sea-caves support algal communities unique to the substrate which comprise members of the Chrysophyceae and Haptophyceae such as *Apistonema carterae* and *Chrysotila* spp. Their restricted presence may be due to physical characteristics of chalk particularly its porosity and ability to remain moist. The generally soft nature of chalk results in the presence of a characteristic flora and fauna, notably rock-boring invertebrates such as the spionid worm *Polydora* sp and piddocks. Littoral chalk also characteristically lacks species common on hard rocky shores (eg *Pelvetia canaliculata* and

Ascophyllum nodosum), but supports distinct successive zones of algae and animals such as *Fucus* spp, kelps *Laminaria* spp and red algal turfs, or barnacles and mussels on wave-exposed shores.

1.1.5 In south-east England infralittoral communities are limited or absent, and animal-dominated circalittoral communities occur in relatively shallow waters due to local high turbidity. At Flamborough, the Isle of Wight and Studland, infralittoral communities are more diverse and extend into deeper waters. Chalk habitats, especially in south-east England, are intrinsically low in species-richness due to the unusual friable and easily eroded nature of chalk and the prevailing harsh environment, characterised by extreme water temperatures, high levels of turbidity, siltation and scouring.

1.2 Links with other action plans

1.2.1 The actions of this plan are linked closely to those of the maritime cliff and slopes habitat action plan. In both plans attention is drawn to the need for avoiding non-sustainable coastal defence works and of raising awareness of the biodiversity and dynamic nature of these habitats and their role in coastal processes.

2. Current factors affecting the habitat

2.1 A recent survey of chalk cliffs throughout England revealed that 56% percent of coastal chalk in Kent and 33% in Sussex has been modified by coastal defence and other works. On the Isle of Thanet (Kent) this increases to 74% and has resulted in the loss of a wide range of micro-habitats on the upper shore and the removal of splash-zone communities. There has been less alteration of chalk at lower shore and subtidal levels, although large ports have been developed at Dover and Ramsgate with harbour developments at Margate, Folkestone, Newhaven and Brighton Marina. Elsewhere in England, coastal chalk remains in a largely natural state.

2.2 The deterioration of water quality by pollutants and nutrients has caused respectively the replacement of furoid dominated biotopes by mussel-dominated biotopes, and the occurrence of nuisance *Enteromorpha* spp blooms.

2.3 A potential factor affecting the chalk biota is human disturbance of littoral plant and animal communities especially by trampling, stone-turning, small-scale fishery, and damage to rocks through removal of piddocks. Chalk exposures in the Strait of Dover are

also vulnerable to oil spills due to the proximity of major shipping lanes.

2.4 Research has indicated that native species along the English Channel have been displaced by the incursion of non-native species. For example, *Sargassum muticum*, *Polysiphonia harveyi* and *Undaria pinnatifida*.

2.5 Sea level rise and post-glacial land adjustment will submerge a greater area of littoral (intertidal) chalk platform. MAFF have predicted an increase of 6 mm per annum for south-east England.

3. Current action

3.1 Legal status

3.1.1 Through the Wildlife and Countryside Act 1981 a large proportion (75%, 17 sites) of coastal chalk has been notified as SSSIs. However, the SSSI designation does not confer protection to sublittoral habitats and until recently the conservation of important subtidal sites was dependent on non-statutory initiatives. For example, subtidal chalk habitat has been included within Sensitive Marine Areas and Voluntary Marine Conservation Areas (VMCA) such as the Seven Sisters VMCA off East Sussex.

3.1.2 The statutory protection of littoral and sublittoral chalk habitats is now possible at four sites, Flamborough Head, Thanet Coast, South Wight and Rathlin Island, through their candidature as SACs. These locations have been nominated as SACs under the EC Habitats Directive because they include the qualifying interests of reefs and submerged or partly submerged sea caves. A further candidate SAC that includes chalk habitats has been proposed for the South Wight Maritime.

3.1.3 Discharges to the sea are controlled by a number of EC Directives, including the Dangerous Substances, Shellfish (Waters), Integrated Pollution Control, Urban Waste Water Treatment, and Bathing Waters Directives. The Oslo and Paris Convention (OSPAR) and North Sea Conference declarations are also important. These commitments provide powers to regulate discharges to the sea and have set targets and quality standards to marine waters. An extensive set of standards covering many metals, pesticides and other toxic, persistent and bioaccumulative substances, and nutrients have been set under UK legislation.

3.1.4 The proposed European Water Framework Directive aims to rationalise much of the EC's water legislation with an overall purpose of providing a framework for the protection of surface waters including coastal waters. This will aim at preventing the deterioration of

aquatic ecosystems with a strong emphasis on ecological quality targets.

3.2 Management, research and guidance

3.2.1 Integrated management of marine SACs will occur through the development of schemes of management by relevant authorities. Shoreline Management Plans (SMPs), which examine options for coastal defence, are also being produced for the entire English and Welsh coast.

3.2.2 Marine biological surveys of littoral and sublittoral chalk reefs were undertaken as part of the JNCC Marine Nature Conservation Review (MNCR), with additional survey work at Thanet candidate SAC. This information will contribute to the development of the SAC management schemes. The voluntary 'Seasearch' programme organised by the Marine Conservation Society, on behalf of JNCC, has also undertaken extensive sublittoral surveys on the chalk reefs of Sussex and provides useful information and data for use in subsequent management proposals for the Seven Sisters VMCA.

4. Action plan objectives and proposed targets

4.1 Seek to retain and where possible increase the existing extent of littoral and sublittoral chalk habitats unaffected by coastal defence and other engineering works.

4.2 Allow natural coastal processes to dictate, where possible, the geomorphology of the littoral and sublittoral environment.

4.3 Adopt sustainable management practices for all uses on littoral and sublittoral chalk habitats.

5. Proposed action with lead agencies

5.1 Policy and legislation

5.1.1 Influence the content of SMPs to recognise the dynamic nature of the littoral environment allowing, where possible, the natural processes of erosion. (ACTION: EHS, EA, LAs, MAFF)

5.1.2 Promote planning policy that includes a presumption against development that, due to the progress of natural erosion, will require coastal defence works. (ACTION: DETR, DoE(NI))

5.1.3 Harmonise the integration of Local Environment Action Plans with the proposed Water Framework Directive so that there is a comprehensive approach to securing

water quality objectives for estuaries and coastal areas.
(ACTION: EA, EHS)

5.2 Site safeguard and management

5.2.1 Ensure management schemes for Flamborough Head, Thanet coast and South Wight candidate SACs are complementary with the objectives of this plan.
(ACTION: All relevant authorities)

5.2.2 Promote the use of both statutory and non-statutory initiatives to conserve nationally and internationally important examples of littoral and sublittoral chalk habitats. (ACTION: DETR, EA, EHS, EN)

5.2.3 Encourage a presumption against littoral stabilisation works except where human life, or important natural or man-made assets, are at risk. (ACTION: EA, EHS, LAs, MAFF)

5.2.4 Consider non-replacement of coastal cliff defences which have come to the end of their useful life..
(ACTION: DANI, DETR, DoE(NI), EHS, LAs, MAFF)

5.3 Advisory

5.3.1 Prepare, publish and distribute to local authorities and port and harbour authorities by 2002 a guidance manual which describes the dynamic and sensitivity characteristics of littoral and sublittoral chalk habitats.
(ACTION: EHS, EN)

5.4 International

5.4.1 None proposed.

5.5 Monitoring and research

5.5.1 Commission research to identify coastal defence strategies that incorporate habitat conservation interests. The research should also identify locations where littoral stabilisation works may no longer be necessary in the future. (ACTION: EHS, EN, LAs, MAFF)

5.5.2 Assist in the development and implementation of monitoring programmes for littoral and sublittoral chalk habitats in line with the statutory reporting requirements for ASSI/SSSI and SAC management schemes.
(ACTION: All relevant and competent authorities)

5.5.3 Implement a surveying and monitoring programme by 2003 to provide data on the changes in extent and quality of littoral and sublittoral chalk resources in England and Northern Ireland. This will enable progress towards the objectives of this plan to be assessed. The information derived from this programme should be

collated in conjunction with data derived from surveying the national maritime cliff and slope resource.
(ACTION: EA, EHS, EN)

5.5.4 Commission a research programme for completion by 2005 to investigate the effects of invasive non-native species on the local ecology of littoral and sublittoral chalk, and determine how to eradicate such species.
(ACTION: DETR, EN)

5.6 Communications and publicity

5.6.1 Prepare and publish by 2000 a pamphlet for the general public describing the biodiversity of littoral and sublittoral chalk habitats and of the importance of allowing natural coastal processes such as erosion.
(ACTION: EHS, EN, LAs)

6. Costings

6.1 The successful implementation of this habitat action plan will have resource implications for both the overleaf and private sectors. The data in the table overleaf provide an estimate of the current expenditure on the habitat and the likely additional resource costs. These additional costs are based on the annual average over 5 and 10 years. The total expenditure for these time periods is also given. Almost all the costs will relate to the public sector, although some costs (eg for research) will be met by the private sector/non-governmental organisations).

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Costings for littoral and sublittoral chalk

| | Current expenditure | 1st 5 yrs to 2004/2005 | Next 10 yrs to 2014/2015 |
|--|---------------------|------------------------|--------------------------|
| Current expenditure /£000/Yr | | | |
| Total average annual cost /£000/Yr | | 30.6 | 9.2 |
| Total expenditure to 2005/£000 | | 153 | |
| Total expenditure 2005 to 2014/£000 | | | 92 |

Sabellaria alveolata reefs

Habitat Action Plan

1. Current status

shore, creating rockpools where there would otherwise be none. Less is known about subtidal communities.

1.1 Physical and biological status

1.1.1 *Sabellaria alveolata* reefs, Marine Nature Conservation Review (MNCR) habitat code MLR.Salv, are formed by the honeycomb worm *Sabellaria alveolata*, a polychaete which constructs tubes in tightly packed masses with a distinctive honeycomb-like appearance. These reefs can be up to 30 or even 50 cm thick and take the form of hummocks, sheets or more massive formations. Reefs are mainly found on the bottom third of the shore, but may reach mean high water of neap tides and extend into the shallow subtidal in places. They do not seem to penetrate far into low salinity areas. Reefs form on a variety of hard substrata, from pebbles to bedrock, in areas with a good supply of suspended sand grains from which the animals form their tubes, and include areas of sediment when an attachment has been established. The larvae are strongly stimulated to settle by the presence of existing colonies or their dead remains. *S. alveolata* has a very variable recruitment and the cover in any one area may vary greatly over a number of years, although in the long term reefs tend mainly to be found on the same shores.

1.1.2 In Britain, *S. alveolata* reefs are found only on shores with strong to moderate wave action in the south and west, between Lyme Bay on the south coast of England and the Scottish coast of the Solway Firth. The reefs have also been found on parts of the Northern Ireland coast. The British Isles represent the northern extremity of the range in the north-east Atlantic, which extends south to Morocco. The reefs also occur in the Mediterranean.

1.1.3 Individual worms have a lifespan of typically three to five years, and possibly up to nine years, but reefs themselves may last longer as a result of further settlement of worms onto existing colonies. Typically in the first two years or so, after a heavy intertidal settlement, there are few associated species. Over time, seaweeds including fucoids, *Palmaria palmata*, *Polysiphonia* spp, *Ceramium* spp, *Enteromorpha* spp and *Ulva lactuca*, and animals including barnacles, dogwhelks, winkles, mussels and other bivalves such as *Nucula nucleus*, *Sphenia binghami* and *Musculus discors*, colonise the reef. Small polychaetes such as *Fabricia stellaris*, *Golfingia* spp and syllidae predators may occur within the colonies. Blennies, small crabs (*Carcinus maenas*) and other crustacea (such as *Unicola crenatipalma*) can be found within crevices. Older reefs may increase the biodiversity and stability of what would otherwise be sand abraded rocks and boulders. Sheet-like reefs may restrict drainage of the

1.1.4 In Britain, *S. alveolata* forms well developed reefs over much of its range. The most numerous and extensive areas occur on the Cumbrian coast, particularly between the Morecambe Bay and the Solway Estuary and at Dubmill Point. Reefs are also found in Cardigan Bay and in the Bristol Channel, including the coasts of south Wales, north Devon, Somerset and Avon. Very extensive subtidal reefs occur in the Severn Estuary, and subtidal populations have also been reported in the Walney Channel (Morecambe Bay) and from Glassdrumman, Northern Ireland.

1.1.5 There is evidence of a significant contraction in range on the south coast of England over a period of at least 20 years until 1984. Declines have also been reported in the western part of the north Cornish coast, the upper parts of the Bristol Channel and in North Wales and the Dee Estuary. Causes have not been postulated and it is difficult to assess the true significance of these changes given the natural variability of the species. For example, *S. alveolata* reefs have recently developed off Heysham (in Morecambe Bay), dominating two hectares of boulder scar from where it had been absent for 30 years.

1.2 Links with other action plans

1.2.1 Reference should be made to the *Sabellaria spinulosa* reefs habitat action plan with particular regard to common actions for these habitats in the subtidal environment. Attention should also be given to the sublittoral sands and gravels habitat action plan, where emphasis is placed on the damage (through physical disturbance) that may be inflicted on sessile organisms by coastal development.

2. Current factors affecting the habitat

2.1 *Sabellaria alveolata* reefs are at the northern end of their range in Britain and are affected by extremely cold winters, after which they may die back for many years, particularly at higher shore levels.

2.2 By their nature, *S. alveolata* reefs occur in areas which are naturally subject to large scale changes in the amount of sand. They can tolerate burial for a period of days or even weeks, but prolonged burial will cause mortality.

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| 2.3 | <i>S. alveolata</i> reefs are potentially vulnerable to accumulations or losses of sand as a result of shoreline development, which is the major cause of loss in parts of Europe. These developments may have positive or negative effects depending on the nature of the changes. | 3.2 | Management, research and guidance |
| 2.4 | Trampling damage by beach users and extraction of the worms for angling bait both occur, but on a limited and local scale. The former probably has the greater potential for damage, particularly in parts of Wales and south-west England, as leisure use of beaches continues to increase. | 3.2.1 | There is, presently, negligible active research on <i>S. alveolata</i> within Britain, although small scale surveys of recently developed reefs off Heysham in Morecambe Bay have been carried out. A report summarising the dynamics and sensitivity of biogenic reefs, including <i>S. alveolata</i> reefs, was recently commissioned for the UK Marine SAC Project. Aerial photographs have also been used by the conservation agencies to map intertidal <i>S. alveolata</i> reefs and the MNCR Database holds information on the occurrence of <i>S. alveolata</i> habitats around the UK coast. It is probable that subtidal reefs in the Severn Estuary proposed SAC will be monitored by CCW and EN as part of the management scheme for that site. |
| 2.5 | There is some evidence that competition for space with common mussels <i>Mytilus edulis</i> occurs, especially on boulder scars, but factors influencing this are unknown. Heavy settlement of mussels on <i>S. alveolata</i> reefs has been suspected of causing short term destabilisation and loss of habitat. | 4. | Action plan objectives and proposed targets |
| 2.6 | <i>S. alveolata</i> is naturally subject to very variable recruitment, but the factors influencing this are not fully understood. Lack of larval supply and wave exposure is thought to be an important factor in the general absence of reefs on Anglesey and near to major peninsulas such as south-west Cornwall, Pembrokeshire and the Llyn Peninsula. | It is difficult to set biological targets for this habitat when little is known about its distribution, stability, rate of (re-)establishment and recovery. Increased survey and research effort is required before quantitative habitat targets can be set. The following objectives and targets are suggested. | |
| 3. | Current action | 4.1 | Maintain the extent and quality of <i>S. alveolata</i> reef habitats. |
| 3.1 | Legal status | 4.2 | Within 15 years, attempt to re-establish <i>S. alveolata</i> reefs in five areas where they were formerly present. Establish a monitoring programme to report on the success of this initiative. |
| 3.1.1 | Intertidal protection for <i>S. alveolata</i> reefs can be achieved through SSSI designation. <i>S. alveolata</i> reefs also occur as sub-features of non-reef Annex 1 habitats (eg intertidal mudflats and sandflats) under the Habitats Directive and are present in a number of candidate Special Areas of Conservation (cSACs), including the Solway Firth, Llyn Peninsula and the Sarnau, Cardigan Bay and Morecambe Bay. However, many examples of <i>S. alveolata</i> reefs lie outside these areas. | 5. | Proposed actions with lead agencies |
| 3.1.2 | Discharges to the sea are controlled by a number of EC Directives, including the Dangerous Substances, Shellfish (Waters), Integrated Pollution Control, Urban Waste Water Treatment, and Bathing Waters Directives. The forthcoming Water Framework Directive will also be relevant. The Oslo and Paris Convention (OSPAR) and North Sea Conference declarations are also important. These commitments provide powers to regulate discharges to the sea and have set targets and quality standards to marine waters. An extensive set of standards covering many metals, pesticides and other toxic, persistent and bioaccumulative substances, and nutrients have been set under UK legislation. | 5.1 | Policy and legislation |
| | | 5.1.1 | Promote planning policies that seek to direct development away from sites of marine natural heritage importance. (ACTION: DETR, EHS, NAW, SE) |
| | | 5.2 | Site safeguard and management |
| | | 5.2.1 | Ensure that when considering the need for, and scope of, Environmental Impact Assessments, the needs of <i>S. alveolata</i> , (including sediment supply), are fully taken into account. (ACTION: CCW, EA, EHS, EN, LAs, SE) |
| | | 5.2.2 | In candidate and proposed SACs with <i>S. alveolata</i> reefs, develop site specific management and protection, including designated monitoring and research areas, which ensure conditions for survival and persistence. (ACTION: CCW, EHS, EN, SNH) |

- 5.2.3** Consider the designation of further SSSIs and ASSIs or the establishment of voluntary refuge areas for *S. alveolata* reefs outside designated sites. (ACTION: CCW, EHS, EN, SNH)
- 5.3 Advisory**
- 5.3.1** Raise awareness of the scarcity and fragility of *S. alveolata* reefs with conservation officers and the public by targeted publicity (posters and leaflets to be produced by 2003). Ensure that this habitat is included in 'Beach/Shore' codes of practice. Effort should be made to involve officers of country agencies, wardens of voluntary reserves and heritage coast officers in survey work. (ACTION: CCW, EHS, EN, SNH)
- 5.4 International**
- 5.4.1** Exchange information with experts in France, Ireland, Spain and Portugal on habitat distribution, role in coastal ecosystems and impacts of development. This would greatly help decision making in the UK. (ACTION: JNCC)
- 5.5 Monitoring and research**
- 5.5.1** Establish by 2003 the extent and quality of significant areas of *S. alveolata* reef habitat in the UK. The study should compare the present extent of reefs with the last extensive intertidal survey in the early 1980s. There is a need especially to include shallow subtidal areas as these have previously been little studied. (ACTION: CCW, EHS, EN, NERC, SNH)
- 5.5.2** Commission research on growth rates, longevity, and persistence of both individual worms and associated reef dynamics, under a variety of environmental conditions including the edges of geographic ranges. Establish by 2003 the necessary habitat conditions for the re-establishment of *S. alveolata* reefs within former areas. Research on subtidal reefs should be carried out as a priority since almost nothing is known about these. (ACTION: CCW, EHS, EN, NERC, SNH)
- 5.5.3** Undertake research on recruitment processes, including sources of larvae and exchange between populations using modern molecular genetics techniques. (ACTION: NERC)
- 5.5.4** Undertake surveys of damage to reefs in areas with different levels of recreational activity. Quantify recreational damage in field experiments (at non-sensitive sites) to measure recovery potential. (ACTION: CCW, EHS, NERC, SNH)
- 5.5.5** Investigate the role of *S. alveolata* reefs in habitat modification including stabilisation of cobble boulder bottoms. (ACTION: CCW, EHS, EN, NERC, SNH)
- 5.5.6** Compile a simple leaflet with an attached record sheet to be returned to a lead agency in order to both heighten awareness and provide valuable distributional data. (ACTION: CCW, EHS, EN, SNH)
- 5.6 Communications and publicity**
- 5.6.1** Many sites in south-west England and Wales are in areas of high tourist activity. Display material strategically placed in car parks and foreshore access points could be used to highlight the natural history of this interesting habitat to casual beach users. Advice should also be given to discourage trampling. (ACTION: CCW, EN)
- 6. Costings**
- 6.1** The successful implementation of this habitat action plan will have resource implications for both the public and private sectors. The data in the table overleaf provide an estimate of the current expenditure on the habitat and the likely additional resource costs. These additional costs are based on the annual average over 5 and 10 years. The total expenditure for these time periods is also given. Almost all the costs will relate to the public sector, although some costs (eg for research) will be met by the private sector/non-governmental organisations).
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Costings for *Sabellaria alveolata* reefs

| | Current expenditure | 1st 5 yrs to 2004/2005 | Next 10 yrs to 2014/2015 |
|--|---------------------|------------------------|--------------------------|
| Current expenditure /£000/Yr | | | |
| Total average annual cost /£000/Yr | | 62.8 | 28.4 |
| Total expenditure to 2005/£000 | | 314 | |
| Total expenditure 2005 to 2014/£000 | | | 284 |

Coastal saltmarsh

Habitat Action Plan

1. Current status

1.1 Physical and biological status

1.1.1 Coastal saltmarshes in the UK (also known as ‘merse’ in Scotland) comprise the upper, vegetated portions of intertidal mudflats, lying approximately between mean high water neap tides and mean high water spring tides. For the purposes of this action plan, however, the lower limit of saltmarsh is defined as the lower limit of pioneer saltmarsh vegetation (but excluding seagrass *Zostera* beds) and the upper limit as one metre above the level of highest astronomical tides to take in transitional zones.

1.1.2 Saltmarshes are usually restricted to comparatively sheltered locations in five main physiographic situations: in estuaries, in saline lagoons, behind barrier islands, at the heads of sea lochs, and on beach plains. The development of saltmarsh vegetation is dependent on the presence of intertidal mudflats.

1.1.3 Saltmarsh vegetation consists of a limited number of halophytic (salt tolerant) species adapted to regular immersion by the tides. A natural saltmarsh system shows a clear zonation according to the frequency of inundation. At the lowest level the pioneer glassworts *Salicornia* spp can withstand immersion by as many as 600 tides per year, while transitional species of the upper marsh can only withstand occasional inundation.

1.1.4 The communities of stabilised saltmarsh can be divided into species-poor low-mid marsh, and the more diverse communities of the mid-upper marsh. On traditionally grazed sites, saltmarsh vegetation is shorter and dominated by grasses. At the upper tidal limits, true saltmarsh communities are replaced by driftline, swamp or transitional communities which can only withstand occasional inundation. Saltmarsh communities are additionally affected by differences in climate, the particle size of the sediment and, within estuaries, by decreasing salinity in the upper reaches. Saltmarshes on fine sediments, which are predominant on the east coasts of Britain, tend to differ in species and community composition from those on the more sandy sediments typical of the west. The northern limits of some saltmarsh species also influence plant community variation between the north and south of Britain.

1.1.5 Saltmarshes are an important resource for wading birds and wildfowl. They act as high tide refuges for birds feeding on adjacent mudflats, as breeding sites for waders, gulls and terns and as a source of food for

passerine birds particularly in autumn and winter. In winter, grazed saltmarshes are used as feeding grounds by large flocks of wild ducks and geese. Areas with high structural and plant diversity, particularly where freshwater seepages provide a transition from fresh to brackish conditions, are particularly important for invertebrates. Saltmarshes also provide sheltered nursery sites for several species of fish.

1.1.6 Since medieval times, many saltmarshes have been reduced in extent by land claim. This practice continued until very recently; for instance, in the Wash 858 ha of saltmarsh were converted to agricultural use between 1970 and 1980. The land enclosed by sea walls was originally converted to grazing marsh with brackish ditches, but since the 1940s large areas of grazing marsh have been agriculturally improved to grow arable crops. As a consequence, many saltmarshes now adjoin arable land, and the upper and transitional zones of saltmarshes have become comparatively scarce in England. Sites still displaying a full range of zonation are particularly valuable for nature conservation. In Scotland and Wales, transitions (eg to freshwater, grassland and dune communities) are still comparatively common. In Northern Ireland most saltmarsh is composed of mid- and upper saltmarsh vegetation with transitions to freshwater or grassland.

1.1.7 The most recent saltmarsh surveys of the UK estimate the total extent of saltmarsh (including transitional communities) to be approximately 45,500 ha (England 32,500 ha, Scotland 6747 ha, Wales 6089 ha, and Northern Ireland 215 ha). This resource is concentrated in the major estuaries of low-lying land in eastern and north-west England and in Wales, with smaller areas in the estuaries of southern England, the firths of eastern and south-west Scotland and the sea loughs of Northern Ireland; north-west Scotland is characterised by a large number of very small saltmarsh sites at the heads of sea lochs, embayments and beaches. It is estimated that, at the mean high water line, 24% of the English coastline, 11% of the Welsh coastline and 3% of the Scottish coastline consists of saltmarsh vegetation.

1.2 Links with species action plans

1.2.1 The following BAP priority species have significant populations on saltmarsh: the eyebright *Euphrasia heslop-harrisonii*, the ground beetles *Amara strenua* and *Anisodactylus poeciloides*, natterjack toad *Bufo calamita*, the snail *Vertigo angustior*, and endemic sea-lavenders *Limonium* spp.

2. Current factors affecting the habitat

2.1 Land claim. Large scale saltmarsh land claim schemes for agriculture are now rare. Piecemeal smaller scale land claim for industry, port facilities, transport infrastructure and waste disposal is still comparatively common, and marina development on saltmarsh sites occurs occasionally. Such developments usually affect the more botanically diverse upper marsh and landward transition zones.

2.2 Erosion and ‘coastal squeeze’. Erosion of the seaward edge of saltmarshes occurs widely in the high energy locations of the larger estuaries as a result of coastal processes. There is evidence that this process is exacerbated both by the isostatic tilting of Britain towards the south-east, and by climatic change leading to a relative rise in sea level and to increased storminess. Many saltmarshes are being ‘squeezed’ between an eroding seaward edge and fixed flood defence walls. The erosional process is exacerbated in some locations by a reduced supply of sediment. ‘Coastal squeeze’ is most pronounced in south-east England, where, for example, it is estimated that 20% of the saltmarsh resource in Kent and Essex was lost between 1973 and 1988. The best available information suggests that saltmarshes in the UK are being lost to erosion at a rate of 100 ha a year. In more western and northern regions, there is recent evidence of a trend towards net sea level rise which may be causing saltmarsh erosion, although the rates of loss are not known.

2.3 Accretion. Accretion and development of saltmarsh is occurring on parts of the British coastline, notably in north-west England where sediments are comparatively coarse and isostatic uplift largely negates sea level rise. However this accretion is not sufficient to offset the national net loss of saltmarsh, and in many cases the newly created habitats differ from those being lost due to the regional differences referred to in 1.1.4.

2.4 Sediment dynamics. Local sediment budgets may be affected by coast protection works, or by changes in estuary morphology caused by land claim, dredging of shipping channels and the impacts of flood defence works over the years.

2.5 Cord grass. The small cordgrass, *Spartina maritima*, is the only species of cordgrass native to Great Britain. The smooth cordgrass, *S. alterniflora*, is a naturalised alien that was introduced to the UK in the 1820s. This introduction led to its subsequent crossing with *S. maritima* resulting in both a sterile hybrid, Townsend’s cordgrass *S. townsendii*, and a fertile hybrid, common cordgrass *S. anglica*. The latter readily colonises mudflats and has spread around the coast. It has also been extensively planted to aid stabilisation of mudflats

and as a prelude to land-claim. Common cordgrass often produces extensive monoculture swards of much less intrinsic value to wildlife, and in many areas is considered to be a threat to bird feeding grounds on mudflats. As a result, attempts have been made to control it at several locations, although in some areas it is undergoing dieback for reasons not fully understood.

2.6 Grazing. Grazing has a marked effect on the structure and composition of saltmarsh vegetation by reducing the height of the vegetation and the diversity of plant and invertebrate species. Intensive grazing creates a sward attractive to wintering and passage wildfowl and waders, whilst less intense grazing produces a tussocky structure which favours breeding waders. In recent decades, some grazed saltmarshes have been abandoned, leading to domination of the mid to upper marsh by rank grasses. Intensive grazing is considered to be a problem in some areas.

2.7 Other human influences. Saltmarshes are affected by a range of other human influences including waste tipping, pollution, drowning by barrage construction, and military activity. Turf cutting is a traditional activity in some areas. Oil pollution can potentially destroy saltmarsh vegetation and whilst it usually recovers, sediment may be lost during the period of die-back. The effects of recreational pressure are not well understood but may be locally significant. Agricultural improvement (re-seeding and draining) has affected the upper edge and transition zones of some saltmarshes in the past and may still occur on a small scale. Eutrophication due to sewage effluent and agricultural fertiliser run-off has caused local problems of algal growth on saltmarshes.

3. Current action

3.1 Legal status

3.1.1 Approximately 80% of the area of saltmarsh in Great Britain has been notified as SSSI, except in north-west Scotland where only about 50% has been notified. In Northern Ireland, five of the seven estuaries containing saltmarsh have been declared as ASSI.

3.1.2 ‘Atlantic Salt Meadows’ is listed as habitat type in Annex I of the EC Habitats Directive. Ten areas in Great Britain have been proposed as SACs for their saltmarsh features. In addition, 27 major saltmarsh sites and many smaller ones are included in SPAs under the EC Birds Directive and in Ramsar sites.

3.1.3 Environmental impact assessment is a statutory requirement for certain proposed developments where there is likely to be a significant effect on the environment.

3.2 Management, research and guidance

3.2.1 The UK Government has set out its commitment to sustainable management of the coast in a number of publications. These include DETR's (formerly DoE) *Policy Guidelines for the Coast and Planning Policy Guidance - Coastal Planning* (PPG 20), and SO's *Coastal Planning* (NPPG 13). A *Coastal Planning Technical Advice Note* has been produced for Wales. DoE(NI)'s *Planning Strategy for Rural Northern Ireland* has provisions relating to development, access and conservation of the coast. MAFF and the Welsh Office have also produced a *Strategy for Flood and Coastal Defence in England and Wales* and DETR has produced *Coastal Zone Management - Towards Best Practice*.

3.2.2 DETR's Coastal Forum was set up in 1994; similar fora have recently been initiated in Scotland and Wales, and one is expected shortly in Northern Ireland. Some country nature conservation agencies have their own coastal initiatives (Estuaries Initiative in England, and Focus on Firths in Scotland), and Arfordir is a partnership of coastal practitioners in Wales. In England, MAFF's Habitat Scheme includes a saltmarsh re-creation option for agricultural land behind sea walls (60 ha under agreement in 1997). Countryside Stewardship in England also offers a saltmarsh management option (3977 ha under agreement in 1997 mainly in relation to grazing). In Wales, 291 ha had been entered into CCW's pilot agri-environmental scheme, Tir Cymen, by 1997. The new Welsh whole farm agri-environment scheme, which will include opportunities for the management and restoration of saltmarsh habitats, was launched in 1999. Grazing of traditionally grazed saltmarshes is encouraged on a number of NNRs, SSSIs and ASSIs; prominent examples are the Ribble and the Wash in England, the Solway in Scotland and the Dyfi in Wales. Reintroduction of appropriate levels of grazing where it was carried out in the past and where there are benefits for nature conservation has been undertaken at a number of sites such as the Wash, the Solway Firth and Orfordness in Suffolk. The Merse Management Scheme developed by SNH aims to encourage traditional grazing practices on the Scottish Solway. This scheme, together with other incentives in Scotland, brings 1783 ha of saltmarsh into positive management.

3.2.3 Recent work led by the EA has promoted the role that saltmarshes have in reducing the wave energy reaching the sea wall. Flood defence costs can therefore be reduced in the long term by setting back lines of defence and by allowing saltmarsh development seaward of the defences. MAFF and EN have cooperated on a 21 ha experimental managed realignment and saltmarsh creation scheme at Tollesbury in Essex where the sea wall was breached

in 1995 and saltmarsh plants are colonising successfully. Other saltmarsh creation schemes have been undertaken at locations in England, Scotland and Wales. Experimental works have been carried out to protect saltmarsh shorelines from erosion, including brushwood 'polders', offshore barriers and beach recharge.

3.2.4 The National Rivers Authority (now the Environment Agency) published *A Guide to the understanding and Management of Saltmarshes* in 1995. In the same year, English Nature published *Managed retreat - a practical guide*. A summary of the initial results from the Tollesbury experiment was produced in 1997.

3.2.5 The Joint Nutrient Study (JoNuS) sponsored by DETR and MAFF, has highlighted the importance of intertidal areas in controlling eutrophication in estuaries.

4. Action plan objectives and proposed targets

4.1 The overall objectives of this plan are to offset the current losses due to coastal squeeze and erosion to maintain the existing extent of saltmarsh habitat of approximately 45,500 ha, and to restore the area of saltmarsh to 1992 levels (the year of adoption of the Habitats Directive which included saltmarsh as a habitat type of community interest). There is a need to identify realistic and achievable targets for creation. The results of individual estuary evaluations during the first five years of this 15 year plan will allow the headline targets set out below to be reviewed and refined. Such studies will also identify potential locations for saltmarsh creation. There will be a presumption against any further net loss of saltmarsh to land claim or other anthropogenic factors. The best available information has been used to establish the targets below.

4.2 There should be no further net loss (currently estimated at 100 ha/year). This will involve the creation of 100 ha/year during the period of this plan. However, local losses and gains are to be expected in this essentially dynamic system.

4.3 Create a further 40 ha of saltmarsh in each year of the plan to replace the 600 ha lost between 1992 and 1998, based on current estimates.

4.4 Maintain the quality of the existing resource in terms of community and species diversity and, where necessary, restore the nature conservation interest through appropriate management. It will be desirable for some managed realignment sites to develop the full range of saltmarsh zonation.

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| 5. Proposed action with lead agencies | 5.3.2 | Encourage the appropriate management of saltmarsh through the production and dissemination of guidance material by 2005. (ACTION: CCW, EA, EHS, EN, SNH) |
| 5.1 Policy and legislation | | |
| 5.1.1 | 5.3.3 | Consider the policy implications of enabling agricultural land to be made available for coastal habitat creation. (ACTION: DANI, MAFF, NAW, SE) |
| 5.1.2 | 5.3.4 | Establish a technical expert group by 1999 to collate and disseminate information relating to the relationship between saltmarshes, nature conservation and flood defence. (ACTION: EA, EN, MAFF) |
| 5.1.3 | 5.3.5 | Ensure that there are mechanisms available during the period of this plan through the agri-environment programme and other initiatives to deliver the targets in this plan for the appropriate management of saltmarsh and creation of new areas of saltmarsh. (ACTION: DANI, MAFF, NAW, SE) |
| 5.1.4 | 5.3.6 | Make use of the potential provided by existing estuary management partnerships in taking forward the actions of this plan. (ACTION: CCW, DETR, EA, EN, LAs, MAFF, SNH) |
| 5.1.5 | | Ensure all relevant agri-environment project officers and members of regional agri-environment conservation groups are advised of the location of existing examples of this habitat, its importance and the management requirements for its conservation. (ACTION: CCW, EN, SNH) |
| 5.1.6 | | The often intimate relationship between saltmarsh vegetation and other coastal habitats such as shingle structures, sand dunes, machair and intertidal mudflats means that the management of saltmarshes can rarely be considered in isolation. Managed realignment of flood defences and saltmarsh habitat creation where existing defences are not sustainable in the long term will, in some places, involve loss of freshwater habitats (eg grazing marsh and reed beds) behind sea walls. Some of these habitats may be within designated sites. Implementation groups for the relevant HAPs should be advised on how to make appropriate provision for compensatory habitat creation. (ACTION: CCW, EA, EN, SNH) |
| 5.2 Site safeguard and management | 5.4 | International |
| 5.2.1 | 5.4.1 | Apply conservation designations to remaining areas of saltmarsh which meet national or international criteria for site selection and ensure appropriate management of notified/designated sites by 2004. (ACTION: CCW, EHS, EN, SNH) |
| 5.2.2 | 5.5 | Monitoring and research |
| 5.3 | 5.5.1 | Ensure that, as far as possible, coastal defence or other construction works avoid any disruption of coastal or other natural processes which might lead to the loss of saltmarsh. (ACTION: DANI, DETR, DoE(NI), EA, LAs, MAFF, NAW, SE) |
| 5.3.1 | 5.5.2 | Put measures in place to clarify the current and future rates of saltmarsh loss enabling a review of the targets of this plan by 2004. (ACTION: CCW, EA, EN, MAFF, SNH) |
| | 5.5.3 | Collate and disseminate information on changes in the extent and quality of the saltmarsh resource in the UK in order to enable effective monitoring and review of the objectives of this plan. (ACTION: JNCC) |
| | | Continue development of the use of remote sensing for monitoring soft coast habitats to determine the extent |

and rate of change, including the identification of the highest priority areas for saltmarsh creation. (ACTION: EA, SEPA)

5.5.4 Investigate the beneficial use of fine dredged materials for promotion of saltmarsh accretion and disseminate the results. (ACTION: CCW, EA, EN, MAFF, SNH)

5.5.5 Continue research into the factors influencing the establishment of saltmarsh vegetation, and use this to develop 'best practice' methods for management. (ACTION: CCW, EA, EN, MAFF, SNH)

5.5.6 Undertake research on estuary dynamics, including the effects of sediment removal in relation to its impact on saltmarsh. (ACTION: EA, MAFF, SEPA)

5.5.7 Initiate an assessment of saltmarsh grazing practice, including agronomic aspects, by 2000. (ACTION: CCW, EHS, EN, MAFF, SNH)

5.6 Communications and publicity

5.6.1 Raise public awareness of the essential mobility of saltmarsh and its value for a variety of interests including coastal processes, flood defence, fisheries, nature conservation, amenity and recreation. (ACTION: CCW, EA, EHS, EN, SNH)

5.6.2 Promote awareness of the implications of the policies outlined in this plan among appropriate decision makers, including Local Authorities. (ACTION: DETR, DoE(NI), LAs, MAFF, NAW, SE)

6. Costings

6.1 The successful implementation of the habitat action plans will have resource implications for both the private and public sectors. The data in the table overleaf provide an estimate of the current expenditure on the habitat, primarily through agri-environment schemes and grant schemes, and the likely additional resource costs to the public and private sectors. These additional resource costs are based on the annual average over 5 and 10 years. The total expenditure for these periods of time is also given. Three-quarters of the additional resources are likely to fall to the public sector.

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Costings for coastal saltmarsh

| | Current expenditure | 1st 5 yrs to 2004/2005 | Next 10 yrs to 2014/2015 |
|--|---------------------|------------------------|--------------------------|
| Current expenditure /£000/Yr | 203.5 | | |
| Total average annual cost /£000/Yr | | 176.4 | 339.6 |
| Total expenditure to 2005/£000 | | 881.9 | |
| Total expenditure 2005 to 2014/£000 | | | 3395.6 |

Mudflats

Habitat Action Plan

1. Current status

1.1 Physical and biological status

1.1.1 Mudflats are sedimentary intertidal habitats created by deposition in low energy coastal environments, particularly estuaries and other sheltered areas. Their sediment consists mostly of silts and clays with a high organic content. Towards the mouths of estuaries where salinity and wave energy are higher the proportion of sand increases. Mudflats are intimately linked by physical processes to, and may be dependent on, other coastal habitats such as soft cliffs and saltmarshes. They commonly appear in the natural sequence of habitats between subtidal channels and vegetated saltmarshes. In large estuaries they may be several kilometres wide and commonly form the largest part of the intertidal area of estuaries. However, in many places they have been much reduced by land claim.

1.1.2 Mudflats, like other intertidal areas, dissipate wave energy, thus reducing the risk of eroding saltmarshes, damaging coastal defences and flooding low-lying land. The mud surface also plays an important role in nutrient chemistry. In areas receiving pollution, organic sediments sequester contaminants and may contain high concentrations of heavy metals.

1.1.3 Mudflats are characterised by high biological productivity and abundance of organisms, but low diversity with few rare species. The mudflat biota reflects the prevailing physical conditions. The JNCC Marine Nature Conservation Review (MNCR) biotope codes for mudflats are LMU.SMu (Sandy mud shores), LMU.Mu (Soft mud shores) and LMS.MS (Muddy sand shores). In areas of lowered salinity, the macroinvertebrate fauna is predominantly of the Petersen *Macoma* community, characteristic species being: common cockle *Cerastoderma edule*, sand-hopper *Corophium volutator*, laver spire shell *Hydrobia ulvae*, ragworm *Hediste diversicolor* and, when salinity is low, large numbers of oligochaete annelids (principally *Tubificoides* spp). With a slight increase in the proportion of sand, the polychaetes catworm *Nephtys hombergi* and lugworm *Arenicola marina* occur. In slightly coarser areas, seagrass (*Zostera* spp) beds may develop. Where stones and shells provide an initial attachment for byssus threads, beds of the common mussel *Mytilus edulis* occur and accrete material through faecal deposition. Occasional stones or shells may also provide suitable attachment for stands of fucoid macroalgae such as *Fucus vesiculosus* or *F. spiralis*.

1.1.4 The surface of the sediment is often apparently devoid of vegetation, although mats of benthic microalgae (diatoms and euglenoids) are common. These produce mucilage (mucopolysaccharides) that binds the sediment. Under nutrient-rich conditions, there may be mats of the macroalgae *Enteromorpha* spp or *Ulva* spp.

1.1.5 The total UK estuarine resource has been estimated as c588,000 ha of which 55% is intertidal area, mostly mud and sandflats with a lesser amount of saltmarsh. Intertidal flats cover about 270,000 ha. The UK has approximately 15% of the north-west European estuarine habitat.

1.1.6 Mudflats are highly productive areas which, together with other intertidal habitats, support large numbers of predatory birds and fish. They provide feeding and resting areas for internationally important populations of migrant and wintering waterfowl, and are also important nursery areas for flatfish. They are widespread in the UK with significant examples in the Wash, the Solway Firth, Mersey Estuary, Bridgwater Bay and Strangford Lough.

1.2 Links with other action plans

1.2.1 Reference should be made to the saltmarsh and seagrass beds habitat action plans.

2. Current factors affecting the habitat

2.1 It has been estimated that sea level rise will result in a loss of 8000 to 10,000 ha of intertidal flats in England between 1993 and 2013. Much of this loss is expected in southern and south-east England although research suggests that the major firths in Scotland will also be affected. The rise results from sinking of the land following the end of the last ice age, plus the effects of global warming. Low water moves landward, but sea defences prevent a compensating landward migration of high water mark with the result that intertidal flats are squeezed out.

2.2 Land claim, for urban and transport infrastructure and for industry, has removed about 25% of Great Britain estuarine intertidal flats and up to 80% in some estuaries. Loss of mudflats reduces estuary productivity and may influence other estuary habitats such as saltmarsh. Although land claim has slowed considerably in recent years, it has not stopped.

| | | | |
|--------------|--|--------------|---|
| 2.3 | Barrage schemes for water storage, amenity, tidal power and flood defence continue to pose a threat to the integrity and ecological value of mudflats in estuaries and enclosed bays. | | animals, and the Bern Convention to conserve European wildlife and habitats. |
| 2.4 | Diffuse and point source discharges from agriculture, industry and urban areas, including polluted storm-water run-off, can create abiotic areas or produce algal mats which may affect invertebrate communities. They can also remove embedded fauna and destabilising sediments thus making them liable to erode. | 3.1.3 | Sites designated under EU law form part of the Natura 2000 series of protected habitats, ie Special Protection Areas (SPA) under the 1979 EC Birds Directive or Special Areas of Conservation (SAC) under the 1992 EC Habitats Directive. SACs may be designated for the Annex I habitat 'Mudflats and sandflats not covered by seawater at low tide'. Mudflats are also included within several other designated Annex I Habitats: 'Estuaries', 'Lagoons' and 'Large shallow inlets and bays'. |
| 2.5 | Oil and gas extraction and related activities, and dredging for navigation, have an important effect on sediment biota and on sediment supply and transport. Many coastal areas, including estuaries, are now either licensed or available for exploration and development. | 3.1.4 | Under the Wildlife and Countryside Act 1981, over 300 SSSIs which include mudflats have been designated on estuaries. In addition there are 22 (November 1998) coastal ASSIs in Northern Ireland, 10 of which contain significant areas of mudflats. |
| 2.6 | Fishing and bait digging can have an adverse impact on community structure and substratum. For example, suction dredging for shellfish or juvenile flatfish bycatch from the shrimp fisheries may have a significant effect on important predator populations. | 3.1.5 | The water quality on mudflats will be improved by a number of EC Directives including the Dangerous Substances, Shellfish (Waters), Integrated Pollution Control, Urban Waste Waters and Bathing Waters Directives. The forthcoming Water Framework Directive will also be relevant. The Oslo and Paris Convention (OSPAR) and the North Sea Conference declarations are also important. These commitments provide for the regulation of discharges to the sea and have set targets and quality standards covering many metals and pesticides, and other toxic persistent and bioaccumulative substances. |
| 2.7 | Human disturbance affects bird populations' roosting and feeding areas. | | |
| 2.8 | The introduction of new or non-native species, for example the spread of cord-grass <i>Spartina anglica</i> which has vegetated some upper-shore mudflat areas with important ecological consequences in some areas. | | |
| 2.9 | Within estuaries, mudflats deposited in the past may erode due to changed estuarine dynamics and remobilised sediment may be redeposited elsewhere in the same littoral sediment cell. Higher sea level and increased storm frequency, resulting from climate change, may further affect the sedimentation patterns of mudflats and estuaries. | 3.1.6 | Government departments (MAFF, SE, CEC, DTI and DETR) are responsible for the assessment of the potential impacts of oil and gas exploration and production aggregate extraction, marine construction work, land reclamation and dumping of dredged material prior to licensing. The conditions attached to these licences can stipulate that measures are adopted to minimise environmental impacts. Licences may be refused on environmental grounds. |
| 3. | Current action | 3.2 | Management, research and guidance |
| 3.1 | Legal status | 3.2.1 | The statutory nature conservation agencies have included the management of mudflats within several wider schemes. The Environment Agency (EA), and local authorities in England and Wales, with guidance from the Ministry of Agriculture Fisheries and Food (MAFF) and the National Assembly for Wales (NAW), develop Shoreline Management Plans (SMPs). The main remit of SMPs is for flood and coast protection, and includes recognition of the important role played by mudflats in protecting low lying coastal features. In Scotland, SNH is leading the Firths Initiative and SMPs are also being developed. The UK Marine SAC project is funded by the EU LIFE |
| 3.1.1 | Protection for mudflats is provided by various international and EU agreements and is implemented by the relevant UK enabling legislation. In addition the UK has its own domestic measures which can protect mudflats. Some of this legislation provides direct protection for the habitat +whilst other measures provide indirect protection by controlling water quality. | | |
| 3.1.2 | International designations of major significance to mudflats are the Ramsar Convention protecting wetlands of international importance, the Bonn Convention to protect migratory species of wild | | |

- programme to develop management schemes to be implemented under the EC Habitats Directive. Mudflats are included in the project's study sites. Many intertidal flats are also covered by Estuary Management Plans (EMPs). The EA takes similar considerations into account in its Local Environment Agency Plans (LEAPs). Many Local Nature Reserves, designated by local authorities, but often managed by Wildlife Trusts, are in upper intertidal areas and can benefit both saltmarsh and mudflats. Wildlife Trusts and the RSPB also own and/or manage mudflats within estuarine and coastal reserves.
- 3.2.2** The Natural Environment Research Council Special Research Topic Land Ocean Interaction Study (1994-8), included estuarine and coastal processes, with a component on littoral sediment processes (LISP). Similarly, the EU Marine, Science and Technology (MAST) programme ECOFLAT studied mudflat physical and biological processes and interactions.
- 3.2.3** English Nature has studied the loss of intertidal areas in the Essex estuaries and is collaborating with EA and MAFF on two different projects studying managed setback as a flood defence option in the Blackwater estuary: at Orplands and Tollesbury. At Orplands research with the EA on estuary hydrodynamics covers sediment erosion and accretion. At Tollesbury work has been done with MAFF on the re-creation of intertidal habitats for nature conservation and flood defence. These schemes have made a small contribution to the creation of new mudflats within the study areas. In Northern Ireland, a study of mudflats at the north end of Strangford Lough, on behalf of the Department of Agriculture Northern Ireland Rivers Agency, has been carried out prior to a major upgrade of the seawall.
- 3.2.4** Local Government planning guidelines (eg PPG20, NPPG7 and NPPG13) identify the consultation required on wetland habitat development. The publications *Strategy for Flood and Coastal Defence* (MAFF/WO, 1993) and *Towards Best Practice for Coastal Zone Management* (Department of the Environment, 1996) also consider mudflat habitats in the light of proposed developments.
- 4. Action plan objectives and proposed targets**
- 4.1** Maintain at least the present extent and regional distribution of the UK's mudflats. This target will require compensating predicted losses to development by the restoration of mudflats. Whilst this may not be possible in the same location, it should be within the same littoral sediment cell.
- 4.2** Create and restore enough intertidal area over the next 50 years to offset predicted losses to rising sea level in the same period. Predicted losses in the next 15 years should be offset in the next 10 years.
- 4.3** Restore estuarine water quality to ensure that existing mudflats fulfil their important ecological and conservation role.
- 5. Proposed action with lead agencies**
- 5.1 Policy and legislation**
- 5.1.1** Provide a clear national policy by 2000 for SMPs, land use planning and development control policy which ensures that there is no net loss of tidal flats by development, from a 1992 baseline, and that provision is made for the restoration of natural losses over the longer term. (ACTION: DETR, EA, MAFF, NAW, SE, SEPA)
- 5.1.2** Monitor the implementation of strong development control policies by 2001 to prevent development in flood risk areas (as defined by Water Resources Act 1991 Section 105(2) Surveys), with the objective of retaining the option to use such areas for the restoration of intertidal flats if required. (ACTION: DETR, DoE(NI), LAs, MAFF, NAW, SE)
- 5.1.3** Strengthen development and coastal protection planning policy to ensure where possible the maintenance of all active sediment sources that supply intertidal flats by 2001. (ACTION: Crown Estates, DETR, DoE(NI), MAFF, NAW, SE)
- 5.1.4** Develop policies to use soft dredged material from estuaries to create mudflats elsewhere (in the same estuary where possible). (ACTION: MAFF, Port authorities)
- 5.1.5** Continue to support the establishment of EMPs and related projects on all estuaries with significant intertidal flats (ACTION: CCW, EHS, EN, SNH)
- 5.2 Site safeguard and management**
- 5.2.1** Apply appropriate conservation designations to all intertidal areas that meet national and international criteria for site selection and ensure appropriate management of designated sites by 2003. (ACTION: CCW, DETR, EHS, EN, SEPA, SNH)
- 5.2.2** Ensure that wherever practicable coastal defence or other construction works avoid disruption of coastal processes that might lead to a loss of, or damage to,

- mudflats. (ACTION: DANI, DoE(NI), EHS, EA, LAs, MAFF, NAW, SE)
- 5.2.3** Maintain and where possible improve estuarine and coastal water quality. (ACTION: EA, EHS, MAFF, SE, SEPA)
- 5.3 Advisory**
- 5.3.1** Ensure that good-practice guidance is available to shoreline management authorities on how to plan for the maintenance of mudflats in a period of rising sea level by 2000. Particular attention should be given to the use of dredged material for this purpose and the creation of new mudflats. (ACTION: DoE(NI), EA, MAFF, NAW, Port Authorities, SE)
- 5.4 International**
- 5.4.1** Ensure that relevant European statutes and international conventions provide adequate protection for mudflats. (ACTION: DETR, MAFF)
- 5.5 Monitoring and research**
- 5.5.1** Run field trials to refine and demonstrate techniques for habitat restoration and creation by 2002. Particular attention should be given to the use of dredged material for this purpose. (ACTION: CCW, EA, EHS, EN, MAFF, Port authorities, SE, SNH)
- 5.5.2** Continue to develop an understanding of the value of mudflats for flood and coastal defence and the holistic management of these habitats in conjunction with flood risk management. (ACTION: EA, MAFF, NAW, SE, SEPA, SNH)
- 5.5.3** Develop holistic quality criteria for the management and monitoring of mudflats by 2002. (ACTION: JNCC)
- 5.5.4** Initiate research into sediment exchange processes between mudflats and other coastal habitats and on the dynamics of cohesive sediments in estuaries. (ACTION: CCW, EA, EHS, EN, MAFF, SE, SEPA, SNH)
- 5.5.5** Collect and collate information on the extent, quality, loss/change of mudflat resource to allow targets to be set and progress to be monitored by 2000. (ACTION: CCW, EHS, EN, JNCC, SNH)
- 5.6 Communications and publicity**
- 5.6.1** Educate planning authorities and developers on the important functions of mudflats in estuarine and coastal systems by the preparation and dissemination of a

pamphlet by 2001. (ACTION: CCW, EA, EHS, EN, MAFF, SE, SEPA, SNH)

- 5.6.2** Raise public awareness of the ecological and socio-economic value of mudflats by 2001. (ACTION: CCW, EHS, EN, SNH)

6. Costings

- 6.1** The successful implementation of this habitat action plan will have resource implications for both the public and private sectors. The data in the table opposite provide an estimate of the current expenditure on the habitat and the likely additional resource costs. These additional costs are based on the annual average over 5 and 10 years. The total expenditure for these time periods is also given. Almost all the costs will relate to the public sector, although some costs (eg for research) will be met by the private sector/non-governmental organisations).

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Costings for mudflats

| | Current expenditure | 1st 5 yrs to 2004/2005 | Next 10 yrs to 2014/2015 |
|--|---------------------|------------------------|--------------------------|
| Current expenditure /£000/Yr | | | |
| Total average annual cost /£000/Yr | | 130.6 | 39.5 |
| Total expenditure to 2005/£000 | | 653 | |
| Total expenditure 2005 to 2014/£000 | | | 395 |

Sheltered muddy gravels

Habitat Action Plan

1. Current status

1.1 Physical and biological status

1.1.1 Sheltered muddy gravel habitats occur principally in estuaries, rias and sea lochs, in areas protected from wave action and strong tidal streams. In fully marine conditions on the lower shore this habitat can be extremely species-rich because the complex nature of the substratum supports a high diversity of both infauna and epifauna. However, good quality examples of this habitat are very scarce. Polychaetes and bivalve molluscs are normally dominant and the most varied, but representatives of most marine phyla can be present. The fauna is often characterised by a large range in body size. As one moves into an estuary, with a consequent reduction in salinity, there is a marked reduction in species richness. Low salinity (mid to upper estuarine) muddy gravels have a lower, but distinctive, species diversity. This plan concentrates on the intertidal and shallow subtidal high salinity muddy gravel habitats.

1.1.2 The carpet shell mollusc *Venerupis senegalensis* is often, though not necessarily, present and can sometimes occur in large numbers. The blunt gaper *Mya truncata* is another characteristic species. There are considerable variations in the composition of these communities depending upon the sediment composition and salinity regime present. Members of the fully saline community can include the tube-dwelling polychaetes *Sabella pavonina*, *Myxicola infundibulum* and *Amphitrite edwardsi*, the sipunculan worm *Golfingia* sp, the anemones *Sagartia troglodytes* and *Cereus pedunculatus* and the holothurian *Labidoplax digitata*. Burrowing deposit-feeding polychaetes such as *Notomastus latericeus*, *Aphelocheata marioni* and *Melinna palmata* may be abundant throughout the salinity range. The presence of coarse gravel and stones at the sediment surface often provides a substratum for the attachment of a variety of fauna and epiflora, for example fucoids, ephemeral green algae with associated littorinids and filamentous red algae.

1.1.3 Although the most diverse communities occur in fully saline conditions a number of different species can occur under reduced salinity (upper estuarine) conditions. Here, *Mya arenaria* may be present, with the polychaetes *Neanthes virens* and *Cirriformia tentaculata*, the cockle *Cerastoderma edule* and the native oyster *Ostrea edulis*. Oligochaetes and the rag worm *Hediste diversicolor* usually dominate the upper estuarine low salinity muddy gravels.

1.1.4 The priority habitat may be considered as an intertidal extension of a habitat more common in the sublittoral. The communities of interest to this plan are restricted to the intertidal and shallow sublittoral. Shallow subtidal muddy gravel (more than 3 m below Chart Datum) can contain communities of burrowing anemones such as *Mesacmaea mitchelli*, *Aureliania heterocera*, *Cereus pedunculatus* and *Cerianthus lloydii*. Deeper water muddy gravel associations are not considered here. However, there are similarities in the infaunal component of the offshore muddy-gravel (*Venerupis*) associations.

1.1.5 The JNCC Marine Nature Conservation Review (MNCR) biotope classification (version 97.06) identifies three biotopes relevant to this action plan:

! IMX.VsenMtru (*Venerupis senegalensis* and *Mya truncata* in lower shore or infralittoral muddy gravel) - typical of fully marine areas.

! LMX.Mare (*Mya arenaria* and polychaetes in muddy gravel shores) - typical of partially reduced salinity areas.

! LMX.MytFab (*Mytilus edulis* and *Fabricia stellaris* on poorly-sorted muddy sand or muddy gravel shores) - a fully marine, but possibly stressed biotope.

1.1.6 Other related shallow sublittoral biotopes include IMX.An (Burrowing anemones in sublittoral muddy gravel), IMX.CreAph (*Crepidula fornicata* and *Aphelocheata marioni* in variable salinity infralittoral mixed sediment) and IMX.PolMtru (*Polydora ciliata*, *Mya truncata* and solitary ascidians in variable salinity infralittoral mixed sediment).

1.1.7 Analysis of the survey records held on the MNCR database suggests that fully saline sheltered muddy gravel communities are scarce in their British distribution. However, the biotope is found extensively in the Solent and Helford River. Other notable locations include the rias of south-west Britain, for example the Fal Estuary, Salcombe Harbour and Milford Haven. Other known sites include the Sound of Arisaig, Lough Foyle, the Dyfi Estuary and Llanbedrog on the Llyn Peninsula.

1.1.8 Available descriptions of intertidal muddy gravel beds are often sparse on detail due to a lack of comprehensive data. They are not easy to survey and monitor, due to the large quantities of coarse material that would need to be laboriously sampled and sieved.

1.1.9 Historical data on the distribution of muddy gravel beds are also very limited, presumably for similar reasons to those given above. Information from surveys carried out in the early 1900s in certain inlets (particularly the Kingsbridge Estuary and Helford River) highlights the extremely diverse communities found in muddy gravel habitats at that time. A review of sediment shores in Great Britain in the late 1970s described a similar distribution of muddy gravel communities to that shown by more recent surveys.

1.2 Links with other action plans

1.2.1 Attention is drawn to the sublittoral sands and gravels and mud in deep water habitat action plans as these habitats and sheltered muddy gravels occur in similar locations such as sea lochs. A transition with depth is therefore possible between these habitats.

1.2.2 Reference should also be made to the native oyster species action plan.

2. Current factors affecting the habitat

2.1 Physical disturbance: Coastal developments including the construction of marinas and slipways, sediment extraction, the widening and dredging of channels and sea defences such as barrages. Such activity may alter tidal flow patterns, affecting the sedimentary conditions across the gravel beds.

2.2 Bait digging: This is especially prevalent in the slightly reduced salinity conditions where king rag *Neanthes virens* is common.

2.3 Fisheries: Intertidal mollusc beds, including *Venerupis senegalensis*, have been the subject of small fisheries in the past. The current fishery is small, but has the potential for a resurgence, whereas *Mercenaria mercenaria* dredging in Southampton Water has severely disrupted this habitat. The molluscs are normally taken for export (eg to Spain) and local human consumption - in dishes such as 'paella' and 'clam chowder'.

2.4 Organic enrichment, especially sewage pollution stress: Severe pollution can lead to anoxic conditions and a decrease in macrobenthic populations and species diversity.

2.5 Persistent bio-accumulating chemicals (eg polychlorinated biphenyls and tri-butyl tin), waste discharges containing heavy metals and chemicals.

2.6 Introduction of non-native species: *Crepidula fornicata* can dominate the fauna resulting in the smothering of the sediment surface leading to anoxia in

the sediment. They are also considered a pest of oyster beds.

3. Current action

3.1 Legal status

3.1.1 Areas of muddy gravels are incorporated within some Ramsar sites, and Special Protection Areas (SPAs). The habitat is also included within some coastal SSSIs in Great Britain and ASSIs in Northern Ireland, although the current seaward limit of SSSIs in England and Wales and ASSIs to Mean Low Water mark would preclude many examples of the habitat.

3.1.2 Muddy gravel biotopes also occur in a number of candidate Special Areas of Conservation (SAC), under the EC Habitats Directive, including Plymouth Sound, the Fal and Helford Estuaries, the Sound of Arisaig and Llyn Peninsula. There are, however, areas in many other inlets that are not currently protected by any legislation.

3.1.3 Although *Venerupis senegalensis* and other muddy gravel molluscs are occasionally fished commercially, there is no EC or national legislation setting limitations on shell size or catch size. The South Wales Sea Fisheries Committee and the North Western and North Wales Sea Fisheries Committee, however, have recently produced byelaws for the control of bivalve mollusc fisheries. Although these regulations do not set limits on shell size, they control the use of fishing vessels and dredging gear (through licensing) and enable the Committees to establish closed seasons and areas. The byelaws have been created in response to the increasing pressures on razor shells and other bivalves in sandy coastal sediments, but they might enable the Committees to similarly manage muddy gravel molluscan fisheries if the occasion arose. Regulating orders are being examined as appropriate fisheries management measures for shellfish on the west coast of Scotland.

3.1.4 Discharges to the sea are controlled by a number of EC Directives, including the Dangerous Substances, Shellfish (Waters), Integrated Pollution Control, Urban Waste Water Treatment, and Bathing Waters Directives. The forthcoming Water Framework Directive will also be relevant. The Oslo and Paris Convention (OSPAR) and North Sea Conference declarations are also important. These commitments provide powers to regulate discharges to the sea and have set targets and quality standards to marine waters. An extensive set of standards covering many metals, pesticides and other toxic, persistent and bioaccumulative substances, and nutrients have been set under UK legislation.

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| 3.2 | Management, research and guidance | | through other mechanisms by 2003. (ACTION: CCW, EHS, EN, JNCC, SNH) |
| 3.2.1 | Information on the distribution of areas of muddy gravel biotopes was collected as part of the MNCR. Much of the most relevant information comes from the Nature Conservancy Council Harbours, Rias and Estuaries surveys (1985 to 1988), the Marine Biological Association/Scottish Marine Biological Association (now known as Scottish Association for Marine Science) intertidal surveys (1976 to 1980) and the CCW Phase 1 Intertidal survey, which now covers more than 10% of the Welsh coast. | 5.2.2 | Ensure that representative examples of sheltered muddy gravel habitats in SACs and SPAs are protected from the adverse effects of fishing activities, development schemes, and dredging operations and associated disposal activities. (ACTION: All relevant authorities) |
| 3.2.2 | Management schemes for relevant SACs are being developed and will include appropriate monitoring programmes. The methodology to be adopted for the study of specific features is under review. | 5.2.3 | Reduce inputs to coastal waters as required under international, EC and domestic pollution control obligations. (ACTION: DoE(NI), EA, SEPA) |
| 3.2.3 | Marine biological monitoring programmes, established by a variety of organisations and including muddy gravel sites, already exist in a number of inlets. The longest running and most relevant of these is that of the Helford Voluntary Marine Conservation Area Group. The muddy gravel habitats which are so common in the Helford are a focus for some of this work. | 5.2.4 | Enforce control of input and accumulation of debris from pleasure craft and fishing vessels and provide waste reception facilities and waste management plans. (ACTION: DETR, DTI, EHS, NAW, Port and Harbour authorities, SE) |
| 3.2.4 | The Environment Agency undertook a programme of studies in the early 1990s in an attempt to classify estuarine systems by the quality of their waters. The programme was most comprehensively undertaken in the Agency's south-west region, where the surveys looked at water quality parameters, sediment and macrofauna. | 5.2.5 | Take account of the conservation requirements of sheltered muddy gravel beds in the development and implementation of coastal zone management plans, ensuring that they are managed in conjunction with other habitats and communities in the same locales. (ACTION: LAs) |
| 4. | Action plan objectives and proposed targets | 5.3 | Advisory |
| 4.1 | Maintain the extent, distribution and quality of sheltered muddy gravel bed habitats, as defined in section 1 of this habitat action plan. | 5.3.1 | Inform local authorities, port and harbour authorities of the reasons for protection of this scarce marine habitat where they have a statutory obligation for its conservation. (ACTION: CCW, EHS, EN, SNH) |
| 5. | Proposed action with lead agencies | 5.4 | International |
| 5.1 | Policy and legislation | 5.4.1 | None proposed. |
| 5.1.1 | Simplify the emergency powers procedure for controlling molluscan fisheries as necessary to protect sheltered muddy gravels. (ACTION: MAFF, NAW, SE) | 5.5 | Future monitoring and research |
| 5.2 | Site safeguard and management | 5.5.1 | Identify nutrient Water Quality (WQ) standards for nutrients that will protect this habitat, and examine the ability of existing regulatory mechanisms to ensure compliance with such standards. (ACTION: CCW, EA, EHS, EN, SEPA, SNH) |
| 5.2.1 | Determine the full extent of the sheltered muddy gravel resource that currently falls within designated areas. Explore alternative means of securing the conservation of representative examples of muddy gravel habitats | 5.5.2 | Gather, compile and publish a detailed account of the extent, quality, current status and geographical distribution of fully saline sheltered muddy gravel beds around the UK by the year 2002. (ACTION: CCW, EHS, EN, JNCC, SNH) |
| | | 5.5.3 | Undertake further structured survey work, especially within SAC boundaries. Further work should be undertaken in Plymouth Sound, the Fal Estuary and Helford River, Milford Haven and Dornoch Firth. This work should endeavour to further delineate community |

composition and also to provide detailed information on the other physical characteristics of the habitat. (ACTION: CCW, EHS, EN, JNCC, SNH)

- 5.5.4** Develop and standardise monitoring methodology specific to the characteristics of sheltered muddy gravel beds by 2002. (ACTION: CCW, EHS, EN, JNCC, SNH)

5.6 Communications and publicity

- 5.6.1** Produce appropriate information for coastal zone management groups and the general public about the conservation needs of this habitat and related biotopes. (ACTION: CCW, EHS, EN, SNH)

6. Costings

- 6.1** The successful implementation of this habitat action plan will have resource implications for both the public and private sectors. The data in the table below provide an estimate of the current expenditure on the habitat and the likely additional resource costs. These additional costs are based on the annual average over 5 and 10 years. The total expenditure for these time periods is also given. Almost all the costs will relate to the public sector, although some costs (eg for research) will be met by the private sector/non-governmental organisations).

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Costings for sheltered muddy gravels

| | Current expenditure | 1st 5 yrs to 2004/2005 | Next 10 yrs to 2014/2015 |
|--|----------------------------|-------------------------------|---------------------------------|
| Current expenditure /£000/Yr | | | |
| Total average annual cost /£000/Yr | | 42.2 | 2 |
| Total expenditure to 2005/£000 | | 211 | |
| Total expenditure 2005 to 2014/£000 | | | 20 |

Sabellaria spinulosa reefs

Habitat Action Plan

1. Current status

1.1 Physical and biological status

1.1.1 *Sabellaria spinulosa* reefs, JNCC Marine Nature Conservation Review (MNCR) biotope code CMX.SpiMx, comprise dense subtidal aggregations of this small, tube-building polychaete worm. *Sabellaria spinulosa* can act to stabilise cobble, pebble and gravel habitats, providing a consolidated habitat for epibenthic species. They are solid (albeit fragile), massive structures at least several centimetres thick, raised above the surrounding seabed, and persisting for many years. As such, they provide a biogenic habitat that allows many other associated species to become established. The *S. spinulosa* reef habitats of greatest nature conservation significance are those which occur on predominantly sediment or mixed sediment areas. These enable a range of epibenthic species with their associated fauna and a specialised ‘crevice’ infauna, which would not otherwise be found in the area, to become established. Studies have compared an area of *S. spinulosa* with other macrofaunal communities in the Bristol Channel and found that the former had a higher faunal diversity (more than 88 species) and higher annual production (dominated by suspension-feeders) than other benthic communities in the area.

1.1.2 *S. spinulosa* requires only a few key environmental factors for survival in UK waters. Most important seems to be a good supply of sand grains for tube building, put into suspension by strong water movement (either tidal currents or wave action). *S. spinulosa* also appears to be very tolerant of polluted conditions. The worms need some form of hard substratum to which their tubes will initially be attached, whether bedrock, boulders, artificial substrata, pebbles or shell fragments. However, the presence of extensive reefs in predominantly sediment areas indicates that, once an initial concretion of tubes has formed, additional worms may settle onto the colony enabling it to grow to considerable size without the need for additional ‘anchorage’ points. Published work has noted that the planktonic larvae are strongly stimulated to settle onto living or old colonies of *S. spinulosa*, although they will eventually (after two or three months in the plankton) settle onto any suitable substratum in the absence of other individuals.

1.1.3 Given its few key requirements, and its tolerance of poor water quality, *S. spinulosa* is naturally common around the British Isles. It is found in the subtidal and lower intertidal/sublittoral fringe with a wide distribution throughout the north-east Atlantic, especially in areas of

turbid seawater with a high sediment load. Recent research in the Wash using remote video, identified very extensive areas of reef rising up to 60 cm above the seabed and almost continuously covering a linear extent of 300 m. However, in most parts of its geographical range *S. spinulosa* does not form reefs, but is solitary or in small groups encrusting pebbles, shell, kelp holdfasts and bedrock. It is often cryptic and easily overlooked in these habitats. Where conditions are favourable, much more extensive thin crusts can be formed, sometimes covering extensive areas of seabed. However, these crusts may be only seasonal features, being broken up during winter storms and quickly reforming through new settlement the following spring. There are extensive examples of this form of colony on the west Wales coast, particularly off the Llyn Peninsula and Sarnau candidate Special Area of Conservation (cSAC) and the Berwickshire and North Northumberland Coast cSAC. These crusts are not considered to constitute true *S. spinulosa* reef habitats because of their ephemeral nature, which does not provide a stable biogenic habitat enabling associated species to become established in areas where they are otherwise absent.

1.1.4 The closely related *Sabellaria alveolata* has been recorded as living for up to nine years. It is possible that *S. spinulosa* is similarly long-lived. The examination of reefs in the Bristol Channel revealed that they possessed only a small number of young, derived from sources outside of the study area. The adults in the colony were not gravid during the study and grew very little. The age of a colony may greatly exceed the age of the oldest individuals present, as empty concretions of *S. spinulosa* sand tubes are frequently found and must be able to persist for some time in the marine environment. However, there have been no studies of the longevity of individual worms, or the longevity and stability of colonies or reefs.

1.1.5 Consideration of the present and historical status of this habitat in the Wadden Sea area is useful because it has been much better studied than in the UK. Large subtidal *S. spinulosa* reefs in the German Wadden Sea, which provided an important habitat for a wide range of associated species, have been completely lost since the 1920s. *S. spinulosa* now appears in the *Red List of Macrofaunal Benthic Invertebrates of the Wadden Sea*.

1.2 Links with other action plans

1.2.1 In this action plan and those for *Sabellaria alveolata* and sublittoral sands and gravels’ emphasis is placed on

damage that may be caused by physical disturbance. Sessile organisms in these habitats are vulnerable to damage resulting from fishing activity and aggregate extraction.

2. Current factors affecting the habitat

2.1 The greatest impact on this biogenic habitat is considered to be physical disturbance from fisheries activities. Dredging for oysters and mussels, trawling for shrimp or fin fish, net fishing and potting can all cause physical damage to erect *S. spinulosa* reef communities. The impact of the mobile gear breaks the reefs down into small chunks which no longer provide a habitat for the rich infauna and epifauna associated with this biotope. Research has attributed the loss of the large *S. spinulosa* reefs in the Wadden Sea to the long-term effects of fishing activity. It has also been noted that commercial fishermen sought out areas of *S. spinulosa* before trawling for pink shrimp *Pandalus montagui*, and appear to have destroyed the reefs along with their associated shrimp fishery in the process. A similar detrimental effect on *S. spinulosa* was reported during the 1950s in Morecambe Bay. Published work has also identified crustacean shellfisheries and potting, and molluscan shellfisheries, as the activities to which *S. spinulosa* accretions are most sensitive.

2.2 Aggregate dredging often takes place in areas of mixed sediment where *S. spinulosa* reefs may occur. For example, an Environmental Statement by Civil and Marine (1994) on a dredging licence for the outer Bristol Channel raised concern over the occurrence of some *S. spinulosa* reefs within the proposed licence area. Some dredged samples were comprised of up to 60% *S. spinulosa* by volume. The impacts of this activity on their long-term survival is unknown, but suspension of fine material during adjacent dredging activity is not considered likely to have detrimental effects on the habitat. A licence condition has therefore been stipulated that the operator, when dredging, avoids the reefs identified within the licensed zone. Aggregate extraction is not considered to be as significant a threat as commercial fisheries, provided that environmental assessments identify reefs, exclude licenced areas and/or establish 'refuge' zones, avoid other reef habitats while dredging, and carry out appropriate monitoring and biological study.

2.3 Pollution is listed as one of the major threats to *S. spinulosa* in the Wadden Sea. However, pollution was not identified as a significant problem (sludge dumping in Dublin Bay actually encouraged the establishment of *Sabellaria*) unless high sedimentation drastically changed the substratum. *S. spinulosa* reefs in the Wadden Sea, destroyed by fishing activities, have been replaced by beds of mussel *Mytilus edulis* and sand-dwelling amphipods *Bathyporeia* spp. This is

partly attributed to an increase in coastal eutrophication, favouring *Mytilus*.

2.4 The risk to *S. spinulosa* from trawling and dredging has been considered high. Other research has assigned scores of moderately high to very high for damage, fragility, longevity and stability to *Sabellaria* accretions, but a low intolerance score (these species are considered to be tolerant to a moderate variety of environmental changes). Recovery was considered to be unlikely within ten years. Regeneration of this habitat is classified as 'difficult' (15-150 years) in the Wadden Sea Red List.

3. Current action

3.1 Legal status

3.1.1 There is currently no statutory protection for known examples of this sublittoral habitat in the UK. The marine SACs list is incomplete with respect to biogenic reefs, although *Sabellaria spinulosa* reefs may represent important sub-features of other Annex I habitats for which a site was selected. None of the cSACs were selected specifically for biogenic reefs, although they may represent important sub-features of other Annex I habitats ('Sandbanks which are covered by seawater at all times'; 'Large shallow bays and inlets', and 'Estuaries'), for which a site was selected. Environmental assessments carried out prior to aggregate extraction operations could result in refusal of licences by the Department of the Environment, Transport and the Regions (DETR), or imposition of conditions to minimise dredging impacts.

3.2 Management, research and guidance

3.2.1 Two recent studies have provided a significant contribution towards the understanding of this habitat and the gaps in knowledge which require attention. The MNCR Database holds information on the occurrence of *S. spinulosa* around the UK coast, and examples of reef habitats may be identified during mapping surveys of both candidate and proposed marine SACs. Researchers monitoring aggregate extraction may hold unpublished data on persistence, growth and other biological characteristics.

4. Action plan objectives and proposed targets

It is difficult to set biological targets for this habitat when so little is known about its distribution, stability, rate of (re-)establishment and recovery. Increased survey and research effort is required before quantitative habitat targets can be set. The following objectives and targets are suggested.

| | | | |
|-------|--|-------|---|
| 4.1 | By 2004 quantify and maintain the extent, distribution and quality of existing <i>S. spinulosa</i> reefs in the UK. | | <i>montagui</i>) and identify indicators of habitat quality. (ACTION: CCW, EN, JNCC, MAFF) |
| 4.2 | Ensure known areas of <i>S. spinulosa</i> reef are avoided by seabed operations that may cause direct impact. | 5.5.2 | Investigate and assess the distribution, area and habitat quality of <i>S. spinulosa</i> reefs. (ACTION: CCW, EHS, EN, JNCC, SNH) |
| 4.3 | By 2004 establish and ensure necessary habitat conditions required for the re-establishment of <i>S. spinulosa</i> reef where formerly found, for example in the Essex Estuaries and Morecambe Bay. Establish monitoring programmes to determine the success of these initiatives. | 5.5.3 | Investigate life cycles, recruitment and longevity of reefs and their associated fauna. Commission research on the interaction and competition between <i>S. spinulosa</i> and other filter feeders (eg <i>Ophiothrix fragilis</i> and <i>Mytilus edulis</i>). (ACTION: CCW, CEC, EN, MAFF, NERC, SNH) |
| 5. | Proposed action with lead agencies | 5.5.4 | Initiate biological monitoring programmes in aggregate dredged and undredged areas. (ACTION: CEC, MAFF) |
| 5.1 | Policy and legislation | 5.5.5 | Study the effect of towed fishing gear on <i>S. spinulosa</i> reefs, their potential for recovery and rates of recovery. (ACTION: CCW, EHS, EN, MAFF, NAW, NERC, SE, SNH) |
| 5.1.1 | Exclude important examples of <i>S. spinulosa</i> reef from aggregate extraction licence areas. Attach detailed monitoring and research conditions to other licences. (ACTION: CCW, CEC, DETR, EHS, EN, MAFF, NAW, SE) | 5.5.6 | By 2004, compile an inventory of areas which formerly supported <i>S. spinulosa</i> reefs, establish the necessary habitat conditions for re-establishment, and identify the highest priority sites for re-establishment. (ACTION: CCW, EHS, EN, JNCC, SNH) |
| 5.1.2 | Ensure that all relevant SAC management schemes take account of the effects of dredging and trawling. (ACTION: All relevant authorities) | 5.6 | Communications and publicity |
| 5.2 | Site safeguard and management | 5.6.1 | Raise awareness of the importance of <i>S. spinulosa</i> reef habitats to marine biodiversity within the dredging and fishing industry. (ACTION: CCW, CEC, EHS, EN, MAFF, SE) |
| 5.2.1 | Establish restrictions on use of mobile fishing gear within areas of known and former habitat where recovery is sought. (ACTION: DANI, MAFF, LAs, SE, SFCs) | 5.6.2 | Publish an appropriate code of practice for commercial and recreational marine users. (ACTION: CCW, CEC, EHS, EN, MAFF, SE, SNH) |
| 5.2.2 | Establish voluntary mechanisms outside SACs. (ACTION: CCW, EN, EHS, SFC, SNH) | 6. | Costings |
| 5.3 | Advisory | 6.1 | The successful implementation of this habitat action plan will have resource implications for both the public and private sectors. The data in the table overleaf provide an estimate of the current expenditure on the habitat and the likely additional resource costs. These additional costs are based on the annual average over 5 and 10 years. The total expenditure for these time periods is also given. Almost all the costs will relate to the public sector, although some costs (eg for research) will be met by the private sector/non-governmental organisations). |
| 5.3.1 | By 2002 develop a code of practice to protect against damage from dredging and trawling. (ACTION: CCW, EHS, EN, MAFF, SE, SFCs, SNH) | | |
| 5.4 | International | | |
| 5.4.1 | Participate in initiatives to develop and strengthen measures for conservation of <i>S. spinulosa</i> reefs in Europe and elsewhere. (ACTION: DETR, JNCC) | | |
| 5.5 | Monitoring and research | | |
| 5.5.1 | Refine the MNCR list of characteristic species associated with <i>S. spinulosa</i> reefs, including commercial species (eg pink shrimp <i>Pandalus</i> | | |

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Costings for *Sabellaria spinulosa* reefs

| | Current expenditure | 1st 5 yrs to 2004/2005 | Next 10 yrs to 2014/2015 |
|--|---------------------|------------------------|--------------------------|
| Current expenditure /£000/Yr | | | |
| Total average annual cost /£000/Yr | | 53.6 | 21.1 |
| Total expenditure to 2005/£000 | | 268 | |
| Total expenditure 2005 to 2014/£000 | | | 211 |

Tidal rapids Habitat Action Plan

1. Current status

1.1 Physical and biological status

1.1.1 In this habitat action plan, the term ‘tidal rapids’ is used to cover a broad range of high energy environments including deep tidal streams and tide-swept habitats. The JNCC's Marine Nature Conservation Review (MNCR) defined rapids as ‘strong tidal streams resulting from a constriction in the coastline at the entrance to, or within the length of, an enclosed body of water such as a sea loch. Depth is usually shallower than five metres.’ In deeper situations, defined in this plan as being more than five metres, tidal streams may generate favourable conditions for diverse marine habitats (eg the entrances to fjordic sea lochs, between islands, or between islands and the mainland, particularly where tidal flow is funnelled by the shape of the coastline). Wherever they occur, strong tidal streams result in characteristic marine communities rich in diversity, nourished by a constantly renewed food source brought in on each tide.

1.1.2 The marine life associated with these habitats is abundant in animals fixed on or in the seabed, and typically include soft corals, hydroids (sea firs), bryozoans (sea mats), large sponges, anemones, mussels and brittlestars in dense beds. In shallow water, bedrock and boulders often support kelp and sea oak plants, which grow very long in the tidal currents, and have a variety of animals growing on them. Other smaller red and brown seaweeds grow on cobbles and pebbles, many of these being characteristic of tide-swept situations. Both the Menai Strait in North Wales and the Scilly Isles provide good examples of tide-swept communities considered to be of national importance. Also, the Dorn in Strangford Lough MNR is remarkable for its diversity of flora and fauna and for displaying a marked emergence phenomenon. Coarse gravel is a more difficult habitat for animals to colonise, as it is constantly moving, yet even here there are typical animals, such as sea cucumbers, worms and burrowing anemones. Maerl beds are also closely identified with the conditions found in tidal narrows and rapids in the south-west (the Fal estuary) and the north of the British Isles (Orkney).

1.1.3 In deeper water, such as between islands, strong tidal streams may be felt down to 30 m. For example, between the Pembrokeshire islands strong tidal currents in the centre of Ramsey Sound provide conditions for a distinctive community, unrecorded elsewhere in south-west Britain.

1.1.4 An important range of tidal rapid habitats are found in Scottish and Irish fjordic and fjardic sea lochs. Fjordic sea lochs occur in the more mountainous areas of the Scottish west coast and islands and were formed by the scouring action of glaciers and ice sheets. The result was an over-deepened basin (with some examples recording a charted depth of 200 m) or a series of basins connected to each other and the open sea by narrow and shallow ‘sills’ at depths of less than 30 m, with many less than 20 m. It is this high energy sill habitat, over which the tide flows, that produces the diverse communities that inhabit this environment. A considerable volume of water may move over the sill during the tidal cycle, with a tidal range in some Scottish sea lochs of up to 5 m on spring tides, generating a tidal flows of up to 10 knots. For example, Strangford Lough in Northern Ireland also has a long rapids system with very strong tidal streams up to 8 knots.

1.1.5 The variability of sea lochs in size, shape, number of basins and length and depth of sills, produces a wide range of marine communities. The seabed may be of bedrock and boulders, or a range of mixed material down to coarse shell gravel. The species composition of tidal rapids in some sea lochs may also be influenced by marked variations in salinity.

1.1.6 Fjardic sea lochs are much shallower often with a maze of islands and shallow basins connected by rapids, which are usually less than five metres deep and often intertidal. Fjardic sea lochs are found mainly in the Western Isles.

1.1.7 The morphology of fjords and fjards is therefore very different to lowland marine inlets and the estuaries of the south and east of the British Isles. However, in south-west England, eustatic change has created rias by drowning coastal river valleys such as the Dart, Tamar and Fal. At the narrow entrances of these rias, strong tidal currents have generated diverse habitats of biological significance.

1.2 Links with other action plans

1.2.1 The actions proposed in this habitat action plan should be combined with efforts to implement other action plans for habitats that share high energy environments, for example maerl beds and *Modiolus modiolus* beds.

2. Current factors affecting the habitat

2.1 The richness and variety of marine life in tidal rapids relies primarily on the strong water currents to carry

food in, and waste materials and fine sediments away. Any obstruction to the water flow can be expected to have adverse effects on the fauna and flora. Various impacts which potentially affect water flow are listed below.

- 2.1.1** The ferries which used to run across the rapids at the entrance to many west coast sea lochs have been gradually replaced by bridges and causeways carrying roads. In many cases the bridges are carried by one or two uprights standing in the centre of the rapids. While this caused some destruction of habitat during construction, restriction to water flow is not substantial and tide-swept communities recovered. However, in a few cases, particularly in the Western Isles, solid causeways with no provision for water exchange, or with only small culverts, have been built across rapids, for instance the causeway joining Vatersay with Barra (Churchill Barriers, Orkney).
- 2.1.2** Tidal power generation has been suggested in conjunction with bridge construction in areas with strong tidal flow as a means of generating electricity. Depending on scale and local circumstances, these could have a devastating effect on communities in rapids and within enclosed bodies of water.
- 2.1.3** Tidal barriers have been built for various reasons in the past, usually for fishing activities. These have generally been across small, shallow rapids connecting brackish lochs with the sea, and may well have changed the ecology of the lochs considerably through restriction of seawater influence and consequent changes in salinity. The effects on the connecting rapids can also be expected to be drastic.
- 2.1.4** In general, tidal rapids are little affected by fishing because the strong tidal streams make fishing operations difficult. However, rapids often have dense beds of animals, for example mussels, which may become attractive for exploitation in the future. Rapids can be a sanctuary for crustaceans because strong tidal currents make creeling difficult.
- 2.1.5** Rapids may contain species sensitive to water pollution. Although the currents in rapids may quickly disperse one-off sources of pollution, chronic continuing pollution could affect sensitive marine life.

3. Current action

3.1 Legal status

- 3.1.1** Strangford Lough in Northern Ireland, including the rapids, is protected as a statutory Marine Nature Reserve, and the Menai Strait is a proposed Marine Nature Reserve. A few Scottish rapids are partly included within intertidal SSSIs (Linne Mhuirich rapids,

in Loch Sween, for example, is part of the Taynish Wood SSSI down to mean low water of spring tides), but these designations do not include the sublittoral parts of the rapids which contain much of the marine biological interest.

- 3.1.2** Rapids can be included in protected sites as Special Areas of Conservation (SACs) under the EC Habitats Directive as 'reefs' (if the seabed is of rock or a biogenic reef, such as a mussel bed); under 'large shallow inlets and bays', or in the priority habitat 'lagoons'. However, rapids with mixed sediments occurring in sea lochs and sounds (many are of this type) do not qualify under the present habitat definitions. The importance of UK rapids in an international context means that current protection through site designation is inadequate.

- 3.1.3** Loch Duich, Long and Alsh is a possible SAC under the category of 'reefs'. The site includes Kyle Rhea, with some of the strongest tidal streams in the UK. Loch Maddy is a candidate SAC under the category of 'shallow inlet' and includes numerous shallow tidal rapids between the many islands of the loch. The Sound of Arisaig cSAC also includes tidal rapids (under the category 'shallow sandbanks covered by water'). The Vadills cSAC and other lagoon sites contain rapids, often intertidal. Strangford Lough is also a cSAC. In England, the Fal and Helford and Isles of Scilly are cSACs and in Wales the Pembrokeshire Islands are a cSAC.

- 3.1.4** Many other sea lochs with tidal rapids are included in the list of 29 Marine Consultation Areas, a non-statutory designation used by SNH to denote areas of special marine interest in connection mainly with consultations over the siting of fishfarms and other works.

3.2 Management, research and guidance

- 3.2.1** The sea loch and other surveys undertaken by the JNCC's MNCR and subsequent surveys commissioned by SNH have included many Scottish rapids sites. The MNCR has described and classified the communities within them.
- 3.2.2** The rapids in Strangford Lough, Northern Ireland have also been well studied and documented.
- 3.2.3** Specific studies have been carried out at some rapids sites in conjunction with the impact of road and bridge schemes.

| | | | |
|--------------|--|--------------|---|
| 4. | Action plan objectives and proposed targets | | required to identify changes in water quality and the effect on the ecology of this habitat. (ACTION: DETR, EA, EHS, MAFF, NAW, SE, SEPA) |
| 4.1 | Maintain the extent, variety and quality of marine communities in tidal rapids based on best available information. | 5.2.4 | Draw up management schemes for all SACs that contain tidal rapids by 2004. (ACTION: CCW, EHS, EN, SNH) |
| 5. | Proposed action with lead agencies | 5.3 | Advisory |
| 5.1 | Policy and legislation | 5.3.1 | Provide advice to local authorities and planners on minimising impacts of plans and operations on tidal rapids communities. Emphasis should be given to the value of considering their importance from the early stages of planning, as there may often be a simple engineering solution to preserving the features of interest. (ACTION: CCW, DETR, DoE(NI), EN, NAW, SE, SNH) |
| 5.1.1 | Although a number of tidal rapids are included in possible or candidate SACs, many tidal rapids do not qualify for protection under existing Habitats Directive habitat types. Therefore consideration should be given to proposing the inclusion of tidal rapids under Annex 1 of the EC Habitats Directive when the opportunity for amendments arise. This could be both as a habitat in its own right and/or as a specific component of sea loch systems (other action plans also call for the inclusion of sea lochs as a habitat in their own right on Annex I of the Habitats Directive). (ACTION: DETR, JNCC, SE) | 5.4 | International |
| | | 5.4.1 | None proposed. |
| 5.1.2 | Ensure that road, bridge, causeway, energy and other construction schemes which might obstruct the water flow in tidal rapids avoid or minimise, as far as possible, damage to the conservation interest of the rapids. (ACTION: CCW, DETR, DoE(NI), DTI, EHS, EN, LAs, MAFF, NAW, SE, SNH) | 5.5 | Monitoring and research |
| 5.1.3 | Ensure that fishing operations with mobile gear are not carried out in tidal rapids. (ACTION: DANI, MAFF, SE, SNH) | 5.5.1 | Complete survey and recording of the extent, quality and composition of the habitats and communities of tidal rapids by 2005, and establish a monitoring programme that will enable progress towards the objective of this plan to be properly assessed. (ACTION: CCW, EHS, EN, SNH) |
| 5.2 | Site safeguard and management | 5.5.2 | Monitor the recovery of sites after construction works to establish the impacts and effectiveness of mitigation measures. For new projects post-construction monitoring should be costed in from the start. (ACTION: CCW, EN, LAs, NAW, SE, SNH) |
| 5.2.1 | Implement the JNCC guidance that all highly rated examples of tide-swept algal habitats in the mid-eulittoral, lower eulittoral and sublittoral fringe of Scottish sea lochs (as communities of national or more than national importance) as assessed by the MNCR in an Area of Search should be included in SSSIs by 2005. (ACTION: JNCC, SNH) | 5.5.3 | Where barriers have been built across tidal rapids, commission surveys to document the effects on the flora and fauna communities. Effort should be directed towards sites where the barrier design made no provision for water flow exchange (eg Watersay causeway). (ACTION: SNH) |
| 5.2.2 | List further sites for eventual notification to ensure the full range of tidal rapid sites and community types and ecological conditions is represented in the network of protected sites. Consideration should be given to the protection of the sub-littoral components of tidal rapids in the context of the proposed Department of the Environment, Transport and the Regions (DETR) working group on marine conservation. (ACTION: CCW, DETR, EHS, EN, JNCC, NAW, SE, SNH) | 5.6 | Communications and publicity |
| 5.2.3 | Reduce inputs to coastal waters as required under international, EC and domestic pollution control obligations. Long term monitoring strategies are also | 5.6.1 | Implement the communication of information on tidal rapids and their importance to planners, coastal users and the general public. This should include their international importance, their variety, diversity and abundance of marine life and communities. (ACTION: CCW, EHS, EN, LAs, SNH) |
| | | 5.6.2 | Ensure that the importance of tidal rapids is sufficiently emphasised in interpretation and management plans for |

possible and candidate SACs where appropriate.
(ACTION: All relevant authorities)

5.6.3 Write popular articles for relevant publications on the importance of tidal rapids. (ACTION: CCW, EHS, EN, SNH)

5.6.4 Consider the role of Coastal Fora and particularly the Minch Project in promoting the awareness of, and disseminating information about, tidal rapids. (ACTION: CCW, EHS, EN, SNH)

6. Costings

6.1 The successful implementation of this habitat action plan will have resource implications for both the public and private sectors. The data in the table below provide an estimate of the current expenditure on the habitat and the likely additional resource costs. These additional costs are based on the annual average over 5 and 10 years. The total expenditure for these time periods is also given. Almost all the costs will relate to the public sector, although some costs (eg for research) will be met by the private sector/non-governmental organisations).

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Costings for tidal rapids

| | Current expenditure | 1st 5 yrs to 2004/2005 | Next 10 yrs to 2014/2015 |
|--|---------------------|------------------------|--------------------------|
| Current expenditure /£000/Yr | | | |
| Total average annual cost /£000/Yr | | 72.5 | 19.3 |
| Total expenditure to 2005/£000 | | 362.5 | |
| Total expenditure 2005 to 2014/£000 | | | 193 |

Modiolus modiolus beds

Habitat Action Plan

1. Current status

undoubtedly take many years at best and may not occur at all. Some beds may be self maintaining relict features.

1.1 Physical and biological status

1.1.1 The horse mussel *Modiolus modiolus* forms dense beds at depths of 5-70 m in fully saline, often moderately tide-swept areas off northern and western parts of the British Isles. Although it is a widespread and common species, true beds forming a distinctive biotope are much more limited and are not known south of the Humber and Severn estuaries. Beds are known from Shetland, Orkney, the Hebrides and other parts of western Scotland, the Ards Peninsula, Strangford Lough, off both ends of the Isle of Man, off north-west Anglesey and north of the Lley Peninsula. Dense beds of young *Modiolus modiolus* also occur in the Bristol Channel but often seem not to survive to adulthood. Off North Sea coasts occasional beds occur between Berwickshire and the Humber, and probably elsewhere.

1.1.5 The byssus threads secreted by *M. modiolus* have an important stabilising effect on the seabed, binding together living *M. modiolus*, dead shell, and sediments. As *M. modiolus* is a filter feeder, the accumulation of faeces and pseudofaeces probably represents an important flux of organic material from the plankton to the benthos. This rich food source, together with the varied habitat, means that extremely rich associated faunas, sometimes with hundreds of species, may occur on dense beds.

1.1.2 *M. modiolus* can occur as relatively small, dense beds of epifaunal mussels carpeting steep rocky surfaces, as in some Scottish sealochs, but is more frequently recessed at least partly into mixed or muddy sediments in a variety of tidal regimes. In some sea lochs and open sea areas, extensive expanses of seabed are covered in scattered clumps of semi-recessed *M. modiolus* on muddy gravels. In a few places in the UK, beds are more or less continuous and may be raised up to several metres above the surrounding seabed by an accumulation of shell, faeces, pseudofaeces and sand. In some areas of very strong currents extensive areas of stony and gravelly sediment are bound together by more or less completely recessed *M. modiolus*, creating waves or mounds with steep faces up to one metre high and many metres long. These areas of semi-recessed and recessed beds may in some cases extend over hundreds of hectares, and in many cases may be considered as 'biogenic reefs', though they are all referred to here as beds. The JNCC Marine Nature Conservation Review (MNCr) has identified four major biotopes dominated by dense *M. modiolus*.

1.1.6 The composition of the biotopes is variable, and is influenced by the depth, degree of water movement, substrate, and density of *M. modiolus*. Sponges, ascidians, soft corals, anemones, hydroids, bryozoans, tubeworms, brittlestars, urchins, starfish, barnacles, crabs, spider crabs and other decapods, whelks and other gastropods, scallops and fish all tend to be abundant as epifauna, while there may also be coralline algae and other red seaweeds in shallower areas. Infauna often includes the purple heart urchin *Spatangus purpureus* and numerous bivalves. The possible role of *M. modiolus* beds as nursery areas for other species has not been investigated.

1.1.3 *M. modiolus* is a long-lived species and individuals within beds are frequently 25 years old or more. Juvenile *M. modiolus* are heavily preyed upon, especially by crabs and starfish, until they are about 3-6 years old, but predation is low thereafter. Recruitment is slow and may be very sporadic; there may be poor recruitment over a number of years in some populations.

1.2 Links with other action plans

1.2.1 Reference should be made to the biogenic reef habitat action plans (*Sabellaria alveolata* and *Sabellaria spinulosa*). Emphasis is given to the vulnerability of these habitats to disturbance by a variety of activities. Given the habitat requirement of *M. modiolus* for moderately tide-swept areas, reference should also be made to the tidal rapids, maerl beds and sublittoral sands and gravels habitat action plans.

1.1.4 There have been no studies of the recovery of damaged beds but full recovery after severe damage would

2. Current factors affecting the habitat

2.1 Fishing, particularly using trawls and dredges for scallops and queen scallops, is known to have caused widespread and long-lasting damage to beds in Strangford Lough and off the south-east of the Isle of Man. Effects include flattening clumps of *M. modiolus* causing fatalities, and loss of much of the associated epifauna, especially emergent types such as *Alcyonium digitatum*. Fishing impacts are likely to be occurring on *M. modiolus* beds elsewhere.

2.2 *Modiolus* beds are likely to be badly damaged by any other physical impacts, such as aggregate extraction,

- trenching and pipe/cable-laying, dumping of spoil/cuttings, or use of jack-up drilling rigs.
- 2.3** *M. modiolus* is known to accumulate contaminants such as heavy metals in spoil disposal areas but the effects on condition, reproduction and mortality rates are unknown.
- 2.4** *M. modiolus* has until now been taken for consumption only on a very small scale in a few localities.
- 2.5** Natural fluctuations in spawning, settlement and recruitment into adult sizes occur in some beds, with predation of young mussels probably being very influential. These must affect the population structure of *M. modiolus* beds over periods of a few years, but in the long term they seem to be stable features.
- 3. Current action**
- 3.1 Legal status**
- 3.1.1** *M. modiolus* beds in Strangford Lough fall within the Strangford Lough Marine Nature Reserve (MNR) designated in July 1995. Fisheries regulations preventing the use of mobile fishing gear in areas which include some relatively undisturbed beds of *M. modiolus* were introduced in 1993. This was prior to designation but as a direct consequence of the MNR consultation procedure. Strangford Lough is also a candidate Special Area of Conservation (SAC). An extensive *M. modiolus* bed occurs within the 'Lleyn Peninsula and the Sarnau' candidate SAC and smaller areas of *M. modiolus* occur within the Loch Duich, Long and Alsh possible SAC, and the Berwickshire and North Northumberland candidate SAC.
- 3.1.2** For some places in England and Wales, local Sea Fisheries Committee byelaws (or Several and Regulating Orders in Scotland) prohibit disturbance of mussel beds without defining the species. In some cases fisheries legislation may require mussel fisheries to be developed without defining the species.
- 3.1.3** Discharges to the sea are controlled by a number of EC Directives, including the Dangerous Substances, Shellfish (Waters), Integrated Pollution Control, Urban Waste Water Treatment, and Bathing Waters Directives. The forthcoming Water Framework Directive will also be relevant. The Oslo and Paris Convention (OSPAR) and North Sea Conference declarations are also important. These commitments provide powers to regulate discharges to the sea and have set targets and quality standards to marine waters. An extensive set of standards covering many metals, pesticides and other toxic, persistent and bioaccumulative substances, and nutrients have been set under UK legislation
- 3.1.4** Environmental assessment is a statutory requirement for certain proposed offshore developments where there is likely to be a significant effect on the environment. The impacts of offshore oil and gas exploration and production, aggregate extraction, dumping of dredged material and pipelaying are assessed by Government Departments prior to licensing. Such assessment would include effects on *M. modiolus* beds that could possibly be affected by proposed activities. Conditions can be attached to licences to minimise any environmental impact or a licence may be refused on environmental grounds.
- 3.2 Management, research and guidance**
- 3.2.1** Existing survey and monitoring data for *M. modiolus* beds are limited. The Strangford Lough beds are the best studied. Information on the distribution of *M. modiolus* beds within the Lough has been obtained using acoustic techniques, video and sampling, and future work is planned which should provide information on affected and unaffected areas, including the recovery of areas subjected to fishing impacts.
- 3.2.2** Work is also being carried out on the beds off the Lleyn Peninsula to develop appropriate survey and monitoring techniques as part of the demonstration project for the UK Marine SAC project. CCW is the lead organisation for this work. The most promising techniques for measuring the extent and integrity of the beds are acoustic surveys and video.
- 3.2.3** There are publications detailing age composition of *M. modiolus* beds from the west of Scotland, Strangford Lough, the Isle of Man and off Anglesey. Since 1984, scientists from the Centre for Environment, Fisheries & Aquaculture Science (CEFAS) have carried out annual surveys of the condition, reproductive state and contaminant content of *M. modiolus* in the Humber to Wash area. The University of Wales, Bangor, has also conducted studies of the age composition of these populations.
- 3.2.4** A number of studies also list associated species but the difficulties of sampling *M. modiolus* beds means that such studies are generally non-quantitative, or semi-quantitative at best.
- 3.2.5** A report summarising the dynamics and sensitivity of biogenic reefs, including *M. modiolus* reefs, was recently commissioned for the UK Marine SAC project.

| | | | |
|--------------|---|--------------|---|
| 4. | Action plan objectives and proposed targets | | investigation of the associated flora and fauna in different conditions. (ACTION: CCW, EHS, EN, SNH) |
| 4.1 | Maintain extent, distribution and quality of <i>M. modiolus</i> beds in UK waters. | 5.5.2 | Investigate the natural dynamics of <i>M. modiolus</i> beds. (ACTION: CCW, EHS, EN, NERC, SNH) |
| 5. | Proposed actions with lead agencies | 5.5.3 | Assess the potential effects of chronically high sediment loads on condition, spawning and recruitment in <i>M. modiolus</i> beds. (ACTION: NERC) |
| 5.1 | Policy and legislation | 5.5.4 | Assess the potential for damage by eutrophication or organic enrichment in enclosed systems such as sea lochs, especially where water exchange is low or where there is high localised organic or nutrient input (eg from fish farms, factories). (ACTION: CEC, DANI, EA, EHS, SE, SEPA) |
| 5.1.1 | Ensure that fisheries legislation and regulations are applied to species rather than to blanket terms such as 'mussels' or 'shellfish'. (ACTION: CEC, DANI, MAFF, SE, SFCs) | 5.5.5 | Assess the potential for recovery of beds after cessation of damaging activities. This should incorporate investigation of the habitat requirements and the length of time taken for recovery, and should cover associated flora and fauna as well as <i>M. modiolus</i> itself. (ACTION: CCW, EHS, EN, MAFF, NAW, NERC, SE, SNH) |
| 5.1.2 | Ensure that the importance of <i>M. modiolus</i> beds is taken into account in appropriate environmental assessments. (ACTION: CEC, DANI, DETR, DoE(NI), DTI, LAs, MAFF, MoD, SE) | 5.5.6 | Assess the feasibility of restoring beds by relaying <i>M. modiolus</i> . (ACTION: CCW, EHS, EN, NERC, SNH) |
| 5.2 | Site safeguard and management | 5.6 | Communications and publicity |
| 5.2.1 | Determine the extent of the resource within protected areas making sure to distinguish between different <i>M. modiolus</i> bed types. (ACTION: CCW, EHS, EN, SNH) | 5.6.1 | Provide advice to relevant authorities, fishermen and recreational bodies. (ACTION: CCW, EHS, EN, SNH) |
| 5.2.2 | Identify those areas of <i>M. modiolus</i> at risk from fishing activities and draw up a strategy to prevent damage. (ACTION: CCW, DANI, EHS, EN, MAFF, NAW, SE, SFCs, SNH) | 6. | Costings |
| 5.2.3 | Reduce inputs to coastal waters as required under international, EC and domestic pollution control obligations. (ACTION: EA, EHS, SEPA) | 6.1 | The successful implementation of this habitat action plan will have resource implications for both the public and private sectors. The data in the table overleaf provide an estimate of the current expenditure on the habitat and the likely additional resource costs. These additional costs are based on the annual average over 5 and 10 years. The total expenditure for these time periods is also given. Almost all the costs will relate to the public sector, although some costs (eg for research) will be met by the private sector/non-governmental organisations). |
| 5.3 | Advisory | 7. | Key references |
| 5.3.1 | By 2002, develop standardised techniques for survey and monitoring of <i>M. modiolus</i> beds. (ACTION: CCW, EHS, EN, JNCC, SNH) | | Anwar, N.A., Richardson, C.A. & Seed, R. 1990. Age determination, growth rate and population structure of the horse mussel <i>Modiolus modiolus</i> . <i>Journal of the Marine Biological Association UK</i> , 70 , 441-457. |
| 5.3.2 | Develop advice to fishermen and recreational organisations on importance and sensitivity of <i>M. modiolus</i> beds. (ACTION: CCW, EHS, EN, JNCC, SNH) | | |
| 5.4 | International | | |
| 5.4.1 | None proposed. | | |
| 5.5 | Future research and monitoring | | |
| 5.5.1 | By 2004, assess the distribution, extent and quality of beds of different types. This needs to include | | |

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Costings for *Modiolus modiolus* beds

| | Current expenditure | 1st 5 yrs to 2004/2005 | Next 10 yrs to 2014/2015 |
|--|---------------------|------------------------|--------------------------|
| Current expenditure /£000/Yr | | | |
| Total average annual cost /£000/Yr | | 101.7 | 19.5 |
| Total expenditure to 2005/£000 | | 508.5 | |
| Total expenditure 2005 to 2014/£000 | | | 195 |

Seagrass beds

Habitat Action Plan

1. Current status

1.1 Physical and biological status

1.1.1 Seagrass beds develop in intertidal and shallow subtidal areas on sands and muds. They may be found in marine inlets and bays but also in other areas, such as lagoons and channels, which are sheltered from significant wave action.

1.1.2 Three species of *Zostera* occur in the UK, and all are considered to be scarce (present in 16-100 ten km squares). Dwarf eelgrass *Zostera noltii* is found highest on the shore, often adjacent to lower saltmarsh communities, narrow-leaved eelgrass *Zostera angustifolia* on the mid to lower shore and eelgrass *Zostera marina* predominantly in the sublittoral. The plants stabilise the substratum, are an important source of organic matter, and provide shelter and a surface for attachment by other species. Eelgrass is an important source of food for wildfowl, particularly brent goose and widgeon which feed on intertidal beds. Where this habitat is well developed the leaves of eelgrass plants may be colonised by diatoms and algae such as *Enteromorpha* spp, *Cladophora rectangularis*, *Rhodophysema georgii*, *Ceramium rubrum*, stalked jellyfish and anemones. The soft sediment infauna may include amphipods, polychaete worms, bivalves and echinoderms. The shelter provided by seagrass beds makes them important nursery areas for flatfish and, in some areas, for cephalopods. Adult fish frequently seen in *Zostera* beds include pollack, two-spotted goby and various wrasse. Two species of pipefish, *Entelurus aequoreus* and *Syngnathus typhie* are almost totally restricted to seagrass beds while the red algae *Polysiphonia harveyi* which has only recently been recorded from the British Isles is often associated with eelgrass beds.

1.1.3 Five different community types have been identified for seagrass beds from the southern North Sea and the Channel and 16 microhabitats including the seagrass itself, sessile epifauna, infauna and free swimming animals not confined to a special part of the community. The diversity of species will depend on environmental factors such as salinity and tidal exposure and the density of microhabitats, but it is potentially highest in the perennial fully marine subtidal communities and may be lowest in intertidal, estuarine, annual beds.

1.1.4 The Cromarty Firth supports what is most probably the largest total area of dwarf eelgrass and narrow leaved eelgrass in Britain (approximately 1200 ha) while the Maplin Sands is estimated to be the largest surviving continuous population of dwarf eelgrass in Europe

(covering around 325 ha). The Fleet has the most extensive population of all three *Zostera* species in Britain. Other important sites are the Exe Estuary, Maplin Sands, the Solents marshes and the Isles of Scilly, Morfa Nefyn, Milford Haven, the Moray Firth, Carlingford Lough, Dundrum Bay, Strangford Lough and Lough Foyle.

1.2 Links with other action plans

1.2.1 Reference should be made to the habitat action plans for saline lagoons, saltmarsh and mudflats.

2. Current factors affecting the habitat

2.1 Disease. A wasting disease was responsible for die-back of large areas of seagrass in the UK in the 1930s. The fungus and slime mould which colonised the weakened seagrass have recently reappeared in seagrass beds around the Isles of Scilly.

2.2 Natural cycles. The extent of seagrass beds may change as a result of natural factors such as severe storms, exposure to air, and freshwater pulses. Grazing by wildfowl can have a dramatic seasonal effect with more than 60% reduction in leaf cover reported from some sites. Warm sea temperatures coupled with low level of sunlight may cause significant stress and die back of seagrass.

2.3 Physical disturbance, for example by trampling, dredging, and use of mobile bottom fishing gear, land claim and adjacent coastal development through the construction of sea defences and potential for changes in the hydrological regime.

2.4 Introduction of, and competition from, alien species such as *Spartina anglica* and *Sargassum muticum*

2.5 Increased turbidity reducing photosynthesis.

2.6 Nutrient enrichment, at low levels, may increase production in *Zostera* while high nitrate concentrations have been implicated in the decline of mature *Z. marina*. Phytoplankton blooms, resulting from nutrient enrichment, have been shown to reduce biomass and depth penetration of eelgrass. Eutrophication can also result in a shift to phytoplankton epiphyte or macroalgal dominance.

2.7 Marine pollution. Eelgrass is known to accumulate Tributyl, tin and possibly other metals and organic

pollutants. Several heavy metals and organic substances have been shown to reduce nitrogen fixation which may affect the viability of the plant, particularly in nutrient poor conditions. Accumulated pollutants may become concentrated through food chains.

3. Current action

3.1 Legal status

3.1.1 Areas of seagrass are included in some coastal ASSIs/SSSIs, Ramsar sites, SPAs (under the EC Birds Directive) and voluntary marine protected areas. Two out of the three UK Marine Nature Reserves have seagrass beds and the habitat occurs in a number of areas proposed as SACs under the EC Habitats Directive.

3.2 Management, research and guidance

3.2.1 Information on the distribution of seagrass beds is being collected as part of the JNCC Marine Nature Conservation Review.

3.2.2 Seagrass beds around the Isles of Scilly were monitored for several years in the late 1980s by the Nature Conservancy Council and have been re-surveyed by volunteers. This work is on-going.

3.2.3 In Milford Haven, re-mapping of the location, extent and density of narrow-leaved eelgrass was completed by the Pembrokeshire National Park, as part of a rolling programme of research and monitoring administered by the Milford Haven Waterway Environment Monitoring Steering Group. Repeat surveys of eelgrass in Milford Haven are likely to be the next focus for attention. Eelgrass in North Haven, Skomer, is monitored on a regular basis as part of the Marine Nature Reserve work programme. This work has been given an extra focus by the events surrounding the Sea Empress oil spill in 1996.

3.2.4 In Northern Ireland research, part funded by the Department of Agriculture (NI), has examined the utilisation of seagrass by wildfowl in Strangford Lough. There have also been investigations by the Department of the Environment (NI) into methods of controlling *Spartina*, which in some situations is encroaching onto seagrass beds. *Spartina* control in Strangford Lough using the herbicide Dalapon was resumed in 1997.

3.2.5 A report on the status of eelgrass in Scotland was published in 1993 covering latest information on taxonomy and systematics, distribution, threats and suggestions for further work.

3.2.6 A major review of the key conservation, management and monitoring requirements of the genus *Zostera* in the UK was completed in 1997 on behalf of EHS.

3.2.7 A two year research project at the Royal Botanic Gardens, Kew, to improve understanding of seagrass seed biology and conserve eelgrass in the seed bank, has also been completed.

3.2.8 A baseline study of the mudflats (including detailed *Zostera* work) at the north end of Strangford Lough has been completed ahead of a major up-grade of the sea wall in the area.

4. Action plan objectives and proposed targets

4.1 Maintain extent, quality and distribution of seagrass beds in UK waters.

4.2 Assess feasibility of restoration of damaged or degraded seagrass beds.

4.3 Until surveys assess the extent of the seagrass resource, it will not be possible to assess whether restoration is necessary, or to specify a final target. An interim target of 1000 ha has been costed.

5. Proposed actions with lead agencies

5.1 Policy and legislation

5.1.1 When the Annexes of the Habitats Directive are reviewed by the EC, consider proposing inclusion of *Zostera* as appropriate. (ACTION: DETR, JNCC)

5.1.2 Ensure that development schemes, dredging operations and fishing activities do not affect the integrity or the conservation interest of intertidal and subtidal seagrass beds. (ACTION: CEC, LAs, MAFF, Ports/harbour authorities, SE)

5.1.3 Explore options for using statutory measures, aside from those specifically designed for nature conservation, to protect seagrass beds. Particular consideration should be given to fisheries legislation and port and harbour regulations. (ACTION: CCW, DoE(NI), EN, SNH)

5.2 Site safeguard and management

5.2.1 Determine the extent and quality of the seagrass resource which falls within protected areas and notify further sites, if required, to fill significant gaps. In particular, ensure that there is adequate representation of the full range of variation in seagrass communities

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| | found around the UK in the network of protected areas. (ACTION: CCW, EHS, EN, SNH) | 5.5 | Monitoring and research |
| 5.2.2 | Identify seagrass beds of particular significance as nursery grounds for fish and ensure these are covered by the protected areas network. (ACTION: CCW, DANI, EHS, EN, MAFF, SE, SFCs, SNH) | 5.5.1 | Compile and publish an up-to-date record of the extent, quality and distribution of seagrass around the UK. (ACTION: CCW, EHS, EN, JNCC, SNH) |
| 5.2.3 | Identify suitable sites for reintroduction or restoration of seagrass and draw up a strategy to enable the target to be met. (ACTION: CCW, EHS, EN, SNH) | 5.5.2 | Complete a classification of the different types of seagrass communities around the UK as part of the EC BIOMAR project. (ACTION: JNCC) |
| 5.2.4 | Seek to control high nutrient loads from agricultural sources that are adversely affecting, or could affect, important areas of seagrass through the designation of nitrate vulnerable zones, where the water body is affected by eutrophication (as defined in the EC Nitrate Directive). (ACTION: DANI, MAFF, NAW, SE) | 5.5.3 | Advise on the establishment of a programme to set up a network of seagrass monitoring stations across the full range of types of seagrass beds in the UK. (ACTION: JNCC, Marine Laboratories) |
| 5.2.5 | Take account of the conservation requirements for seagrass beds in the development and implementation of coastal zone management plans and ensure that they are not managed in isolation from other habitats and communities in these areas. (ACTION: DANI, MAFF, NAW, SE) | 5.5.4 | Carry out further research into the factors which adversely affect seagrass beds to understand how these may be avoided or minimised. (ACTION: CCW, EHS, EN, JNCC, SNH) |
| 5.2.6 | Define statutory water quality objectives for coastal waters. (ACTION: EA, MAFF, SEPA) | 5.5.5 | Carry out research and feasibility studies on the restoration of seagrass beds through transplanting and germination. (ACTION: CCW, EHS, EN, JNCC, SNH) |
| 5.3 | Advisory | 5.6 | Communications and publicity |
| 5.3.1 | Publish guidelines on the designation of intertidal SSSIs/ASSIs for their marine biological importance and assess whether, in light of these, seagrass beds are adequately covered by the network. (ACTION: CCW, EHS, EN, JNCC, SNH) | 5.6.1 | Promote awareness among coastal users of the conservation importance of seagrass beds and how to avoid impact on these habitats. (ACTION: CCW, EHS, EN, SNH) |
| 5.3.2 | Standardise procedures for monitoring of seagrass beds. (ACTION: JNCC, Research institutes) | 6. | Costings |
| 5.3.3 | Provide advice to local authorities and others on minimising impacts of plans and operations on seagrass beds. (ACTION: CCW, EHS, EN, SNH) | 6.1 | Limited data on habitat restoration and management of seagrass beds does not permit a full costing to be undertaken for this action plan. However, an estimate of potential costs is provided on the basis of several recent US studies. One project, in Tampa Bay, Florida, will require approximately £6,000 per hectare for full restoration of a 263 hectare site. It should be noted that this project incorporates other objectives as well as seagrass restoration. In the UK, a 1974 study concluded that transplanting of seagrass was feasible at a cost of approximately £4,200 (1994/95 prices) per hectare. |
| 5.4 | International | 6.2 | Until surveys to ascertain the extent of the seagrass resource are completed it is not feasible to provide a specific target for restoration. However, the data in Table 1 below provide indicative costs on the basis of assumptions that at least 1,000 hectares will require restoration during the programme and that this will be at an average cost of £5,000 per hectare. |
| 5.4.1 | Liaise with research institutes and coastal managers in Europe and elsewhere to exchange data and information on the conservation of seagrass beds and the developing of techniques for transplanting and germination of the three species of <i>Zostera</i> found in UK waters. (ACTION: CCW, EHS, EN, JNCC, SNH) | | |

Habitat Type: Seagrass beds (£000 per annum)

| Area to be restored (Ha) | 1997 | 2000 | 2010 |
|--------------------------|------|------|------|
| 1000 | 330 | 330 | 330 |

Maerl beds

Habitat Action Plan

| 1. Current status | 1.2 Links with other action plans |
|--|---|
| <p>1.1 Physical and biological status</p> <p>1.1.1 Maerl is a collective term for several species of calcified red seaweed. It grows as unattached nodules on the seabed, and can form extensive beds in favourable conditions. Maerl is slow-growing, but over long periods its dead calcareous skeleton can accumulate into deep deposits (an important habitat in its own right), overlain by a thin layer of pink, living maerl.</p> <p>1.1.2 Maerl beds typically develop where there is some tidal flow, such as in the narrows and rapids of sea lochs, or the straits and sounds between islands. Beds may also develop in more open areas where wave action is sufficient to remove fine sediments, but not strong enough to break the brittle maerl branches. Live maerl has been found at depths of 40 m, but beds are typically much shallower, above 20 m and extending up to the low tide level.</p> <p>1.1.3 Maerl beds are found off the southern and western coasts of the British Isles, north to Shetland, but are particularly well developed around the Scottish islands and in sea loch narrows, around Orkney, and in the south in the Fal Estuary. Maerl beds also occur in other western European waters, from the Mediterranean to Scandinavia.</p> <p>1.1.4 The distributions of the three main maerl bed-forming species in the UK are not entirely clear because of problems with identification in the field. <i>Phymatolithon calcareum</i> occurs throughout British waters, while <i>Lithothamnion glaciale</i> is a northern species with its southern limits at Lundy in the Bristol Channel and in the North Sea, off Yorkshire. <i>Lithothamnion corallioides</i> has caused the most problems with identification, but appears to be a south-western species with Scottish records as yet unconfirmed. Currently, it is known to occur in less than 15 of the ten km squares for the UK as defined by JNCC.</p> <p>1.1.5 Maerl beds are an important habitat for a wide variety of marine animals and plants which live amongst or are attached to its branches, or burrow in the coarse gravel of dead maerl beneath the top living layer. Maerl beds, because of the wide geographical range over which they occur, have a wide range of associated animals and plants, with species diversity tending to be greater in the south and west. Due to the fragility of maerl, the beds are easily damaged and have probably declined substantially in some areas.</p> | <p>1.2.1 Reference should be made to the habitat action plans produced for saline lagoons and tidal rapids. In particular, attention needs to be drawn to operations that may damage benthic habitats.</p> <p>2. Current factors affecting the habitat</p> <p>2.1 Maerl is of commercial value as a soil conditioner on acidic ground, as an animal food additive, for the filtration of acid drinking water and in pharmaceutical and cosmetic products. In 1978 a licence was issued by the Crown Estate Commissioners (CEC) to dredge 30,000 tonnes per year of dead maerl from the Fal Estuary. The area dredged avoids the live maerl of the St Mawes Bank. An exploratory licence was awarded to a company to remove 20 tonnes of maerl off Barra, but was not subsequently taken up. A licence has been granted by the CEC under the Government View Procedure, in Wyre Sound, Orkney, for the experimental dredging of 4,000 cubic metres a year for five years. A condition of the licence was the establishment of a monitoring programme agreed with SNH.</p> <p>2.2 Scallop dredging has been identified as the biggest impact on maerl beds in the Clyde, causing serious decline of both maerl, by breaking and burying the thin layer of living maerl, and the associated species. Other types of mobile fishing gear are also likely to damage the living layer of maerl on top of the bed.</p> <p>2.3 Heavy anchors and mooring chains could cause considerable damage to maerl beds.</p> <p>2.4 Maerl communities in Brittany have been damaged by eutrophication, which has caused smothering of the maerl by excess growth of other seaweeds and increased sedimentation. Finfish farms discharge large amounts of nutrients into sea lochs, derived from uneaten food and waste materials. Finfish farms also routinely use chemicals which are specifically toxic to fish lice and other crustaceans and molluscs. When such chemicals disperse in the marine environment there is the possibility that fauna associated with maerl beds may be affected.</p> <p>2.5 Maerl beds rely on water movement to disperse fine sediment particles, which would otherwise accumulate between the maerl fragments and smother the bed. Any obstruction to the water flow can be expected to have adverse effects on the maerl and its associated fauna and flora. The building of barrages, causeways and</p> |

bridges are potential blockages to water flow, particularly in sea lochs and between islands.

3. Current action

3.1 Legal status

- 3.1.1 No maerl species are specifically listed for protection under the Wildlife and Countryside Act 1981 or the Wildlife (NI) Order 1985. However, maerl is mentioned in the JNCC guidelines for selection of intertidal SSSIs as a component of the tidal rapids part of saline lagoons. The guidelines also list 'tide-swept algae' as a community of at least national importance, which could include maerl on the lower shore.
- 3.1.2 As most maerl beds are subtidal, they cannot normally be included within SSSIs in England and Wales, or ASSIs in Northern Ireland, as the lower limit of SSSI and ASSI designations is usually the Mean Low Water mark. However, in Scotland, the planning boundary is normally the Mean Low Water of Spring tides, which could include maerl where it occurs in the subtidal fringe. This happens at a few sites, for instance at Taynish on the shores of Loch Sween, Argyll, where the SSSI boundary (but not the National Nature Reserve boundary) extends to Mean Low Water of Spring tides and includes the rapids, which are of high marine interest. At best SSSI designation can only afford limited protection to a very small proportion of the total maerl habitat.
- 3.1.3 All three of the statutory Marine Nature Reserves in Britain - Skomer in Wales, Lundy in England and Strangford Lough in Northern Ireland - contain maerl, although none have particularly well-developed beds.
- 3.1.4 Maerl beds are covered by four different habitat types in Annex I of the EC Habitats Directive: 'Sandbanks which are slightly covered by seawater at all times'; 'Large shallow bays and inlets'; 'Estuaries' and the priority habitat 'Lagoons'. For the first of these, the JNCC interpretation manual specifically mentions maerl beds, for which Special Areas of Conservation (SACs) have been selected to cover the geographical and ecological range of variation.
- 3.1.5 Annex V of the Habitats Directive lists two maerl species, *Lithothamnium* (sic) *corallioides* and *Phymatolithon calcareum*, as species of community interest whose taking in the wild and exploitation may be subject to management measures. However, *Lithothamnion glaciale*, an important constituent of maerl beds in the north, is not included in Annex V.
- 3.1.6 The current list of candidate SACs includes the Sound of Arisaig, selected particularly for its extensive series of maerl beds. Loch Maddy and The Vadills also

contain maerl communities. In Northern Ireland, Strangford Lough (a cSAC and statutory Marine Nature Reserve) contains maerl. In England, the Fal and Helford cSAC includes the largest beds in south-west Britain. The Pembrokeshire Islands cSAC also includes maerl communities.

- 3.1.7 Other areas with maerl beds are included in the list of 29 Scottish Marine Consultation Areas. Although this is a non-statutory designation used by SNH to denote areas of special marine interest, it is used in planning consultations, particularly over the siting of fish farms.
- 3.1.8 Discharges to the sea are controlled by a number of EC Directives, including the Dangerous Substances, Shellfish (Waters), Integrated Pollution Control, Urban Waste Water Treatment, and Bathing Waters Directives. The forthcoming Water Framework Directive will also be relevant. The 1992 Convention for the Protection of the Marine Environment of the North East Atlantic (OSPAR) and North Sea Conference declarations are also important. These commitments provide powers to regulate discharges to the sea and have set targets and quality standards to marine waters. An extensive set of standards covering many metals, pesticides and other toxic, persistent and bioaccumulative substances, and nutrients have been set under UK legislation.
- 3.2 Management, research and guidance
 - 3.2.1 The surveys undertaken throughout Britain by JNCC's Marine Nature Conservation Review (MNCR) and subsequent surveys commissioned by country agencies have identified maerl bed sites, and described and classified the communities within them, based on conspicuous macrofauna.
 - 3.2.2 The University Marine Biological Station, Millport, has coordinated a three-year EU-funded project looking at maerl bed biodiversity, function, structure and anthropogenic impacts at sites in Scotland (Clyde), Brittany, Galicia, Alicante and Malta. This project has identified numerous impacts threatening this habitat.
 - 3.2.3 An EU-funded review of literature and extraction of information, which could be of use to managers of protected sites, has been conducted by Queen's University, Belfast.
 - 3.2.4 Specific studies have been carried out at some sites with maerl in conjunction with the impact of road and bridge schemes (eg Skye Bridge).

| | | | |
|--------------|---|--------------|--|
| 4. | Action plan objectives and proposed targets | 5.2.4 | Ensure that planning for aquaculture and other operations, which may cause eutrophication and smothering does not adversely affect the conservation requirements of important maerl beds. (ACTION: CEC, DETR, EA, EHS, LAs, NAW, SE, SEPA) |
| 4.1 | Maintain extent, variety and quality of maerl beds and associated plant and animal communities in the UK subject to best available information. | 5.2.5 | Ensure that road, bridge, energy and other construction schemes which might affect maerl beds do not risk damage to their conservation interest. (ACTION: CCW, DETR, DTI, EHS, EN, LAs, SE, SNH) |
| 5. | Proposed actions with lead agencies | 5.2.6 | Take account of the conservation requirements for maerl bed communities in the development and implementation of coastal zone management plans and ensure they are not managed in isolation from other habitats and communities in these areas. (ACTION: All relevant authorities) |
| 5.1 | Policy and legislation | 5.2.7 | Ensure that fishing operations do not adversely affect the conservation interests of maerl beds within designated sites. (ACTION: CCW, DANI, DETR, EN, MAFF, LAs, SE, SFCs, SNH) |
| 5.1.1 | Give consideration to proposing the inclusion of maerl beds under Annex 1 of the EC Habitats Directive when the opportunity arises. This could be in their own right or as a specific component of large shallow inlets and bays (other action plans also call for the inclusion of sea lochs as a specific Habitats Directive category). Protection can be afforded to a limited number of sites at present using the existing Habitats Directive categories (large shallow bays and inlets; estuaries; sandbanks slightly covered with water all the time; lagoons). (ACTION: JNCC) | 5.3 | Advisory |
| 5.1.2 | Consider proposing the addition of <i>Lithothamnion glaciale</i> to Annex V of the Habitats Directive (species of community interest whose taking in the wild and exploitation may be subject to management measures). This will allow consistency with the present listing of the other two UK maerl bed-forming species. (ACTION: DETR, JNCC) | 5.3.1 | Advise government on the best maerl beds for inclusion in the UK network of protected sites, thus ensuring that the full range of habitat and associated community types is represented. This includes co-operation with other EU countries to ensure an adequate EU-wide network of sites. (ACTION: JNCC) |
| 5.1.3 | Ensure that fishing policy takes account of the potential impact of operations with mobile gear on maerl beds and seeks to avoid or minimise operations. (ACTION: DANI, EHS, MAFF, NAW, SE, SFCs) | 5.3.2 | Provide advice to local authorities and planners on minimising impacts of plans and operations on maerl bed communities by 2000. Consideration should be given to their importance from the early stages of planning, as there may often be a simple engineering or siting solution to preserving the features of interest. (ACTION: CCW, DETR, EHS, EN, NAW, SE, SNH) |
| 5.1.4 | In view of the present extent of known maerl beds there should be a presumption against the granting of new extraction licences. (ACTION: CEC, DETR, DoE(NI), Duchy of Cornwall, LAs, MAFF, SE) | 5.4 | International |
| 5.2 | Site safeguard and management | 5.4.1 | None proposed. |
| 5.2.1 | Include in all new extraction licences criteria for the continued existence of maerl beds. (ACTION: CEC, Duchy of Cornwall, MAFF, SE) | 5.5 | Monitoring and research |
| 5.2.2 | Re-negotiate existing extraction licences to ensure the continued existence of maerl beds and their associated species. (ACTION: CEC, Duchy of Cornwall, MAFF, SE) | 5.5.1 | Complete survey and recording of the extent, quality and composition of maerl bed habitats by 2005. (ACTION: CCW, EHS, EN, SNH) |
| 5.2.3 | Include by 2005 provision for the maintenance of the extent and health of maerl bed communities in management plans for SACs where these include maerl beds. (ACTION: All relevant authorities) | 5.5.2 | Monitor the recovery of sites after previously consented construction works to establish the effectiveness of mitigation measures (eg Skye Bridge). For new construction projects prior environmental assessment is required and monitoring should be costed |

in before the start of development. (ACTION: LAs, NAW, SE, SNH)

- 5.5.3** Establish a monitoring programme by 2005 that will enable progress towards the objective of this plan to be properly assessed. (ACTION: CCW, EHS, EN, SNH)

5.6 Communications and publicity

- 5.6.1** Implement the communication of information on maerl beds and their importance to planners, coastal users and the general public. This should include their importance as a Scottish sea loch feature and their international importance in the context of the European distribution of this habitat. Attention should also be given to the variety and diversity of maerl and the abundance of associated marine life and communities. (ACTION: CCW, EHS, EN, LAs, SNH)

- 5.6.2** Provide information on maerl beds for relevant SACs. This should place more emphasis on local features of interest and should encourage local pride and 'ownership' of the resource. (ACTION: All relevant authorities)

- 5.6.3** Write popular articles for relevant publications on the importance of maerl beds. (ACTION: CCW, EHS, EN, SNH)

6. Costings

- 6.1** The successful implementation of this habitat action plan will have resource implications for both the public and private sectors. The data in the table below provide an estimate of the current expenditure on the habitat and the likely additional resource costs. These additional costs are based on the annual average over 5 and 10 years. The total expenditure for these time periods is also given. Almost all the costs will relate to the public sector, although some costs (eg for research) will be met by the private sector/non-governmental organisations).

Costings for maerl beds

| | Current expenditure | 1st 5 yrs to 2004/2005 | Next 10 yrs to 2014/2015 |
|--|----------------------------|-------------------------------|---------------------------------|
| Current expenditure /£000/Yr | | | |
| Total average annual cost /£000/Yr | | 54.1 | 29.7 |
| Total expenditure to 2005/£000 | | 270.5 | |
| Total expenditure 2005 to 2014/£000 | | | 297 |

7. Key references

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Saline lagoons

Habitat Action Plan

1. Current Status

1.1 Lagoons in the UK are essentially bodies, natural or artificial, of saline water partially separated from the adjacent sea. They retain a proportion of their sea water at low tide and may develop as brackish, full saline or hyper-saline water bodies. The largest lagoon in the UK is in excess of 800 ha (Loch of Stenness) although the rest are much smaller and some may be less than 1 ha. Lagoons can contain a variety of substrata, often soft sediments which in turn may support tasselweeds and stoneworts as well as filamentous green and brown algae. In addition lagoons contain invertebrates rarely found elsewhere. They also provide important habitat for waterfowl, marshland birds and seabirds. The flora and invertebrate fauna present can be divided into three main components: those that are essentially freshwater in origin, those that are marine/brackish species and those that are more specialist lagoonal species. The presence of certain indigenous and specialist plants and animals make this habitat important to the UK's overall biodiversity.

1.2 There are several different types of lagoons, ranging from those separated from the adjacent sea by a barrier of sand or shingle ('typical lagoons'), to those arising as ponded waters in depressions on soft sedimentary shores, to those separated by a rocky sill or artificial construction such as a sea wall. Sea water exchange in lagoons occurs through a natural or man-modified channel or by percolation through, or overtopping of, the barrier. The salinity of the systems is determined by various levels of fresh water input from ground or surface waters. The degree of separation and the nature of the material separating the lagoon from the sea are the basis for distinguishing several different physiographic types of lagoon.

2. Current factors affecting the habitat

2.1 The processes which lead to the natural development of some types of lagoons are generally inhibited by human coastal activities. It is probable that the formation of new lagoons will not keep pace with the process of lagoon loss. Current factors affecting this habitat type are listed below.

2.1.1 Many lagoons, particularly in England and Wales, are naturally transient; salinity regimes change as succession leads to freshwater conditions and eventually to vegetation such as fen carr. Some formerly saline sites are now freshwater.

2.1.2 The bar-built sedimentary barriers of 'typical' coastal lagoons tend to naturally move landwards with time. Lagoons behind them will eventually be in-filled as bar sediments approach the shore.

2.1.3 Pollution, in particular nutrient enrichment leading to eutrophication, can have major detrimental effects. This may result from direct inputs to the lagoon or from water supply to the lagoon.

2.1.4 Artificial control of water (sea and fresh) to lagoons can have profound influences on the habitat.

2.1.5 Many lagoons are often seen as candidates for infilling or land claim as part of coastal development.

2.1.6 Some coastal defence works can prevent the movement of sediments along the shore and lead to a gradual loss of the natural coastal structures within which many coastal lagoons are located.

2.1.7 The impact of coastal defences will be compounded by the effects of sea level rise. One study in 1992 estimated that about 120 ha of coastal lagoons in England (10% of the existing resource in England) would be lost over the subsequent 20 years, mainly as a consequence of sea level rise.

2.1.8 Sea level rise may present opportunities for creation of new lagoonal habitat where sea water inundates freshwater areas, including sites that were once coastal lagoons.

3. Current Action

3.1 Legal status

3.1.1 In Great Britain 12 species of invertebrate and plant associated with lagoons are protected under the Wildlife and Countryside Act 1981. No lagoon species are listed for protection under the Wildlife (Northern Ireland) Order 1985.

3.1.2 Of the 177 lagoon sites surveyed in England, covering 1200 ha, just over 50% occur within existing SSSIs and about 10% occur within NNRs and as many in LNRs. Fewer examples are found in Wales where only between 5 and 10 lagoons are recognised following recent survey. 139 sites, covering about 3892 ha have been identified in Scotland, of which 15% are SSSIs and less than 2% lie within NNRs. A preliminary study suggests that there may be 30 lagoonal habitat sites in Northern Ireland (of these only a few small perched salt

marsh pools are thought to be natural in origin). In Northern Ireland they will all eventually fall within the ASSI/SPAs network.

- 3.1.3** Internationally important lagoons have been designated for their bird interest as SPAs under the EC Birds Directive. Coastal lagoons are also listed as a priority habitat on Annex 1 of the EC Habitats Directive; the UK Government has identified 10 candidate SACs under this Directive, some of which include several individual lagoon sites.

3.2 Management, research and guidance

- 3.2.1** Coastal groups are currently preparing shoreline management plans for defined lengths of coast. The production of these plans will require identification of key habitats, including coastal lagoons, and confirmation of their management requirements.

- 3.2.2** Certain lagoons have an established research base and study group.

4. Action plan objectives and proposed targets

- 4.1** The current number, area and distribution of coastal lagoons should be maintained and enhanced. There are at present about 5200 ha of known saline lagoonal habitats in the UK.

- 4.2** Create, by the year 2010, sufficient lagoon habitat to offset losses over the last 50 years. It is considered that even with a great deal of effort it will be possible to produce only very indicative figures on losses over the last 50 years. Instead it should be accepted that there has been some loss during this period and to focus effort on creating new habitat, using the target of 120 ha referred to herein. If any figures were to be obtained there should be an attempt to distinguish between losses due to natural processes and due to human activities.

- 4.3** Recent evaluations estimated that 38 English lagoons were lost in the latter half of the 1980s (this is an estimate which should be taken as an indication of the fact that saline lagoon habitat has been lost over the last 50 years). In 1992 the creation of at least 120 ha of lagoon habitat over the following 20 years was considered attainable and necessary within England just to keep pace with projected losses. It is considered that this figure should be used as the target for creation of new saline lagoon habitat to offset previous losses. Future losses should be compensated for where feasible as and when they arise, creating new habitat as near to the original site as possible.

5. Proposed action with lead agencies

5.1 Policy and legislation

- 5.1.1** Continue to take account of the coastal lagoon habitats in assessing the grant-aiding of coastal defence works. (ACTION: MAFF, NAW)

- 5.1.2** Identify abstractions known, or likely to be adversely affecting (through reduced freshwater flows) lagoonal habitats of nature conservation importance. Abstractions should be revoked or reduced where the review identifies this as necessary. (ACTION: EA, SEPA)

- 5.1.3** Review current marine aggregate extraction licences by 1997 as a means of assessing the combined impact of aggregate extraction on coastal processes relating to lagoons. This action is subject to the results of studies on the cumulative effects of individual aggregate extraction operations which are on-going. (ACTION: DETR, NAW)

5.2 Site safeguard and management

- 5.2.1** Continue notification of sites which meet the SSSI/ASSI guidelines ensuring that representation of the full range of lagoonal types is covered. (ACTION: CCW, EHS, EN, SNH)

- 5.2.2** Progress with the programme to designate lagoonal habitats as SPAs, Ramsar sites and SACs by 2004. (ACTION: DETR, NAW, SE)

- 5.2.3** Maintain and monitor the stable exchange of waters to and from lagoonal habitats as part of site management plans. (ACTION: CCW, EA, EN, SEPA, SNH)

- 5.2.4** Encourage the production of management plans for lagoonal sites especially SSSIs/ASSIs, NNRs, LNRs and NGO-owned nature reserves by 1998. These should include objectives for BAP priority species and may include objectives for all relevant Red Data Book species. Management objectives and actions for saline lagoons should be incorporated into broader management initiatives such as Local Environment Agency Plans and Estuary Management Plans. (ACTION: CCW, EHS, EN, SNH)

- 5.2.5** Contribute to the different stages of producing Shoreline Management Plans (including guidance on their preparation) to ensure that processes relevant to coastal lagoons are taken into account. (ACTION: CCW, EA, EN, LAs, MAFF, NAW)

- 5.2.6** Consider establishing a management scheme, or adapting existing schemes such as agri-environment

schemes and managed realignment initiatives, to contribute to creating, by the year 2010, sufficient lagoonal habitat to offset losses of the last 50 years. This scheme should also contribute to maintaining the coastal lagoon and saline pond resource, despite losses due to sea level rise. (This is unlikely to be possible behind shingle bars/spits which should be preserved where possible as they are exceedingly rare structures in the UK). (ACTION: DETR, MAFF)

5.2.7 In so far as the legislation permits, the Government should take account of the potential benefits to lagoons when designating Nitrate Vulnerable Zones. (ACTION: DETR, NAW, SE)

5.3 Advisory

5.3.1 Create a lagoons working group to define best management practices, lagoon creation and colonisation/re-introduction of characteristic species by 1996. (ACTION: CCW, EN, JNCC, MAFF, SNH)

5.4 International

5.4.1 Develop liaison within Europe to ensure best practice in lagoonal conservation is exchanged and developed. (ACTION: CCW, EN, JNCC, SNH)

5.5 Monitoring and research

5.5.1 Establish an inventory of all coastal lagoons currently of national and international importance by 1998. Where information is still inadequate, encourage surveys which assess the importance of lagoonal habitats. (ACTION: CCW, DETR, EHS, EN, JNCC, SE, SNH)

5.5.2 Consider the development of coastal geomorphological modelling techniques which could assist in an understanding of the retention and development of lagoonal and other habitats, and consider supporting an associated programme for the monitoring of sediment supply and movement where appropriate. (ACTION: MAFF, NAW, SE)

5.5.3 Assess the feasibility of using some derelict docks as sites for the creation of lagoons including for possible *ex-situ* conservation of threatened lagoonal species. (ACTION: CCW, EN, SNH)

5.5.4 Use saline lagoon habitat creation schemes to test methods and the approach for creating new habitat. Such opportunities may arise, for example, through coastal defence set-back and perhaps also land use by industry. (ACTION: CCW, EN, SNH)

5.5.5 Support research into the environmental requirements and other elements of the ecology and genetic viability

of populations of certain key characterising lagoonal species. This would provide a sound basis for management. (ACTION: CCW, EN, SNH)

5.6 Communications and publicity

5.6.1 Raise public awareness by increasing links between schools, colleges and universities and local estuarine sites by providing educational resources and training on the interpretation of saline lagoonal habitats. (ACTION: DETR, NAW, SE)

6. Costings

6.1 The successful implementation of the action plan will have resource implications for both the private and public sectors. The data in Table 1 below provide a preliminary estimate of the likely resource costs to the public sector in the years 1997, 2000 and 2010.

6.2 The data are based on targets whereby 700 hectares of lagoon habitat will be appropriately maintained and enhanced through to 2010. The figure of 700ha is provided for illustration and does not supercede any of the targets included in Section 4.

Habitat Type: Saline lagoons (£000 per annum)

Habitat Type: Seagrass beds (£000 per annum)

| Area to be maintained and enhanced (Ha) | 1997 | 2000 | 2010 |
|--|-------------|-------------|-------------|
| 700 | 800 | 1500 | 600 |

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Annex to the saline lagoons habitat action plan: species

1. Background

1.1 A number of species found only, or predominantly, in saline lagoons are listed as priority species under the UK Biodiversity Action Plan. The species considered to be associated with saline lagoons are:

- ! starlet sea anemone *Nematostella vectensis*
- ! Ivell's sea anemone *Edwardsia ivelli*
- ! lagoon sandworm *Armandia cirrhosa*
- ! the hydroid *Clavopsella navis*
- ! lagoon sand shrimp *Gammarus insensibilis*
- ! the lagoon seaslug *Tenellia adspersa*
- ! Baltic stonewort *Chara baltica*
- ! bearded stonewort *Chara canescens*
- ! foxtail stonewort *Lamprothamnium papulosum*
- ! bird's nest stonewort *Tolypella nidifica*.

1.2 Given the intimate association of the listed species with their lagoonal habitat, and therefore between threats, actions and management for such species and the habitat, it is considered appropriate to link the species with the saline lagoons habitat action plan. Consequently, all of the species (except the two anemone species for which species action plans have already been published) are addressed through species statements rather than being subject to individual species action plans. It is considered that the group steering the implementation of the habitat action plan will also address the species concerned. It should be noted, however, that two species - *Chara canescens* and *C. baltica* - are also known from freshwater sites; this fact is reflected in the species statements. The lagoons HAP does not encompass such sites and therefore these species cannot be addressed solely by the saline lagoons HAP steering group.

1.3 It should be noted that actions implemented for the saline lagoon habitat and for the species named here will also benefit other lagoon fauna and flora including a number of other rare and/or specialist lagoonal species, eg *Gammarus chevreuxi* and *Hydrobia neglecta*.

2. Objectives for the species

2.1 The objectives for the habitat will by default contribute to protection and conservation of the species with the exception of where they occur outside of saline lagoons. The following additional objectives apply to all the species

2.1.1 Maintain, and where appropriate enhance, existing populations and, where appropriate, restore populations at former sites.

2.1.2 Maintain the range and number of sites including, where appropriate, through introduction to adjacent localities where existing localities become unsuitable.

3. Proposed action

3.1 Most of the actions listed for the habitat apply to the species and include a number that are species-specific. The following additional generic actions should be noted.

3.1.1 Promote surveys to determine the full extent of each species including at former localities. (ACTION: CCW, EHS, EN, SNH)

3.1.2 Ensure management and monitoring of relevant sites takes account of the species listed, and that species-related objectives and actions in management plans are acted on. (ACTION: CCW, EA, EHS, EN, SEPA, SNH)

3.1.3 Where appropriate, ensure habitat creation initiatives, including in the vicinity of present and former localities, take into account the requirements of the species. (ACTION: CCW, EHS, EN, LAs, SNH)

3.1.4 Where appropriate, determine the feasibility of former localities for the reintroduction of particular species. (ACTION: CCW, EHS, EN, LAs, SNH)

3.1.5 Where appropriate, consider further species-specific policy or legislative measures. (ACTION: CCW, DETR, DoENI, EHS, EN, JNCC, NAW, SE, SNH)

3.1.6 Pass relevant information gathered during survey and monitoring to JNCC or BRC for incorporating into national databases. (ACTION: CCW, EHS, EN, SNH)

3.1.7 Provide information periodically to WCMC on the UK status of species to contribute to up-to-date global red lists. (ACTION: JNCC)

3.1.8 Use the species as appropriate to raise awareness about saline lagoon habitat conservation and management. (ACTION: CCW, DETR, EHS, EN, NAW, SE, SNH)

Lagoon sandworm (*Armandia cirrhosa*)

Species Statement

1. Current status

- 1.1** The lagoon sandworm *Armandia cirrhosa* is a small polychaete, for which little biological information exists. The species is reported to prefer gravelly sediment although it is also found in muddy/sandy sediments in the UK, in salinities close to seawater.
- 1.2** The species has been recorded from only three UK sites which represent the most northerly records of the species in Europe. It was originally known only from Eight Acre Pond, Hampshire where it was found in 1984 and again in large numbers in 1985. It was last recorded in 1990. Despite repeated surveys (1991, 1993, 1996 and 1997) it has not been found there again. However, in 1994 it was found at two adjacent sites in Dorset, Small Mouth Spit, Portland Harbour and East Fleet Sandbank, Fleet Lagoon, but in very small numbers. The species was again identified at these two sites in the 1995 survey, but still in very low numbers.
- 1.3** Elsewhere in Europe this species is recorded from the Mediterranean, Adriatic, Madeira and the eastern Atlantic coasts.
- 1.4** The lagoon sandworm is protected under Schedule 5 of the Wildlife and Countryside Act 1981. The species was listed as *Insufficiently known* but possibly *Endangered* in the British Red Data Book. It is classified as a nationally rare benthic marine species.

2. Current factors causing loss or decline

- 2.1** See the saline lagoons action plan and associated species annex.
- 2.2** The decline at Eight Acre Pond may be associated with changes in salinity and/or inappropriate drainage.

3. Current action

- 3.1** The sites at Eight Acre Pond and inside the Fleet are both SSSIs and part of SACs whilst the other site lies adjacent to the Portland Harbour Shore SSSI.
- 3.2** The species is included in English Nature's Species Recovery Programme.

4. Objectives for the species

- 4.1** Maintain, and where appropriate enhance, existing populations and, where appropriate, restore populations at former sites.
- 4.2** Maintain the range and number of sites including, where appropriate, through introduction to adjacent localities where existing localities become unsuitable.

5. Proposed action

- 5.1** The requirements of the species should be considered in the implementation of the saline lagoons action plan and associated species annex.

Clavopsella navis (a hydroid)

Species Statement

1. Current status

- 1.1** The hydroid *Clavopsella navis* grows to a height of 30 mm and is predominantly found attached to algae. The minimal salinity tolerance of the species is thought to be 8‰.
- 1.2** In the UK, *C. navis* is found at only one site, Widewater Lagoon (Sussex). It was first reported in 1973 with individuals attached to *Chaetomorpha* algae, and was recorded again in 1983, 1985 and 1987 surveys. In 1990, *C. navis* was reported to be abundant and individuals were also recorded in a 1993 survey. Fieldwork in 1997 failed to record *C. navis*, but subsequent laboratory analysis of samples, collected during the survey revealed one individual hydroid, thought to be *C. navis*, attached to an *Ulva lactuca* plant.
- 1.3** Little information exists for the distribution of *Clavopsella navis* with the only recent report of the species, outside of the UK, being from the Kiel Canal (Germany), although it has been previously reported from South Africa and the Azores.
- 1.4** *C. navis* is regarded as nationally and internationally rare but was not formally classified in the British Red Data Book. It has been noted as a non-native species in Britain by some. The species was added to Schedule 5 of the Wildlife and Countryside Act 1981 in 1998.

2. Current factors causing loss or decline

- 2.1** See saline lagoons action plan and associated species annex.
- 2.2** It is considered that water-levels, and perhaps water quality, at Widewater lagoon may have deteriorated with a reduction in seawater input appearing to have resulted in hypersaline conditions during the summer months. The decline in numbers of the species may be associated with this.

3. Current action

- 3.1** Following recent survey, consideration is now being given to updating and implementing various actions in the Widewater lagoon management plan.

4. Objectives for the species

- 4.1** Maintain, and where appropriate enhance, existing populations and, where appropriate, restore populations at former sites.
- 4.2** Maintain the range and number of sites including, where appropriate, through introduction to adjacent localities where existing localities become unsuitable.

5. Proposed action

- 5.1** The requirements of the species should be considered in the implementation of the saline lagoons action plan and associated species annex, and in particular through the implementation of the Widewater lagoon management plan.

Lagoon sand shrimp (*Gammarus insensibilis*)

Species Statement

1. Current status

1.1 The lagoon sand shrimp (the amphipod crustacean *Gammarus insensibilis*) is a lagoonal specialist species for which little published biological and ecological information exists. It is always associated with macrophytes, and in particular with drifting mats of the green alga *Chaetomorpha linum*, which has been recorded at all lagoon sand shrimp sites. Other macrophyte-associated species often occurring with *Gammarus insensibilis* include lagoon specialists such as the isopod crustaceans *Idotea chelipes* and *Sphaeroma hookeri*, the lagoon cockle *Cerastoderma glaucum*, the gastropods *Hydrobia ventrosa* and *Littorina tenebrosa*, and the starlet anemone *Nematostella vectensis*. Site characteristics include: a regular tidal input of sea water; a small tidal range; freshwater input (other than rainfall or run-off from surrounding land) low or absent; water is retained at all states of the tide and at all seasons; salinity is high, within the range 10-58‰, usually 15-35‰, with seasonal variation; sediments are variable.

1.2 Within the UK, the amphipod is fairly widely distributed in lagoons along the south and east coasts of England, between Dorset and Lincolnshire. The species was initially recorded in the UK at only two localities, the Chesil Fleet in Dorset (recorded in 1947 as *G. locusta*) and New England Creek on the Thames estuary in Essex (1939, again as *G. locusta*). It has since been recorded on the south coast of England from the Chesil Fleet (Dorset), Hengistbury Head Lagoon (Dorset), the Keyhaven-Lymington lagoons (Hampshire), Warren Park Shore Lagoons (Hampshire), Stansore Point Lagoon (Hampshire), Ashlett Mill Pond (Hampshire), Gilkicker Lagoon (Hampshire), Little Anglesey (Hampshire), Cockle Pond (Hampshire), Seaward Tower Moat (Hampshire), Newtown Quay Lagoon (Isle of Wight), Harbour Farm Lagoons (Isle of Wight), Thorney Great Deep (W. Sussex), Birdham Pool (W. Sussex) and Widewater (W. Sussex). On the east coast of England, it has been recorded from Sheerness Lagoon (Kent), New England Creek (Essex), Shingle Street (Suffolk), Aldeburgh P8 Lagoon (Suffolk), Reedland Marshes Lagoon (Suffolk), Benacre Broad (Suffolk), Salthouse Broad (Norfolk), New Moon (Norfolk), West and East Gramborough Hill (Norfolk), Titchwell Lagoon (Norfolk), Lawyer's Farm Lagoon (Lincolnshire) and Humberston Fitties Lagoon (Lincolnshire). Recent surveys indicate that the species is no longer present at Stansore Point Lagoon or Hengistbury Head Lagoon, Widewater Lagoon and Benacre Broad.

1.3 Outside the UK, the lagoon sand shrimp is known from the Black and Mediterranean seas to the Atlantic coast

of Europe, extending in distribution as far north as the English Channel. Although usually occurring at depths down to 15 m in sheltered brackish waters, in the Mediterranean it can be found in fully marine conditions. As this species is morphologically close to *G. locusta* it may be under-recorded in parts of its range.

1.4 The species is protected under Schedule 5 of the Wildlife and Countryside Act 1981. It is listed as *Rare* in the British Red Data Book. The species is regarded as *Nationally scarce* in a recent review of benthic marine species.

2. Current factors causing loss or decline

2.1 See saline lagoons action plan and associated species annex.

2.2 Changes in the salinity regime of sites in particular should be noted. For example, the species has been lost from Widewater (W. Sussex), where a reduction in seawater input appears to have resulted in hypersaline conditions during the summer months. Within the Keyhaven-Lymington lagoon system, the lagoon sand shrimp has been lost from the western Keyhaven-Pennington section, following sea-wall reconstruction resulting in markedly hyposaline conditions, especially in winter.

3. Current action

3.1 Of the 24 lagoons/lagoon systems where the lagoon sand shrimp is currently recorded, 10 are within candidate SACs, 16 are within SSSIs and 8 are undesignated. The current status of this species is dependent on informed management of its habitat.

4. Objectives for the species

4.1 Maintain, and where appropriate enhance, existing populations and, where appropriate, restore populations at former sites.

4.2 Maintain the range and number of sites including, where appropriate, through introduction to adjacent localities where existing localities become unsuitable.

5. Proposed action

5.1 The requirements of the species should be considered in the implementation of the saline lagoons action plan and associated species annex.

Lagoon seaslug (*Tenellia adpersa*)

Species Statement

| 1. Current status | 4. Objectives for the species |
|--|--|
| <p>1.1 The lagoon seaslug <i>Tenellia adpersa</i> is a very small nudibranch, growing to a maximum length of less than 10 mm, with a pale yellow or pale brown body marked with tiny black spots of varying density. It has few cerata arranged in up to six rows. It feeds predominantly on hydroids including <i>Abietinaria abietina</i>, <i>Cordylophora lacustris</i>, <i>Laomedea</i> spp and <i>Protohydra leuckarti</i>. Populations in the Fleet are known to fluctuate widely. The species favours a range of sheltered brackish water habitats including saline lagoons, brackish ditches, estuaries and harbours, tolerating salinities down to 3‰.</p> <p>1.2 Recent records for the species are from Portishead (Bristol Channel), the Fleet (Dorset) and St. Osyth (Essex). The species has been recorded from four other localities in Britain this century - Snettisham Pits lagoon and a creek near Dersingham (both Norfolk), New England Creek (Essex), and saltmarsh pools in the Firth of Forth. Records from before 1900 include Rotherhithe (London docklands), where the species was reported to be common. The species may prove to occur more widely in the UK as it can be easily overlooked.</p> <p>1.3 Outside of the UK the species is widespread but in north-western Europe it is sporadically distributed and apparently not common at any locations.</p> <p>1.4 The lagoon seaslug is protected under Schedule 5 of the Wildlife and Countryside Act 1981. The species was listed as <i>Insufficiently known</i> but at least <i>Rare</i> in the British Red Data Book and classified as <i>Nationally rare</i> in a recent review of benthic marine species.</p> | <p>4.1 Maintain, and where appropriate enhance, existing populations and, where appropriate, restore populations at former sites.</p> <p>4.2 Maintain the range and number of sites including, where appropriate, through introduction to adjacent localities where existing localities become unsuitable.</p> |
| 2. Current factors causing loss or decline | 5. Proposed action |
| <p>2.1 See saline lagoons action plan and associated species annex.</p> <p>2.2 The Fleet population declined during the 1980s, possibly due to a reduction in hydroid numbers.</p> | <p>5.1 The requirements of the species should be considered in the implementation of the saline lagoons action plan and associated species annex.</p> |
| 3. Current action | |
| <p>3.1 The Fleet is a SSSI and cSAC. The Essex site lies within a SSSI and Portishead Beach forms part of a SSSI.</p> | |

Baltic stonewort (*Chara baltica*)

Species Statement

1. Current status

- 1.1** The Baltic stonewort *Chara baltica* is a rare stonewort (charophyte) growing to a height of up to 90 cm with regular whorls of slender cylindrical branches. It differs from several related species by colour, having only solitary spines on the stem and various microscopic features. It grows in a variety of habitats adjacent to the sea, including lakes, lagoons, quarry pools and pools in sand dunes. It can tolerate salinities up to 18 ‰ but it more frequently occurs in lower salinities (to less than 1 ‰). However, it does seem to require some salt, even if only carried to the site by the wind. In Britain it grows in depths up to 2.5 m and it seems to prefer sandy or marly substrates with low organic content. In more saline situations it often grows with tasselweeds (*Ruppia* spp) and other brackish water stoneworts, including foxtail stonewort *Lamprothamnium papulosum*, bearded stonewort *Chara canescens* and bird's nest stonewort *Tolypella nidifica*. In fresher water it is normally associated with other stoneworts typical of high lime and low nutrients, including bristly stonewort *Chara hispida*, common stonewort *Chara vulgaris* and intermediate stonewort *Chara intermedia* as well as vascular plants such as spiked watermilfoil *Myriophyllum spicatum*. Baltic stonewort is usually a perennial species but in certain situations it can act as an annual. Oospores are normally produced between July and September.
- 1.2** In the UK, the species is currently known from five sites scattered around the coast: two pools at Branton Burrows (Devon); one pool at Newborough Warren (Anglesey); Loch an Strumore (Outer Hebrides); Loch an Duin (Outer Hebrides); and one part of Hickling Broad (Norfolk). The size of the Hebridean populations is uncertain. Two other sites, Mullion Cliffs (Cornwall) and Loch of Spiggie (Shetland) require confirmation. Historically there are records from six other sites in Cornwall (Kynance Downs, Goonhilly Downs and Newlyn), Kent (Birchington Marshes) and Orkney (Loch of Stenness and Loch of Harray).
- 1.3** The species is recorded from all of the northern coastal countries of Europe and is most frequent in the reduced salinities of the Baltic Sea. Outside Europe it is only known from Greenland and Bolivia.
- 1.4** Baltic stonewort has no specific legal protection. It is listed as *Vulnerable* in the British Red Data Book.

2. Current factors causing loss or decline

- 2.1** The main threat to this species is thought to be poor water quality. The species is restricted to nutrient-poor situations and is therefore highly sensitive to nutrient enrichment where angiosperms and filamentous algae have a competitive advantage.

- 2.2** Boat disturbance and cutting of aquatic vegetation at Hickling Broad may be detrimental, or may become so in the future, but this needs further investigation.

- 2.3** Losses from sites in Cornwall may have been due to natural succession and this could become a problem in the sand dune sites in Devon and Anglesey.

- 2.4** Some of the factors affecting saline lagoons are relevant to several sites (see saline lagoons action plan and associated species annex). Reference should also be made to the sand dunes action plan in relation to sand dune sites.

3. Current action

- 3.1** All of the current sites have SSSI status, including those that require confirmation. Hickling Broad is also a NNR, a Special Protection Area, Ramsar site and candidate Special Area of Conservation. Newborough Warren is a NNR. Loch an Duin and Loch an Strumore both lie within the Loch Maddy Special Area of Conservation and the former is also a Ramsar site.

4. Objectives for the species

- 4.1** Maintain, and where appropriate enhance, existing populations and, where appropriate, restore populations at former sites.
- 4.2** Maintain the range and number of sites including, where appropriate, through introduction to adjacent localities where existing localities become unsuitable.

5. Proposed action

- 5.1** The requirements of the species should be considered in the implementation of the saline lagoons action plan and associated species annex, and the implementation of the sand dunes action plan.
- 5.2** In addition, actions in relation to freshwater sites will involve other relevant bodies, eg the Broads Authority for Hickling Broad.

Bearded stonewort (*Chara canescens*)

Species Statement

1. Current status

- 1.1** The bearded stonewort *Chara canescens* is a rare stonewort (charophyte) growing to a height of up to 30 cm with regular whorls of slender cylindrical branches. The plant is densely covered with spines which gives it a furry appearance. Bearded stonewort is normally a species of clear brackish water up to 2.5 m deep in lagoons, lakes and pools by the coast. It often grows with slender-leaved pondweed *Potamogeton filiformis*, rough stonewort *Chara aspera* or fennel pondweed *Potamogeton pectinatus* on calcareous sandy or marly, gradually shelving edges of lakes, usually associated with sand dunes or machair or with tasselweed *Ruppia maritima* on muddy substrates in brackish lakes and lagoons. It usually prefers sites in the range 4-20 ‰ salinity and may be able to tolerate levels up to 34 ‰. However, its remaining English sites are unusual in being inland and in very low salinity (<1 ‰). Here it occurs in a number of pools in abandoned clay pits growing with a mixture of stoneworts, particularly hedgehog stonewort *Chara pedunculata* together with fen pondweed *Potamogeton coloratus*, fennel pondweed *Potamogeton pectinatus* and glaucous bulrush *Schoenoplectus tabernaemontani*. It is confined to the youngest pools and does not survive in pools older than 20 years without management.

Only female plants occur in northern Europe and the species reproduces parthenogenetically. It can be annual or perennial and produces oospores abundantly in the summer, ripening from mid-July onwards. The oospores are probably transported by birds who ingest them with other food. In dense vegetation, for example of *Ruppia* species, the plant often grows in the clearings created by feeding swans and wildfowl.

There is evidence from the historical records that the species is able to colonise new sites where suitable conditions develop close to existing populations.

- 1.2** In the UK, bearded stonewort is now restricted to three sites near Peterborough, Cambridgeshire and one site in the Outer Hebrides (Loch Mor, Baleshare). It has previously been recorded from 11 other sites around the coast of England from Cornwall to Norfolk and in Orkney in Scotland. In two of the Peterborough sites it occurs either rarely or fairly frequently, but in the other it is found in over 40 small ponds, sometimes in considerable abundance. The size of the Hebridean population is unknown.

- 1.3** The species is widely but sparsely distributed around the coast of Europe, and occasionally in saline lakes or ponds inland. It also occurs sporadically in Asia, north Africa and North America. The male plant is much more localised and is restricted to southern Europe and south-western Asia (southern France to the Caspian Sea) and to eastern Asia (China and Mongolia).

- 1.4** The species has been protected under Schedule 8 of the Wildlife and Countryside Act 1981 since 1992. It is listed as *Endangered* in the British Red Data Book

2. Current factors causing loss or decline

- 2.1** Historically, many of the factors affecting saline lagoons are relevant to the species (see saline lagoons action plan and associated species annex).
- 2.2** Losses have occurred due to salinity changes, habitat destruction and changes in water quality.
- 2.3** The species is restricted to nutrient-poor situations and is therefore highly sensitive to nutrient enrichment where angiosperms and filamentous algae have a competitive advantage.
- 2.4** In the Peterborough area, the species is restricted to recently excavated pools up to 20 years old, eventually disappearing through natural successional changes. Colonies can be maintained through periodic clearance but the long-term future of the species is related to continued brick-clay extraction. This has been reducing in recent years and extraction methods in the remaining pits are less favourable to the bearded stonewort.
- 2.5** See also the habitat action plan for machair in relation to factors at the Hebridean site.

3. Current action

- 3.1** One of the Peterborough sites is largely a SSSI and a nature reserve but the other two have no conservation status. The Hebridean site is a SSSI and cSAC (but for machair rather than lagoons).
- 3.2** This species is included in English Nature's Species Recovery Programme. A management programme is being developed for the larger Peterborough site and a programme of reintroductions to former coastal sites was initiated in 1998 (eg to Benacre Broad).

4. Objectives for the species

- 4.1** Maintain, and where appropriate enhance, existing populations and, where appropriate, restore populations at former sites.
- 4.2** Maintain the range and number of sites including, where appropriate, through introduction to adjacent localities where existing localities become unsuitable.

5. Proposed action

- 5.1** The requirements of the species should be considered in the implementation of the saline lagoons action plan and associated species annex and, in relation to the Hebridean site, the machair habitat action plan.
- 5.2** The majority of the population near Peterborough lies within a future nature reserve within which management is directed towards ensuring a viable population in the long term.

Foxtail stonewort (*Lamprothamnium papulosum*)

Species Statement

- | | | | |
|------------|---|------------|--|
| 1. | Current status | | <p>discovered after this was published and its status would probably now be <i>Rare</i> under the old IUCN criteria or <i>Lower risk</i> under the revised IUCN criteria.</p> |
| 1.1 | <p>The foxtail stonewort <i>Lamprothamnium papulosum</i> is a rare, brackish water stonewort (charophyte) growing to a height of up to 40 cm with regular whorls of slender cylindrical branches each with several spine-like bracts which give the plant a furry appearance. The upper parts of the stem are usually contracted so that the whorls form bushy heads reminiscent of fox tails. The species grows best in salinities in the range 8-28 ‰, but it can tolerate up to 32 ‰. It grows on sandy or silty substrates in depths of up to 2 m in coastal lagoons or lagoon-like habitats. It often grows with tassel weeds <i>Ruppia</i> spp, but it does not compete well with dense vascular plant growth. It is therefore often found in areas where there is some disturbance from animals, or in shallow water where fluctuations in the water level result in more open vegetation. It does not, however, tolerate strong wave-action. In Britain it is a summer annual, germinating in spring or early summer and producing oospores from July to September.</p> | 2. | Current factors causing loss or decline |
| | | 2.1 | <p>Many of the factors affecting saline lagoons are relevant to the species (see saline lagoons action plan and associated species annex).</p> |
| | | 2.2 | <p>Losses have occurred due to salinity changes, habitat destruction and changes in water quality.</p> |
| | | 2.3 | <p>The species is restricted to nutrient-poor situations and is therefore highly sensitive to nutrient enrichment where angiosperms and filamentous algae have a competitive advantage. This has been implicated in its probable loss from Eight Acre Pond.</p> |
| | | 3. | Current action |
| 1.2 | <p>In the UK, foxtail stonewort is restricted to a few sites on the south coast of England and in the Outer Hebrides. In England it occurs at four brackish coastal sites at The Fleet (Dorset), Fort Gilkicker Moat (Hampshire), Harbour Farm Lagoons, Bembridge (Isle of Wight) and Great Deep (West Sussex). Of these, only The Fleet supports a sizeable population. It seems to have disappeared from a fifth site at Eight Acre Pond (Hampshire) within the last ten years. In the Outer Hebrides, the species has been found at nine sites on North Uist and up to three on South Uist, although two of the latter are not confirmed. At many of the North Uist sites, the species is locally frequent, often co-occurring with other brackish stonewort species. It has been argued that the Hebridean sites may represent the most secure global stronghold for foxtail stonewort.</p> | 3.1 | <p>All of the current sites in England have SSSI status. Three are within lagoon candidate Special Areas of Conservation (SACs): Chesil and the Fleet, Solent and Isle of White Lagoons, and Solent Maritime (which includes Great Deep but is not identified for lagoon features). In Scotland in the Outer Hebrides, seven of the sites are within three SSSIs and one of these is also a Ramsar site (Loch an Duin). Five of the sites lie within the Loch Maddy cSAC, and one within the Obain Loch Euphoirt cSAC.</p> |
| | | 4. | Objectives for the species |
| | | 4.1 | <p>Maintain, and where appropriate enhance, existing populations and, where appropriate, restore populations at former sites.</p> |
| | | 4.2 | <p>Maintain the range and number of sites including, where appropriate, through introduction to adjacent localities where existing localities become unsuitable.</p> |
| 1.3 | <p>The foxtail stonewort has a sporadic distribution around the coast of Europe from Norway to the Iberian Peninsula. In the Mediterranean it extends eastwards to Tunisia and Sicily with isolated records from Cyprus and the Black Sea. Outside the UK the main strongholds seem to be southern France and the western Baltic Sea, and there are several sites in Ireland, but it is declining throughout its range. There is also an isolated report from South Africa.</p> | 5. | Proposed action |
| | | 5.1 | <p>The requirements of the species should be considered in the implementation of the saline lagoons action plan and associated species annex.</p> |
| 1.4 | <p>The species has been protected under Schedule 8 of the Wildlife and Countryside Act 1981 since 1987. It is listed as <i>Vulnerable</i> in the British Red Data Book. However, most of the Hebridean populations were</p> | | |

Bird's nest stonewort (*Tolypella nidifica*)

Species Statement

1. Current status

1.1 The bird's nest stonewort (*Tolypella nidifica*) is a rare, brackish water stonewort (charophyte) growing to a height of up to 30 cm. It is a delicate much-branched species with long slender sterile branches and short fertile branches which are incurved to form tufted bird's-nest-like heads. It is a species of brackish lakes and lagoons in depths of up to 2.5 m. It grows best in salinities in the range 4-15 ‰, but it can sometimes occur in salinities in the range 2-18 ‰. In the Baltic Sea it is mainly restricted to sandy substrates but it can tolerate a mixture of sand and silt as it does in its British sites. It often grows with tasselweeds *Ruppia* spp, and it is often associated with other brackish water stoneworts, including foxtail stonewort *Lamprothamnium papulosum*, bearded stonewort *Chara canescens* and Baltic stonewort *Chara baltica*. It is a summer annual, germinating in spring or early summer and producing oospores from July to October.

1.2 In the UK, bird's nest stonewort is restricted to two sites in northern Scotland; Loch an Duin (Outer Hebrides) and Loch of Stenness (Orkney). There are unconfirmed historic records from Norfolk, Suffolk and Shetland, some of which may have been correct, but the only other confirmed site is Loch of Boardhouse (Orkney) where attempts to rekindle it have been unsuccessful. The sizes of the populations are still poorly known; the Orkney site seems to be restricted to a few square m but at the Hebridean site it seems to be scattered sparsely over one bay.

1.3 The bird's nest stonewort is restricted to the coasts of northern Europe. It is most frequent in the Baltic Sea but there are scattered records from around the North Sea and from northern Norway.

1.4 The species has no specific legal protection. It was listed as *Indeterminate* in British Red Data Book prior to its rediscovery in Scotland. Its status would now be *Endangered* under the old IUCN criteria or *Critically endangered* under the revised IUCN criteria.

2. Current factors causing loss or decline

2.1 Many of the factors affecting saline lagoons are relevant to the species (see saline lagoons action plan and associated species annex).

2.2 The ecology of the species is still poorly understood but it is likely to be affected by salinity changes and changes in water quality. Most stoneworts require

nutrient-poor situations and it is thought this may have caused a decline at the current Orkney site and possibly the loss from its other Orkney site.

3. Current action

3.1 Both of the current sites have SSSI status and are within candidate Special Areas of Conservation (Loch Maddy and Loch of Stenness); Loch an Duin is also a Ramsar site.

4. Objectives for the species

4.1 Maintain, and where appropriate enhance, existing populations and, where appropriate, restore populations at former sites.

4.2 Maintain the range and number of sites including, where appropriate, through introduction to adjacent localities where existing localities become unsuitable.

5. Proposed action

5.1 The requirements of the species should be considered in the implementation of the saline lagoons action plan and associated species annex.

Mud habitats in deep water

Habitat Action Plan

1. Current status

extreme conditions of anoxia, little survives except the *Beggiatoa*.

1.1 Physical and biological status

1.1.1 Mud habitats in deep water (circalittoral muds) occur below 20-30 m in many areas of the UK's marine environment, including marine inlets such as sea lochs. The relatively stable conditions associated with deep mud habitats often lead to the establishment of communities of burrowing megafaunal species where bathyal species may occur with coastal species. The burrowing megafaunal species include burrowing crustaceans such as *Nephrops norvegicus* and *Callinassa subterranea*. The mud habitats in deep water can also support seapen populations and communities with *Amphiura* spp.

1.1.5 Offshore mud habitats can be characterised by the burrowing urchin *Brissopsis lyrifera* and the brittlestar *Amphiura chiajei* and in certain areas around the UK, such as the northern Irish Sea, this community may also include *N. norvegicus*.

1.1.6 In boreal and Arctic areas of water deeper than 100 m, the soft muds are dominated by a community of foraminiferans and hatchett shells *Thyasira* spp. with polychaete worms. There can be thousands of dead foraminiferan tests per square metre.

1.1.2 Burrows and mounds produced by megafauna are prominent features on the surface of plains of fine mud, amongst conspicuous populations of seapens, typically *Virgularia mirabilis* and *Pennatula phosphorea*. These soft mud communities occur extensively throughout the more sheltered basins of sea lochs and voes. As these sites are typically sheltered from wave action, these communities may occur in quite shallow depths (15 m). These communities also occur in deep offshore waters of the North Sea, where densities of *N. norvegicus* can reach 68 per 100 m², and in the Irish Sea. Other burrowing crustaceans include *Calocaris macandreae*, *C. subterranea* and *Goneplax rhomboides*. The echinuran *Maxmuelleria lankesteri* forms large mounds in some sea loch sites. Epibenthic scavengers include *Asterias rubens*, *Pagurus bernhardus* and *Liocarcinus depurator*. Brittlestars may be present and the infauna can contain populations of polychaetes and bivalves

1.1.7 The most rare deep mud biotope is notable for the very high density of the rare sea squirt *Styela gelatinosa* and is known from only one site in the UK: Loch Goil, a Clyde sea loch. Within Loch Goil, the fine mud at 65 m has large numbers of solitary ascidians, including *S. gelatinosa*, *Ascidia conchilega*, *Corella parallelogramma* and *Ascidiella* spp along with terebellid worms and the bivalve *Pseudamussium septemradiatum*. This biotope is considered to be an ice age relic.

1.1.3 Within deep fjordic sea lochs, 'forests' of the nationally scarce tall seapen *Funiculina quadrangularis* can occur, together with the other two species of seapens. However, as *F. quadrangularis* is considered to be a bathyal species which 'intrudes' into sea lochs and fjords, it may only be nationally scarce in inshore waters. The mud is also extensively burrowed by crustaceans, mainly *N. norvegicus*, and the goby *Lesueurigobius friesii* may be present in burrow entrances.

1.1.8 The JNCC Marine Nature Conservation Review (MNCR) classification for sublittoral mud biotopes is still under development and additional new biotopes are likely to be added which have to be taken into account in the future. The characteristic species in circalittoral mud biotopes are:

- ! Seapens - *Virgularia mirabilis* and *Pennatula phosphorea* and burrowing megafauna (CMU.SpMeg). Distribution: Shetland; Scottish west coast sea lochs; Western Isles; Irish Sea including off the Welsh coast; North Sea and southern England.
- ! Seapens - *Funiculina quadrangularis* and burrowing megafauna (CMU.SpMeg.Fun). Distribution: Scottish west coast sea lochs.
- ! *Beggiatoa* sp. on anoxic mud (CMU.Beg). Distribution: Shetland; Scottish west coast sea lochs.
- ! Burrowing urchin *Brissopsis lyrifera* and the brittle star *Amphiura chiajei* (CMU.BriAchi). Distribution: Northern part of Irish Sea; the Clyde and Minch and some Scottish sea lochs (eg Loch Etive).

1.1.4 Areas of soft anoxic mud can have extensive bacterial mats of *Beggiatoa* spp. The anoxia may be the result of natural conditions of poor water exchange in some Scottish sea lochs or of nutrient enrichment under fish farm cages. The associated fauna is usually impoverished but scavenging species such as *Asterias rubens* and *Carcinus maenas* are typically present. In

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| | <p>! Foraminiferans and <i>Thyasira</i> spp (COS.ForThy). Distribution: Norwegian fjords; Greenland; northern North Sea; Loch Eil; and Loch Nevis (Scottish west coast); southern Irish Sea (Celtic Deep to Milford Haven).</p> | <p>2.4 Development. The construction of roads, bridges and barrages may affect the local hydrodynamic and sediment transport regimes of inshore enclosed areas and consequently affect the deep mud substratum.</p> |
| | <p>! <i>Styela gelatinosa</i> and other solitary ascidians (COS.Sty). Distribution: Loch Goil (a Clyde sea loch on the Scottish west coast).</p> | <p>2.5 Anchoring. This can cause physical damage to static megafaunal species such as seapens and <i>S. gelatinosa</i>.</p> |
| 1.2 | Links with other action plans | <p>2.6 Offshore oil rigs and other oil installations. These can cause a variety of disturbance effects such as smothering due to disposal of drill cuttings, localised disturbance of sediments due to anchors and rig feet emplacement and trench digging for pipelines.</p> |
| 1.2.1 | Two species statements have been written for <i>Funiculina quadrangularis</i> (a seapen) and <i>Styela gelatinosa</i> (a sea squirt). The implementation of these statements should be directed by the actions given in this habitat action plan. | 3. Current action |
| 1.2.2 | Reference should also be made to the action plans for sheltered muddy gravels and serpulid reefs, because of their similar physical conditions. A degree of compatibility will therefore exist in the aims and objectives of these action plans and this should facilitate their implementation. | 3.1 Legal status |
| 2. | Current factors affecting the habitat | 3.1.1 |
| 2.1 | Demersal fishing. The majority of deep mud habitats are subject to some demersal fishing effort, principally for <i>Nephrops norvegicus</i> . <i>Nephrops</i> is one of most important fisheries in Scotland and benthic trawls or pots/creels are the two methods of fishing employed. The use of benthic trawls can result in the removal of non-target species and disturbance to the seabed. Where heavy demersal fishing occurs, populations of <i>Brissopsis lyrifera</i> may be reduced. Potting for prawns and other crustacea selectively removes some of the burrowing megafauna from deep mud areas but the physical impact of the pots on the seabed and non-target species is generally considered to be slight. <i>Styela gelatinosa</i> is not known to be associated with <i>Nephrops</i> so fisheries by-catch damage to it is not likely to occur. | Currently the three species of seapens and the sea squirt <i>S. gelatinosa</i> have no statutory protection under UK or EC legislation. Some deep mud habitats are covered by some of the marine Special Areas of Conservation (SAC) sites, selected for 'Large shallow inlets and bays' under the EC Habitats Directive. However, this Annex I habitat is generally limited to 30 m. Within the existing SAC network, mud habitats in deep water are represented within sites such as Strangford Lough, Loch Maddy and Lochs Duich, Long and Alsh. Some of the Scottish Marine Consultation Areas include areas of circalittoral mud. The adoption in July 1998 of the new Annex V to the OSPAR Convention on Protection of the Marine Environment of the North East Atlantic may also offer a new opportunity to protect important deep water or offshore habitats and species, although this Annex emphasises that work under OSPAR should not duplicate that being undertaken under other international agreements. |
| 2.2 | Marine fish farms. These are often sited within Scottish sea lochs and may have direct effects on mud communities, including smothering and increasing the Biological Oxygen Demand of the mud. Additional effects may result from the discharges of chemicals, some of which are especially toxic to crustaceans. | 3.1.2 Government departments (MAFF, SE, CEC, DTI and DETR) are responsible for the assessment of the potential impacts of oil and gas exploration and production aggregate extraction, marine construction work, land reclamation and dumping of dredged material prior to licensing. The conditions attached to these licences can stipulate that measures are adopted to minimise environmental impacts. Licenses may be refused on environmental grounds. |
| 2.3 | Pollution. Nutrient enrichment leading to eutrophication can have significant detrimental effects. This can lead to changes in the structure and composition of deep mud communities. | 3.2 Management, research and guidance 3.2.1 Considerable research is undertaken by the Centre for Environment, Fisheries and Aquaculture Science (CEFAS) of MAFF and the Fisheries Research Service (FRS) of the Scottish Office Agriculture, Environment and Fisheries Department (SOAEFD) into the effects of fishing gear on benthic habitats and communities. |

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| | Deep mud communities are being studied as part of the UK National Monitoring Programme. | 5.2.3 | Promote the use of potting, instead of trawling, in sheltered areas of deep water with mud biotopes as the most ecologically sustainable, least-damaging method of harvesting <i>Nephrops</i> and other crustaceans. (ACTION: DANI, MAFF, NAW, SE) |
| 3.2.2 | A broad variety of research into deep mud communities, seapens and burrowing megafauna is being undertaken by a number of research institutions, principally the University Marine Biological Station Millport, Dunstaffnage Marine Laboratory, Oban and the University of Newcastle (long-term studies off the Northumberland coast). | 5.3 | Advisory |
| 4. | Action plan objectives and proposed targets | 5.3.1 | Provide information to yachting and mooring associations on best practice to avoid damage to sensitive mud biotopes in deep water, such as seapen beds and especially <i>S. gelatinosa</i> in Loch Goil. (ACTION: CCW, EHS, EN, SNH) |
| 4.1 | Protect a representative range of 8 to 10 sites, illustrating typical mud biotopes in deep water, by 2009. | 5.3.2 | Provide general advice and information to fisheries managers and policy-makers on the sensitivity, conservation importance and ecological requirements of mud biotopes in deep water. Particular attention should be drawn to the seapen beds and <i>S. gelatinosa</i> , in order to raise awareness and promote the protection of key sites. (ACTION: CCW, EHS, EN, SNH) |
| 5. | Proposed action with lead agencies | 5.3.3 | Provide general advice and information to Loch Goil fisheries organisations and managers, as well as appropriate local authorities, on the importance and ecological requirements of the <i>S. gelatinosa</i> community. Effort should be made to avoid any impacts of operations and new developments on the populations of <i>S. gelatinosa</i> in Loch Goil. (ACTION: SE, SEPA, SNH) |
| 5.1 | Policy and legislation | 5.4 | International |
| 5.1.1 | Assist fisheries ministers in pressing for greater account to be taken of marine biodiversity within the Common Fisheries Policy. (ACTION: DANI, MAFF, NAW, SE) | 5.4.1 | None proposed. |
| 5.1.2 | Review the EC Habitats Directive Annex I habitats to address the shortfalls of the original list and consider whether mud biotopes in deep water, specifically those found within sea lochs, should be proposed as an addition to the Annex. (ACTION: DETR, JNCC, SE) | 5.5 | Monitoring and research |
| 5.1.3 | Investigate the possibility of adding the three seapen species and the sea squirt <i>S. gelatinosa</i> to the Wildlife and Countryside Act 1981 (schedule 5) and the Wildlife (NI) Order 1985. (ACTION: DoE(NI), JNCC) | 5.5.1 | Establish the status and ecological requirements for <i>S. gelatinosa</i> and confirm Loch Goil as the only location for this species in the UK. (ACTION: NERC, SNH) |
| 5.1.4 | Encourage the long-term management of <i>Nephrops</i> and other crustaceans and the conservation of mud habitats in deep water through the use of Regulating Orders in Scotland. (ACTION: SE, SNH) | 5.5.2 | Investigate the biology and ecological requirements of the three seapen species. (ACTION: NERC, SNH) |
| 5.2 | Site safeguard and management | 5.5.3 | Confirm the distribution of the three seapen species, particularly <i>F. quadrangularis</i> . (ACTION: NERC, SNH) |
| 5.2.1 | Identify by 2002 nationally important mud habitats in deep water and the associated communities within the UK. (ACTION: CCW, EHS, EN, JNCC, SNH) | 5.5.4 | Assess the current extent and quality (including extent of damage) of mud habitats in deep water in the UK (ACTION: CCW, EHS, EN, JNCC, NERC, SNH) |
| 5.2.2 | Implement measures to protect mud habitat in deep waters through the network of SACs where such habitats are included within the site as an interest feature. (ACTION: All relevant authorities) | 5.6 | Communications and publicity |
| | | 5.6.1 | Promote and encourage a marketing strategy that works towards pot-caught <i>Nephrops</i> being harvested in the least-damaging, ecologically sustainable manner. |

Encourage the long-term management of this resource through the use of Regulating Orders in Scotland. (ACTION: SE, SNH)

5.6.2 Raise awareness of the importance and diversity of deep mud habitats among marine users. (ACTION: CCW, EHS, EN, SNH)

5.6.3 Gain public support in promoting the biological importance of this habitat – ‘mud in deep water is deeply interesting!’ (ACTION: CCW, EHS, EN, SNH)

6. Costings

6.1 The successful implementation of this habitat action plan will have resource implications for both the public and private sectors. The data in the table below provide an estimate of the current expenditure on the habitat and the likely additional resource costs. These additional costs are based on the annual average over 5 and 10 years. The total expenditure for these time periods is also given. Almost all the costs will relate to the public sector, although some costs (eg for research) will be met by the private sector/non-governmental organisations).

7. Key References

Dyer, M.F., Fry, W.G., Fry, P.D. & Cranmer, G.J. 1982. A series of North Sea benthos surveys with trawl and headline camera. *Journal of the Marine Biological Association UK*, **62**, 297-313.

Dyer, M.F., Fry, W.G., Fry, P.D. & Cranmer, G.J. 1983. Benthic regions within the North Sea. *Journal of the Marine Biological Association UK*, **63**, 683-693.

Costings for mud habitats in deep water

| | Current expenditure | 1st 5 yrs to 2004/2005 | Next 10 yrs to 2014/2015 |
|--|----------------------------|-------------------------------|---------------------------------|
| Current expenditure /£000/Yr | | | |
| Total average annual cost /£000/Yr | | 69.6 | 8.7 |
| Total expenditure to 2005/£000 | | 348 | |
| Total expenditure 2005 to 2014/£000 | | | 87 |

Funiculina quadrangularis (a seapen)

Mud habitats Species Statement (1)

1. Current status

1.1 *Funiculina quadrangularis* is by far the largest of the three seapens which occur around the British Isles, growing to a spectacular 1.5 to 2.1 m in height and forming dense groves over soft subtidal mud plains.

1.2 *Funiculina quadrangularis* is restricted in its distribution within Britain to west Scotland (mainland Scotland, Mull, Skye, Lewis and Harris), where soft mud habitats are found in the deep sheltered fjordic sea lochs and nearby inshore areas. It appears to be absent from inshore areas in the Clyde, Shetland, Orkney and Ireland (according to the JNCC Marine Nature Conservation Review database records at February 1999) but is cited as occurring around north and west coasts of Scotland and Ireland. Although relatively common where it occurs, its habitat requirements are very specific (soft undisturbed mud below about 15 m depth in fully marine conditions) and it is thus relatively restricted in its geographical distribution.

1.3 *F. quadrangularis* is a characterising species of the CMU.SpMeg.Fun biotope (Seapens, including *Funiculina quadrangularis*, and burrowing megafauna in undisturbed circalittoral soft mud) in the national marine biotope classification. It is typically found associated with the seapens *Virgularia mirabilis* and *Pennatula phosphorea*, the anemones *Cerianthus lloydii* and *Pachycerianthus multiplicatus*, the large isopod *Astacilla longicornis*, the burrowing megafaunal crustaceans *Nephrops norvegicus*, *Calocaris macandreae* and *Callianassa subterranea*, and Fries' goby *Lesueurigobius friesii*.

1.4 *F. quadrangularis* is not currently protected under the Wildlife and Countryside Act 1981, or within any designated conservation site. Populations do however occur in or nearby the Loch Duich candidate Special Area of Conservation, designated for its reefs, and within the Loch Duich, Loch Sunart, Loch Sween and Loch Seaforth Marine Consultation Areas (a non-statutory designation).

2. Current factors causing loss or decline

2.1 *F. quadrangularis*' particular habitat requirements, ie undisturbed soft mud, appear to be important in limiting the species' distribution to sheltered localities, often behind shallow sills. It is absent from many sea lochs which appear to hold a suitable habitat for the species; these lochs have soft mud habitats and support populations of Norway lobster *Nephrops norvegicus*

and other species normally associated with *F. quadrangularis*.

2.2 *F. quadrangularis* also appears to be absent from the *Nephrops* fishing grounds of the Irish and North Seas. It is possible that trawling activities in open coast areas and the more accessible sea lochs (ie not the more isolated basins behind shallow sills) have removed populations of *F. quadrangularis*. Where *F. quadrangularis* has been recently recorded, in the isolated sea loch basins, it is creeling (potting) for *Nephrops norvegicus* which traditionally occurs, rather than trawling. Recent research on the effects of creeling indicates that it has a considerably less damaging effect to *Funiculina quadrangularis*, as the seapen has the ability to right itself if hit by a creel pot.

2.3 *F. quadrangularis* occurs in relatively isolated sea loch basins and water exchange with the open coast may be limited, thus concentrating the effects of any pollutants or eutrophication within the loch basins.

3. Current action

3.1 No conservation action is currently undertaken.

4. Objective for the species

4.1 Ensure that the distribution of the species is maintained.

5. Proposed action

5.1 The conservation of this species should be directed by the actions published in the mud habitats in deep water habitat action plan.

Styela gelatinosa (a sea squirt)

Mud habitats Species Statement (2)

| 1. Current status | 5. Proposed action |
|--|--|
| <p>1.1 <i>Styela gelatinosa</i> is a nationally rare solitary ascidian (sea squirt) which has a soft pear-shaped body about 3-4 cm tall. The habitat in which <i>Styela gelatinosa</i> has been found is an isolated sea loch basin with a soft mud bottom, very sheltered from water movement (waves or currents) and subject to near full salinity conditions. It is currently known from only a single location in the UK having been collected in large numbers from Loch Goil in the Clyde Sea in 1989.</p> <p>1.2 <i>S. gelatinosa</i> inhabits soft mud with terrigenous debris at about 65 m depth, and is associated with large numbers of other solitary ascidians (<i>Ascidia conchilega</i>, <i>Corella parallelogramma</i>, <i>Ascidiella aspersa</i>, <i>Ascidiella scabra</i>), terebellid worms and bivalves (<i>Pseudamussium septemradiatum</i>). This highly unusual community (such densities of ascidians are not typical of soft mud habitats) is defined in the national marine biotope classification as COS.Sty (<i>Styela gelatinosa</i> and other solitary ascidians on very sheltered deep circalittoral muddy sediment) and, like <i>S. gelatinosa</i> itself, is only known from this single location in Loch Goil.</p> <p>1.3 <i>S. gelatinosa</i> is a cold-water species, known from Scandinavia and Iceland; the population in Loch Goil may represent a relict population. <i>S. gelatinosa</i> is not currently protected under the Wildlife and Countryside Act 1981, or within any designated or proposed conservation site.</p> | <p>5.1 The conservation of this species should be directed by the actions published in the mud habitats in deep water habitat action plan.</p> |
| 2. Current factors causing loss or decline | |
| 2.1 As a single known population in the UK, the species is potentially extremely vulnerable to any activity that may affect the site at which it occurs, such as through direct physical disturbance (eg from trawling) or from pollutants or eutrophication (the species occurs in a relatively isolated sea loch basin and water exchange with the open coast may be limited, thus concentrating the effects of any pollutants entering the loch). | |
| 3. Current action | |
| 3.1 No conservation action is currently undertaken. | |
| 4. Objectives for the species | |
| 4.1 Ensure that the distribution of the species is maintained. | |

Serpulid reefs

Habitat Action Plan

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| 1. | Current status | 1.2 | Links with other action plans |
| 1.1 | Physical and biological status | 1.2.1 | This plan is similar to those for <i>Sabellaria spinulosa</i> and serpulid reefs in that attention needs to be drawn to potentially damaging operations. |
| 1.1.1 | <i>Serpula vermicularis</i> is a marine worm which makes a hard, calcareous tube 4-5 mm in diameter and up to 150 mm long. In most places the worms are solitary with the base of the tube attached to stones or shells, and the feeding end growing up into the water. The worms can also aggregate into clumps or 'reefs' up to 1 m across. The species has a worldwide distribution (except for polar seas) in sheltered sites, but the reef form has been reported from very few locations. In the UK, reefs have only been found in Loch Creran, and the Linne Mhuirich arm of Loch Sween, both sea lochs on the west mainland coast of Scotland. The reefs in Loch Sween are now reported to be dead. Small <i>Serpula vermicularis</i> reefs have also been found in two loughs on the west coast of Ireland, but the best developed reefs in the world are in Loch Creran. | 2. | Current factors affecting the habitat |
| | | 2.1 | It is not known why serpulid reefs form at so few sites, and the factors which might cause loss or decline are therefore unclear. Some possible factors affecting the reefs are listed below. |
| | | 2.2 | Serpulid reefs are fragile and vulnerable to mechanical disturbance, such as from mobile fishing gear, which would seriously damage the reefs. Creels would also damage a reef if they were dropped directly on top, or were dragged across it. |
| | | 2.3 | Anchors and mooring chains could cause considerable damage to serpulid reefs. |
| 1.1.2 | The serpulid reefs in Loch Creran begin as single tubes on stones or shells on a sandy mud seabed. As more worms settle and grow on already established ones the reef grows upwards and outwards to form a rounded clump of white tubes, similar to a coral head. The worms extend their feeding fans, which are about 2 cm across and a range of colours from white through orange to bright red, from the ends of the tubes. The larger reefs, over 1 m in diameter, tend to collapse outwards from the centre but the collapsed sections continue growing. The reefs are best developed in a relatively narrow vertical zone in the loch, at a depth between 6-10 m. | 2.4 | Serpulid worms rely on water movement to feed; in both Loch Creran and Loch Sween this is a relatively gentle flow. However, changes in the water flow may have adverse effects on the reefs and their associated fauna and flora. The building of barrages, causeways and bridges are potential blockages to water flow. |
| 1.1.3 | The reefs are a haven for other marine wildlife on the muddy seabed where there is little other solid attachment, and become covered with orange sponges, colonial and solitary sea squirts, hydroids and seaweeds. Mobile animals live between the tubes in the centre of the reef; particularly common are brittlestars, terebellid worms, small spider crabs, squat lobsters, hermit crabs, starfish and a range of marine snails. | 2.5 | A survey commissioned by SNH of the distribution and abundance of serpulid reefs in Loch Creran found that there were no reefs within 0.5 km of an effluent discharge point consisting mainly of particulate organic matter from a seaweed processing factory. The effluents from finfish farms might also be considered a potential threat although some of the best reefs in Loch Creran are adjacent to the moorings of a salmon farm. Finfish farms routinely use chemicals which are specifically toxic to fish lice and other crustaceans and molluscs. When such chemicals disperse in the marine environment, there is the possibility that the rich infauna of the reefs may be affected |
| 1.1.4 | The reefs at Loch Creran, at least in the sublittoral fringe, have declined over the last 100 years (together with eelgrass <i>Zostera marina</i> beds), while those in Loch Sween apparently died between 1982 and the mid 1990s. | 3. | Current action |
| | | 3.1 | Legal status |
| | | 3.1.1 | <i>Serpula vermicularis</i> reefs are not specifically listed as a protected species or habitat by either the Wildlife and Countryside Act 1981, the Wildlife (NI) Order 1985 or the EC Habitats Directive. However they can be covered by the latter under 'reefs', which includes 'biogenic' reefs, where the reef is made up of massed |

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| | living animals or plants, together with their non-living protective structures (shells, tubes etc). Serpulid reefs are sublittoral so cannot be included within SSSIs in Great Britain or ASSIs in Northern Ireland, but they could be protected within a Marine Nature Reserve. | 5.1.3 | Ensure that serpulid reefs are protected from the adverse effects of smothering and chemical discharges from marine installations. (ACTION: SEPA) |
| | | 5.2 | Site safeguard and management |
| 3.1.2 | There is no current legal protection for the serpulid reefs in Loch Creran. However, Loch Creran is a Marine Consultation Area, a non-statutory designation used by SNH to denote areas of special marine interest in connection mainly with consultations over the siting of fish farms and other works. | 5.2.1 | Consider giving statutory protection to the reefs in Loch Creran by proposing the loch as a Special Area of Conservation (SAC) under Annex 1 of the EC Habitats Directive. The whole of the upper and lower loch should be designated because the factors affecting the health of the reefs are unclear, and the reefs are widely distributed through the loch system. (ACTION: JNCC, SE, SNH) |
| 3.2 | Management, research and guidance | | |
| 3.2.1 | The sea loch surveys undertaken by the JNCC's Marine Nature Conservation Review (MNCR) and subsequent surveys commissioned by SNH have confirmed that Loch Creran is the only Scottish sea loch with well-developed <i>Serpula vermicularis</i> reefs. | 5.2.2 | Make provision for the maintenance of the extent and quality of associated serpulid reef communities, as well as the serpulids themselves, through the management plan for Loch Creran. (ACTION: All relevant and competent authorities) |
| 3.2.2 | A survey commissioned by SNH and carried out by Heriot-Watt University mapped the distribution, abundance, and colony size of serpulid reefs at 50 sites around Loch Creran. | 5.2.3 | Take account of the conservation requirements for the serpulid reefs in the development and implementation of coastal zone management plans and ensure they are not managed in isolation from other habitats and communities in the area. (ACTION: LAs, Port/Harbour authorities, SE) |
| 3.2.3 | Students from Heriot-Watt University have carried out projects on the reefs in Loch Creran. Topics include studies of the associated fauna of the reefs and the effects of the reefs on the surrounding benthos. | 5.2.4 | Ensure that fishing operations within Loch Creran are compatible with the conservation interests of serpulid reefs. (ACTION: SE) |
| 3.2.4 | As part of the planning for a proposed re-routing of the road around Loch Creran across an existing rail bridge, mitigation measures have been suggested at the planning stage to protect nearby serpulid reefs from possible damage during construction. | 5.3 | Advisory |
| 4. | Action plan objectives and proposed targets | 5.3.1 | Provide advice to local authorities and planners on minimising impacts of plans and operations on serpulid reefs. In particular, consideration should be given to their importance from the early stages of planning. (ACTION: SE, SNH) |
| 4.1 | Maintain the extent and quality of serpulid reefs and associated plant and animal communities in the UK. | 5.4 | International |
| 4.2 | Restore lost reefs in Loch Sween. | 5.4.1 | Communicate with researchers in Ireland regarding exchange of information on the reefs in Ardbear Lough and Killary Harbour. (ACTION: JNCC) |
| 5. | Proposed action with lead agencies | 5.5 | Monitoring and research |
| 5.1 | Policy and legislation | | |
| 5.1.1 | Ensure that fishing operations are not carried out across serpulid reefs. (ACTION: SE) | 5.5.1 | Complete survey and recording of the distribution, extent, quality and composition of the serpulid reefs and their associated species in Loch Creran. (ACTION: SNH) |
| 5.1.2 | Ensure that road, bridge, energy and other construction schemes which might obstruct or otherwise alter the water flow to serpulid reefs do not risk damage to their conservation interest. (ACTION: LAs, SE, SNH) | 5.5.2 | Monitor closely the health of the reefs in Loch Creran, together with important physical and biological factors. (ACTION: SEPA, SNH) |

- 5.5.3** Re-survey the Linne Mhuirich arm of Loch Sween to establish the current status of the serpulid reefs and explore the potential for restoration. (ACTION: SNH)
- 5.5.4** Encourage research into factors affecting the settlement, growth, maintenance and ecology of the reefs and associated species in Loch Creran. (ACTION: NERC, SNH)
- 5.5.5** Monitor the recovery of marine communities after construction works on the Creagan Bridge to establish the effectiveness of mitigation measures. (ACTION: LAs, SE, SNH)
- 5.6 Communications and publicity**
- 5.6.1** Disseminate information on serpulid reefs and their biodiversity to planners, coastal users and the general public. (ACTION: LAs, SNH)
- 5.6.2** Encourage public aquaria to provide interpretation to the public on the unique features of serpulid reefs. (ACTION: SNH)

6. Costings

- 6.1** The successful implementation of this habitat action plan will have resource implications for both the public and private sectors. The data in the table below provide an estimate of the current expenditure on the habitat and the likely additional resource costs. These additional costs are based on the annual average over 5 and 10 years. The total expenditure for these time periods is also given. Almost all the costs will relate to the public sector, although some costs (eg for research) will be met by the private sector/non-governmental organisations).

Costings for serpulid reefs

| | Current expenditure | 1st 5 yrs to 2004/2005 | Next 10 yrs to 2014/2015 |
|--|---------------------|------------------------|--------------------------|
| Current expenditure /£000/Yr | | | |
| Total average annual cost /£000/Yr | | 30 | 5 |
| Total expenditure to 2005/£000 | | 150 | |
| Total expenditure 2005 to 2014/£000 | | | 50 |

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Sublittoral sands and gravels

Habitat Action Plan

1. Current status

1.1 Physical and biological status

1.1.1 Sublittoral sand and gravel sediments are the most common habitats found below the level of the lowest low tide around the coast of the United Kingdom. The sands and gravels found to the west of the UK (English Channel and Irish Sea) are largely shell derived, whereas those from the North Sea are largely formed from rock material. For the purposes of this habitat action plan, inshore is defined as extending to six nautical miles, and offshore as six nautical miles to the limit of UK waters. This plan encompasses both the inshore and offshore environments.

1.1.2 Sublittoral sand and gravel habitats occur in a wide variety of environments, from sheltered (sea lochs, enclosed bays and estuaries) to highly exposed conditions (open coast). The particle structure of these habitats ranges from mainly sand, through various combinations of sand and gravel, to mainly gravel. While very large areas of seabed are covered by sand and gravel in various mixes, much of this area is covered by only very thin deposits over bedrock, glacial drift or mud. The strength of tidal currents and exposure to wave action are important determinants of the topography and stability of sand and gravel habitats.

1.1.3 The variation in sediment structure and extensive range of this key habitat type means that it is included in a total of 17 sublittoral biotopes as defined in the JNCC Marine Nature Conservation Review (MNCR) biotope classification scheme (version 97.06). This part of the MNCR biotope classification is, however, still under development and is likely to be modified before final publication in 1999. Four of these biotopes are maerl communities that are dealt with specifically by a separate habitat action plan.

1.1.4 The diversity of flora and fauna living within the remaining 13 biotopes varies according to the level of environmental stress to which they are exposed. Sand and gravel habitats that are exposed to variable salinity in the mid- and upper regions of estuaries, and those exposed to strong tidal currents or wave action, have low diversity and are inhabited by robust, errant fauna specific to the habitat such as small polychaetes, small or rapidly burrowing bivalves and amphipods. The epifauna in these habitats tends to be dominated by mobile predatory species. Upper estuarine mobile sands, subject to very low fluctuating salinity, are species poor. This habitat is characterised by mysids (*Neomysis integer*) and amphipods (*Gammarus* spp).

1.1.5 Coarse sand sediment can occur in sand-wave formations in shallow water, wave exposed and tide-swept coasts. The infauna in this type of habitat is highly impoverished and is typified by small opportunistic capitellid and spionid polychaetes and isopods (*Pontocrates arenarius*, *Haustorius arenarius* and *Eurydice pulchra*) that are adapted to living in a highly perturbed environment. The epifauna is characterised by mobile predators such as crabs (*Carcinus maenas* and *Liocarcinus* spp), hermit crabs (*Pagurus bernhardus*), whelks (*Buccinum undatum*), and occasionally sand eels (*Ammodytes* spp). Similar habitats also occur in estuaries where the marine fauna is replaced with a sparse low salinity tolerant fauna (Forth and Humber Estuaries, Solway Firth).

1.1.6 Well sorted medium and fine sands on exposed coasts subjected to frequent wave action and variable tidal currents are typified by errant polychaetes such as *Nephtys cirrosa* and isopods such as *Bathyporeia* spp (common in full salinity areas of many estuaries). A low salinity variant of this habitat occurs in the Humber and Severn Estuaries.

1.1.7 Loose, coarse sand habitats fully exposed to wave action and swept by strong tidal streams are comparative with the 'Shallow *Venus* Community', the 'Boreal Off-shore Sand Association' and the '*Goniadella-Spisula* Association' defined in past studies. This habitat is dominated by small or highly mobile polychaetes, thick shelled and rapidly burrowing bivalves (*Spisula elliptica* and *S. subtruncata*) and mobile amphipods that are adapted to periodic disturbance. It is a common habitat with examples found from Shetland to the Scilly Isles.

1.1.8 A close variant of this community occurs in fine compacted sands with moderate exposure and weak tidal currents. This habitat is characterised by the thin-shelled bivalve *Fabulina fabula*, and is found in the Irish Sea, north-east coast of England and in numerous Scottish sea lochs.

1.1.9 Sand mixed with cobbles and pebbles that is exposed to strong tidal streams and sand scour is characterised by conspicuous hydroids (*Sertularia cupressina* and *Hydrallmania falcata*) and bryozoans (*Flustra foliacea* and *Alcyonidium diaphanum*). These fauna increase the structural complexity of this habitat and may provide an important microhabitat for smaller fauna such as amphipods and shrimps. Examples of the habitat are to be found in Shapinsay Sound, Cromarty Firth, Lowestoft, Thames, Thanet, Menai Strait, Lough Foyle and in numerous Scottish sea lochs.

- 1.1.10** In contrast, those biotopes found in full salinity in sheltered or deeper waters that are less perturbed by natural disturbance are among the most diverse marine habitats with a wide range of anemones, polychaetes, bivalves, amphipods and both mobile and sessile epifauna. Clean stone gravel habitats are characterised by the sea anemones *Halcampa chrysanthellum* and *Edwardsia timida*, associated with hydroid/bryozoan turfs and red seaweeds. This habitat type has limited recorded distribution: Loch Creran, Loch Eynort (Skye), Church Bay (Rathlin Island) and Strangford Narrows.
- 1.1.11** Shallow areas with coarse sand swept by tidal currents but sheltered from wave exposure may develop dense beds of the polychaete *Janice conchilega*. Dense beds of polychaete tubes reduce near-bed currents and significantly increase sediment stability. Examples are to be found in Outer Hebrides lagoons, Skye and sea lochs.
- 1.1.12** Circalittoral gravels, sands and shell gravel are split into three different biotopes and have communities of high diversity. These habitats are dominated by thick-shelled bivalve and echinoderms species, (eg *Pecten maximus*, *Circomphalus casina*, *Ensis arcuatus* and *Clausinella fasciata*), sessile sea cucumbers (*Neopentadactyla mixta*), and sea urchins (*Psammechinus miliaris* and *Spatangus purpureus*). These biotopes have been described by previous workers as the 'Boreal Off-Shore Gravel Association' and the 'Deep Venus Community' and can be found in Shetland, the western coasts, Irish Sea and English Channel.
- 1.1.13** Information on the distribution of these biotopes was collected by the JNCC Marine Nature Conservation Review (MNCR). However, this survey was restricted to an area less than 3 km from the shore. The survey resolution of these communities decreases at greater distances offshore, such as the large-scale historical and recent benthic surveys conducted in the North Sea and Irish Sea.
- 1.1.14** A comprehensive wide-scale survey of benthic communities in the North Sea was undertaken in 1986 by members of the ICES Benthos Ecology Working Group. Sand and gravel communities in the English Channel have been studied extensively by scientists from Plymouth Marine Laboratory and scientists from the Centre for Environment, Fisheries and Aquaculture Science (MAFF).
- 1.1.15** Many of the inshore habitats are important nursery grounds for juvenile commercial species such as flatfishes and bass. Offshore, sand and gravel habitats support internationally important fish and shellfish fisheries while SE have recently carried out a comprehensive survey of benthic communities in the

Greater Minch. Broad scale habitat mapping has also been carried out on behalf of the nature conservation agencies to support their work on marine SACs and by other organisations responsible for carrying out environmental assessments, for example for dredging and cable laying.

1.2 Links with other action plans

- 1.2.1** Reference should be made to other habitat action plans that concern sublittoral sediment, in particular those for maerl beds, *Sabellaria spinulosa* reefs and mud in deep water.
- 1.2.2** The actions and objectives of this habitat action plan are also of relevance to the commercial marine fish and the fan shell *Atrina fragilis* species action plans.

2. Current factors affecting the habitat

- 2.1** Sand and gravel habitats are subjected to a variety of anthropogenic factors including the influence of pollutants in riverine discharge, and physical disturbance by fishing and aggregate dredging activities. The latter two factors probably have the greatest influence on the organisms that inhabit sand and gravel substrata. Most flatfish fisheries are found in areas of sandy seabed and are subjected to intensive perturbation by bottom fishing gears (such as beam trawling) in the southern North Sea and English Channel. Gravel substrata are also disturbed by scallop dredging, particularly in the English Channel and northern Irish Sea. Gravel habitats are severely modified by aggregate extraction in licensed areas off the east and south-east coast of England. These disturbances are less prevalent north of the Firth of Forth, on the west coast of Scotland, and in large parts of the Irish Sea.
- 2.2** Many species inhabiting highly perturbed and mobile sediments are relatively unaffected by fishing activities or other anthropogenic physical disturbance. However, large bodied, slow growing fauna such as bivalves are sensitive to fishing disturbances and their populations may be slow to recover. Biogenic reefs and sedentary worm beds may be particularly vulnerable to trawling activity.
- 2.3** Some of the bivalve species found in these habitats, such as *Pecten maximus*, are subject to significant fishing effort. Other species, such as *Paphia rhomboides*, *Glycymeris glycymeris*, *Chamelea gallina*, and *Ensis* spp are only subject to occasional fishing effort. Most of these species are exported to continental Europe for human consumption.
- 2.4** Fishing may alter the trophic interactions within these habitats by removing predators and competitors.

However, the removal of some species may not necessarily adversely affect the ecological functioning of the community.

- 2.5 Aggregate extraction, in contrast to fishing activity, is restricted to smaller and strictly defined areas. However, in some places within the licensed dredged areas, the impact on the seabed can be greater per unit area than bottom fishing as both the substrata and fauna are removed, which prolongs the recovery of the habitat and benthic community. Such major impacts can be limited, however, as some areas within a licensed area are commercially unattractive because the aggregate resource is too thin. Once an area has been dredged and aggregate removed, the operator generally moves on and recovery begins. Areas that are heavily fished, however, may never fully recover because the seabed is disturbed before recovery has taken place.
- 2.6 Other physical disturbances include land claim, construction of marinas and slip ways, the widening and dredging of channels, pipe and cable laying and the construction of sea defences. These activities can alter tidal flow regimes and wave exposure, or result in deposition of sediments that influence the structure of sedimentary habitats.
- 2.7 Organic pollution from sewage discharge and aquaculture activities leading to anoxic conditions and a decrease in benthic diversity.
- 2.8 Pollution is caused by persistent bio-accumulating chemicals (eg polychlorinated biphenyls and tri-butyl tin), heavy metals and other chemicals. These pollutants have led to decreases in the populations of common whelks in the North Sea and cause DNA breakdown in some marine organisms.
- 2.9 Oil exploration, leakages and shipping accidents lead to localised pollution of sediment organisms.

3. Current action

3.1 Legal status

- 3.1.1 SSSIs in Great Britain and ASSIs in Northern Ireland generally do not extend into the subtidal so few contain sublittoral sand and gravel habitats. Such habitats are, however, better represented in a number of proposed and candidate marine Special Areas of Conservation (SACs).
- 3.1.2 Further management measures are designed to conserve stocks of bivalves or to minimise interactions between mobile and static gear. Equally, they could be used to manage anthropogenic disturbances of sand and gravel habitats. Commercial fishing activities are excluded from a number of estuaries and bays around

the coast of the UK which are important nursery areas for juvenile commercial species (eg River Exe, River Conwy and Filey Bay). Fishing activities are prohibited within 500 m of gas and oil platforms, from firing ranges and in close proximity to certain military installations (eg Gareloch).

- 3.1.3 Government departments (MAFF, SE, CEC, DTI and DETR) are responsible for the assessment of the potential impacts of oil and gas exploration and production aggregate extraction, marine construction work, land reclamation and dumping of dredged material prior to licensing. The conditions attached to these licences can stipulate that measures are adopted to minimise environmental impacts. Licenses may be refused on environmental grounds.

- 3.1.4 Discharges to the sea are controlled by a number of EC Directives, including the Dangerous Substances, Shellfish (Waters), Integrated Pollution Control, Urban Waste Water Treatment, and Bathing Waters Directives. The forthcoming Water Framework Directive will also be relevant. The Oslo and Paris Convention (OSPAR) and North Sea Conference declarations are also important. The Environment Acts provide powers to regulate discharges to the sea and have set targets and quality standards for marine waters. An extensive set of standards covering many metals, pesticides and other toxic, persistent and bioaccumulative substances, and nutrients have been set under UK legislation.

3.2 Management, research and guidance

- 3.2.1 For the preparation of SAC management schemes and monitoring programmes, acoustic survey techniques have been developed. These techniques have recently been employed by the statutory nature conservation agencies for the broad scale mapping of benthic habitats. This surveying technique has also been used by other organisations conducting environmental assessments, for example for dredging and for cable laying.
- 3.2.2 Scientists at the Port Erin Marine Laboratory are currently repeating some of the northern Irish Sea surveys first conducted in the 1950s. A collaborative project co-ordinated by the Museum of Wales in Cardiff has undertaken an extensive survey of Irish Sea benthic communities from Anglesey down to the George's Channel, while SE have recently carried out a comprehensive survey of benthic communities in The Minch.
- 3.2.3 Research projects that are examining the ecological implications of fishing and aggregate dredging activities on the seabed have been commissioned by MAFF and the Crown Estate respectively. Removal of dense aggregations of tube building fauna has been shown to

destabilise sediments which severely affects the recovery rate of this habitat. Where such aggregations are identified, conditions are normally attached to the dredging licence requiring the establishment of exclusion areas. Devices to track and monitor the activities of aggregate extraction vessels are already in use.

4. Action plan objectives and proposed targets

- 4.1** Protect the extent and quality of a representative range of sublittoral sand and gravel habitats and communities.

5. Proposed action with lead agencies

5.1 Policy and legislation

- 5.1.1** Ensure that the best examples of sublittoral sand and gravel habitats are protected from the adverse effects of fishing, dredging, aggregate extraction and other activities. (ACTION: CCW, DANI, DETR, EHS, EN, LAs, MAFF, MoD, Port and Harbour Authorities NAW, SE, SNH)

- 5.1.2** Consider the potential for implementation of fisheries by-laws to minimise the impact of molluscan fisheries on sensitive sand and gravel habitats within the six nautical mile limit of their jurisdiction. (ACTION: DANI, MAFF, NAW, SE, SFCs)

5.2 Site safeguard and management

- 5.2.1** Seek to identify a series of representative sites of this habitat type by 2004. (ACTION: CCW, EHS, EN, JNCC, SNH)

- 5.2.2** Seek to ensure that the appropriate SAC management schemes are adequate to protect the sublittoral sands and gravel habitats that they contain. (ACTION: All relevant authorities)

- 5.2.3** Reduce inputs to coastal waters as required under international, EC and domestic pollution control obligations. (ACTION: DETR, EA, EHS, MAFF, NAW, SE, SEPA)

5.3 Advisory

- 5.3.1** Provide information and advice to local authorities and others involved in the management of the coastal zone on how to minimise the adverse impacts of coastal activities on sublittoral sands and gravels. (ACTION: CCW, DETR, DoE(NI), EN, Home Office, MAFF, NAW, SE, SNH)

5.4 International

- 5.4.1** Encourage actions at a European level, which will help improve understanding of the conservation of undisturbed sublittoral sands and gravels. Promote measures that will strengthen the conservation of representative examples. (ACTION: JNCC)

5.5 Monitoring and research

- 5.5.1** Review the data on the extent of sublittoral sand and gravel habitats around the UK to aid selection and management of representative examples. (ACTION: CCW, EHS, EN, JNCC, SNH)

- 5.5.2** Identify criteria for assessing future significant changes (if any) in the level of biodiversity within sand and gravel habitats. (ACTION: CCW, DETR, EHS, EN, MAFF, NAW, SE, SNH)

- 5.5.3** Assess the ecological importance and function and environmental requirements of long-lived species that are sensitive to disturbance in sand and gravel habitats. (ACTION: CCW, DETR, EHS, EN, JNCC, MAFF, NERC, NAW, SE, SNH)

- 5.5.4** Assess the status of sublittoral sand and gravel habitats as essential fish habitats for commercially important fish and shellfish species. (ACTION: DANI, MAFF, NAW, SE)

- 5.5.5** Investigate and refine techniques for surveying and monitoring subtidal sand and gravel habitats and biotopes. (ACTION: CCW, EN, EHS, JNCC, SNH)

5.6 Communications and publicity

- 5.6.1** Prepare guidelines on the importance of this habitat. In particular, liaise with fishing organisations and the aggregates industry to promote environmental awareness across these industries. (ACTION: CCW, DETR, EHS, EN, SNH)

- 5.6.2** Educate coastal zone managers with respect to the importance of sublittoral sand and gravel habitats in terms of biodiversity and their importance to commercial fisheries. (ACTION: CCW, EHS, EN, SNH)

6. Costings

- 6.1** The successful implementation of this habitat action plan will have resource implications for both the public and private sectors. The data in the table opposite provide an estimate of the current expenditure on the habitat and the likely additional resource costs. These additional costs are based on the annual average over

5 and 10 years. The total expenditure for these time periods is also given. Almost all the costs will relate to the public sector, although some costs (eg for research) will be met by the private sector/non-governmental organisations).

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Costings for sublittoral sands and gravels

| | Current expenditure | 1st 5 yrs to 2004/2005 | Next 10 yrs to 2014/2015 |
|--|---------------------|------------------------|--------------------------|
| Current expenditure /£000/Yr | | | |
| Total average annual cost /£000/Yr | | 29.6 | 5.3 |
| Total expenditure to 2005/£000 | | 148 | |
| Total expenditure 2005 to 2014/£000 | | | 53 |

Lophelia pertusa reefs

Habitat Action Plan

1. Current status

1.1 Physical and biological status

1.1.1 Temperate hard corals are usually solitary. However, *Lophelia pertusa* (L.) is a colonial bank-forming species of ahermatypic coral, found in deep, dark, cold waters. *L. pertusa* grows in oceanic water of 4-12°C and is typically found offshore, on the continental shelf and shelf break, most commonly between 200-400 m depth. It can occur down to 3000 m on oceanic banks and seamounts, but is also found at 50 m in the sheltered, clear but dark coloured waters of Norwegian fjords.

1.1.2 Unlike tropical corals, *L. pertusa* does not contain symbiotic algae, but captures food from the water column. It is found in current-swept areas, where the local topography or hydrography accelerates the current flow or encourages the development of internal waves in the water column, and where sediment accumulation is low. Currents keep the corals free from settling silt, carry suspended food and remove waste. Internal waves increase vertical mixing and productivity as well as increasing bottom mixing which resuspends organic particles.

1.1.3 *L. pertusa* can reproduce asexually by intratentacular budding but currently there is no information available concerning sexual reproduction and larval development. It does not form true colonies and is regarded as a pseudo-colonial organism. The development of *L. pertusa* pseudo-colonies appears to take place primarily through the growth of fragments of coral that break off mature pseudo-colonies. This form of reproduction may preclude the need for larval recruitment to existing coral pseudo-colonies.

1.1.4 Due to variations in its growth form and colour, this species is known by 13 other synonyms. Currently the genus *Lophelia* is monotypic but it is possible that *L. pertusa* represents several different species. The various morphotypes appear to be associated with differences in energy levels ie tall, slender forms from lower-energy environments.

1.1.5 Initial settlement requires pieces of hard substrate. The individual polyps are usually 5 mm in diameter but the size and shapes of the psuedo-colonies can vary. Initially, *L. pertusa* tends to grow into a 'bushy' primary pseudo-colony, until it breaks off the initial attachment substrate or topples over. The branches are extremely delicate and fragments that break off and fall onto the seabed can continue to develop. Eventually the

primary pseudo-colony dies, forming a central core of coral debris surrounded by a ring of secondary pseudo-colonies. These 'coral thickets' may be 10-50 m across and several metres high. This process continues with fragments forming more rings, as well as recolonising the central coral debris, to form large reef structures or 'bioherms'. *L. pertusa* can also occur as small isolated pseudo-colonies and the best evidence from the UK Atlantic Margin surveys thus far is that this may be the most common form in this area.

1.1.6 The *L. pertusa* pseudo-colonies are composed of an outer stratum of living coral polyps growing over dead and decaying coral mixed with sediment. Growth rate estimates for *L. pertusa* polyps vary between 4 and 19 mm per year. These growth rates are comparable with some tropical corals, which is impressive considering the absence of symbiotic algae and the cooler water temperatures. Bioherms can reach sizes of 10-35 m in height and up to 330 x 120 m in horizontal extent and it has been calculated that reefs of this size are between 1700 and 6250 years old. However, large reefs are unknown from the UK Atlantic Margin.

1.1.7 *L. pertusa* forms long-lasting, three-dimensional coral debris, due to its large and robust aragonite skeleton, unlike most other species of deep-water coral. *L. pertusa* pseudo-colonies and reefs provide at least four main habitats: the surface of living *L. pertusa*, the detritus laden surface of dead *L. pertusa*, the cavities formed inside *L. pertusa* skeletons by boring species, and the free space between the coral branches.

1.1.8 There is limited information on the ecology of deep-water ahermatypic colonies and reefs and their species diversity. However, studies on the associated fauna of *L. pertusa* have found that over 850 species, mainly suspension feeders, have been recorded living on or in *L. pertusa* pseudo-colonies and reefs in the north-east Atlantic, excluding the Mediterranean. Almost all sampling thus far has been by dredge or trawl and as such samples may be 'contaminated' by fauna from the surrounding sediment community.

1.1.9 A study of *L. pertusa* coral reefs off the Faeroes indicated that the diversity of *L. pertusa* coral reefs is of a similar magnitude to that of some tropical, shallow water hermatypic corals. The overall faunal diversity and the numbers of species within many faunal groups (foraminifera, porifera, polychaetes, echinoderms and bryozoans) were found to be similar. The diversity of the taxa associated with the *L. pertusa* reefs is around three times as high as that of the surrounding soft sediment seabed, indicating that these reefs create

biodiversity hotspots and increased densities of associated species.

- 1.1.10** A number of the associated species, including some sponges and eunicid, cirratulid, sabellid and spionid polychaete worms, are 'bioeroders' whose activities erode and weaken the calcareous skeleton of the reef building coral. On *L. pertusa* pseudo-colonies and reefs, the coral secretes calcium carbonate around the long calcareous tube networks of *Eunice* spp, a polychaete worm, and new pseudo-colonies are often associated with *Eunice* spp tubes. Bioerosion plays a major role in the development and maturation of the *L. pertusa* pseudo-colonies and reefs, weakening the reef structure and creating cavities, which increases the habitat complexity of the reef. However, by secreting their own calcareous skeletons, some bioeroding species and other inhabitants help to strengthen the reef.
- 1.1.11** Hydrography and current topography interactions appear to play an important role in *L. pertusa* distribution. Recent studies on a *L. pertusa* reef off the coast of Norway suggest that *L. pertusa* pseudo-colonies and reefs might be associated with hydrocarbon seeps, specifically methane seeps. However, the consensus is that deep-water corals occur where the local topography induces current acceleration or the development of internal waves and where sediment accumulation is low. Wilson's recent records of *L. pertusa* on the Rockall Bank and Sula Ridge, do not relate to the locations of hydrocarbon seeps.
- 1.1.12** Specimen records for *L. pertusa* indicate that its distribution extends throughout the north Atlantic, including parts of the Mediterranean, along the coasts of west Africa to the east and the coasts of North America and Brazil to the west, including the eastern Gulf of Mexico and the Caribbean. It has also been recorded around many mid-oceanic islands in the Atlantic, south to Tristan da Cunha, with a few scattered records from the Pacific and Indian Oceans.
- 1.1.13** As records often refer to dead or sub-fossil remains, the abundance of *L. pertusa* in some parts of the world may have been over-estimated. As many of the Mediterranean records are Pleistocene remains, it has been suggested that the distribution of *L. pertusa* within the Mediterranean has receded since the last Ice Age.
- 1.1.14** Estimating the current distribution of *L. pertusa* is complicated by the difficulties encountered in detecting and sampling the discrete patches of *L. pertusa* that are scattered over wide areas of the seabed, on offshore banks and steep continental slopes.
- 1.1.15** The majority of the *L. pertusa* records come from the north-east Atlantic, where *L. pertusa* is widely

distributed. Many of these records are from Norway, where *L. pertusa* banks are found at depths of between 240 and 290 m, range (in height above the seabed) between 2 and 31 m and cover between 1550 and 50,600 m² of the seabed. The reef on the Sula Ridge off Norway is over 30 m high and 13 km long.

- 1.1.16** Other records are concentrated around the Faeroes shelf, Rockall Bank, Anton Dohrn Seamount, Rosemary Bank and Bill Bailey's Bank. These areas have been targeted by several scientific investigations but until recently other areas of the continental shelf and shelf break, such as the Wyville-Thomson Ridge and the shelf break west of Shetland, have not been so well studied. Recent survey work to the north and west of Shetland and to the west of the Outer Hebrides has been funded by the oil industry, largely ahead of drilling activity in the area. High resolution side-scan sonars have failed to detect any pseudo-colonies of *Lophelia* in areas surveyed. Seabed photography has revealed some small pieces of *Lophelia*. Investigation of mounds which might represent small accumulations continue.
- 1.1.17** It is generally believed that within UK waters *L. pertusa* pseudo-colonies are either small and isolated or occur as clusters.
- 1.1.18** In areas west of Ireland and within the Bay of Biscay, extensive 'massifs', many kilometres long, exist along the shelf break and on the flanks of offshore banks but have not yet been studied. In the Porcupine Basin, off western Ireland, *L. pertusa* mounds occur in water depths of 650-1000 m, close to faults from which hydrocarbons may seep.
- 1.2** **Links with other action plans**
 - 1.2.1** Attention should be given to the deep-water fish species action plan, particularly in regard to the risk of damaging benthic organisms through fishing activity.

2. Current factors affecting the habitat

- 2.1** Within coral reefs, the rate of bioerosion can lead to levels of reef destruction that are close to the levels of reef accumulation. Any process that results in a decline in the growth rate of the corals may cause this balance of gain and loss to switch and may rapidly lead to the destruction of the reef. In *L. pertusa* pseudo-colonies and reefs, this process could occur if physical conditions are altered. This is an important factor to consider in relation to potential anthropogenic impacts. The larval biology of *L. pertusa* is completely unknown and there may be limited potential for larval recruitment from other areas. Pseudo-colonies that have developed asexually and are genetically homogenous are likely to be more vulnerable to anthropogenic impacts than populations with higher genetic diversity. Owing to the

relatively slow rate of *L. pertusa* reef development, the recovery of pseudo-colonies and reefs damaged or removed as a result of human activities could potentially take many hundreds of years.

2.2 Offshore fisheries employing demersal trawls are known to break off pieces of *L. pertusa* reef, removing reef clumps and causing physical damage to the associated reef species and seabed. There is good evidence that the repeated use of heavy rock-hopper gear will flatten and destroy even very substantial reefs and should be regarded as a very significant threat to such structures. The intensity of, and areas affected by, demersal trawling has been poorly recorded and so it is difficult to assess the significance of this factor on the status of *L. pertusa*.

2.3 *L. pertusa* and other deepwater corals are generally found in areas of low sediment accumulation. Corals are generally very sensitive to the effects of sedimentation, which can result in slowed growth or death and may reduce the diversity of associated species. In a study of shallow water coral reefs, the effects of a sediment event were detected 35 years later. The development of the 'Atlantic Frontier' oil fields is being undertaken in areas where *L. pertusa* pseudo-colonies are found. This development is in an 'unfamiliar' environment and there are various issues relating to the potential impacts of these activities which need to be carefully considered. However, there are major differences in the physical and oceanographic conditions of the North Sea oilfields and the West of Shetland fields. These will affect the applicability of the models used to predict the behaviour of cuttings and associated water-based and synthetic drilling muds discharged as a result of drilling operations. Due to the fundamental data limitations, oil companies suggest that the model predictions provided in their environmental assessments can only be considered to be indicative of the expected pattern of deposition on the seabed.

3. Current action

3.1 Legal status

3.1.1 *L. pertusa* is listed under CITES I (Convention on International Trade in Endangered Species of Wild Flora and Fauna). The genus *Lophelia* (currently monotypic - *L. pertusa*) is listed under CITES II. Reefs are an Annex I habitat under the EC Habitats Directive and the definition of 'reef' habitats includes biogenic reefs or 'concretions' which arise from the sea floor and support communities, such as those formed by *Modiolus modiolus*, *Serpula vermicularis*, *Sabellaria spinulosa* and *Sabellaria alveolata*. The UK government considers that the provision of the Habitats Directive extend only to the limits of the territorial sea. As there were no known *L. pertusa* reefs within territorial waters during the selection

process, *L. pertusa* reefs have not been chosen as cSACs. The adoption in 1998 of a new Annex to the OSPAR Convention (1992 Convention for the Protection of the Marine Environment of the North East Atlantic) may offer an opportunity to protect important deeper water or offshore habitats and species, such as *L. pertusa*.

3.1.2 Government departments (MAFF, SE, CEC, DTI and DETR) are responsible for the assessment of the potential impacts of oil and gas exploration and production aggregate extraction, marine construction work, land reclamation and dumping of dredged material prior to licensing. The conditions attached to these licences can stipulate that measures are adopted to minimise environmental impacts. Licences may be refused on environmental grounds. The EIA Directive requires oil companies to conduct an environmental impact assessment before any operations take place. The assessments are then scrutinised by DTI and statutory consultees (JNCC, FRS and MAFF). The Directive is implemented through the Offshore Petroleum Production and Pipelines (Assessment of Environmental Effects) Regulations 1999.

3.2 Management, research and guidance

3.2.1 The Atlantic Frontier Environmental Network (AFEN) is a consortium of oil companies and government regulators and advisors (DTI, SE and JNCC), undertaking large-scale seabed surveys of areas licensed for oil exploration in the UK sector of the north-east Atlantic. The surveys were conducted by the 'Atlantic Margin Environmental Survey' cruises in 1996 and 1998 co-ordinated by the Challenger and Rennel Divisions of Southampton Oceanographic Centre.

3.2.2 The MIME (Managing Impacts on the Marine Environment) programme is a joint government/industry initiative, funded by NERC and by oil companies. Much of the research that is funded by MIME relates to *L. pertusa*. Research at Southampton University is concentrating on *L. pertusa* reproduction, colony development and genetic diversity. Research at Dunstaffnage Marine Laboratory (Scottish Association for Marine Science) is focusing on ground-truthing survey records and mapping the distribution of *L. pertusa*. Work is also directed at the development of a monitoring programme using digital camera systems and investigating the influence of particles in the water column. The British Geological Survey is studying carbon and oxygen isotope ratios in, and applying micro-chemical analysis to, *L. pertusa* skeletons to obtain information on levels of chemical contaminants through time.

3.2.3 Norwegian research cruises took place during the summer of 1998 to collect detailed data on *L. pertusa*

| | | | |
|-------|--|-------|---|
| | populations and to assess the impacts of demersal fishing. | | |
| 3.2.4 | BIOFAR is a co-operative research programme, undertaken by several Scandinavian universities, investigating the benthic communities of the Faeroe Islands, including those found in deep-sea regions. It has recorded the presence of <i>L. pertusa</i> and 14 other species of corals and deepwater sponge assemblages. | 5.3.2 | Build on the advice and information to oil exploration and production companies on the sensitivity, conservation importance and ecological requirements of <i>L. pertusa</i> pseudo-colonies and reefs, to raise awareness and promote the protection of key sites. (ACTION: DTI, JNCC) |
| 3.2.5 | The international research interest in this field is expanding and it is possible that more organisations and institutions may become involved in the future. For example, academics from the University of London and the University of Bremen are studying the <i>L. pertusa</i> reefs on the Sula Ridge, off the Norwegian coast. | 5.4 | International |
| 4. | Action plan objectives and proposed targets | 5.4.1 | Take account of the conservation requirements for <i>L. pertusa</i> pseudo-colonies and reefs in the development and implementation of international marine resource management mechanisms (in particular, demersal fisheries and oil and gas exploration and production) especially through the OSPAR Convention and the revised Common Fisheries Policy. (ACTION: DETR, DTI, JNCC, MAFF, SE) |
| 4.1 | Protect and enhance the distribution, status, density and community richness of the <i>L. pertusa</i> pseudo-colonies and reefs within the UK territorial sea and the 200 mile UK waters. | 5.5 | Monitoring and research |
| 5. | Proposed action with lead agencies | 5.5.1 | Continue studies to determine current distribution and status of <i>L. pertusa</i> pseudo-colonies and reefs in UK waters by 2010 and establish a monitoring programme that will enable progress towards the objective of this plan to be properly assessed. (ACTION: CCW, EHS, EN, SNH) |
| 5.1 | Policy and legislation | 5.5.2 | Establish the variations in species diversity and community structure of <i>L. pertusa</i> pseudo-colonies in the UK territorial sea. (ACTION: NERC) |
| 5.1.1 | Promote the provision of wider protection measures for the offshore habitats of <i>Lophelia pertusa</i> , in particular from fisheries and oil exploration. (ACTION: DTI, JNCC, MAFF, SE) | 5.5.3 | Confirm the ecological requirements of <i>L. pertusa</i> by 2010. (ACTION: NERC) |
| 5.1.2 | Advise that the UK Government adopts <i>L. pertusa</i> as a species for which biogenic reef SACs can be selected and designated within the UK territorial sea and promote the opportunities that may arise through the adoption of the OSPAR Annex V. (ACTION: JNCC) | 5.5.4 | Determine the reproduction and development modes of <i>L. pertusa</i> , as the details of sexual reproduction and larval development, and consequently the dispersal capabilities of the species, are unknown. (ACTION: NERC) |
| 5.2 | Site safeguard and management | 5.6 | Communications and publicity |
| 5.2.1 | Contribute to the consideration of key areas for <i>L. pertusa</i> aggregations for possible selection as marine protected areas (MPAs) under Annex V of OSPAR by 2005. (ACTION: JNCC) | 5.6.1 | Maintain the high level of awareness of the importance of <i>L. pertusa</i> pseudo-colonies and reefs in demersal fisheries and oil and gas exploration and production. (ACTION: DTI, MAFF, SE) |
| 5.3 | Advisory | 6. | Costings |
| 5.3.1 | Provide advice and information to fisheries policy makers, managers, fisheries organisations and fishermen on the sensitivity, conservation importance and ecological requirements of <i>L. pertusa</i> colonies and reefs, to promote the protection of key sites by 2005. (ACTION: JNCC, MAFF, SE) | 6.1 | The successful implementation of this habitat action plan will have resource implications for both the public and private sectors. The data in the table opposite provide an estimate of the current expenditure on the habitat and the likely additional resource costs. These additional costs are based on the annual average over 5 and 10 years. The total expenditure for these time periods is also given. Almost all the costs will relate to |

the public sector, although some costs (eg for research) will be met by the private sector/non-governmental organisations).

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Costings for *Lophelia pertusa*

| | Current expenditure | 1st 5 yrs to 2004/2005 | Next 10 yrs to 2014/2015 |
|--|---------------------|------------------------|--------------------------|
| Current expenditure /£000/Yr | | | |
| Total average annual cost /£000/Yr | | 66.5 | 30.8 |
| Total expenditure to 2005/£000 | | 332.5 | |
| Total expenditure 2005 to 2014/£000 | | | 308 |

Broad Habitat Statements

Supralittoral rock

Habitat Statement

1. Current status

1.1 Supralittoral rock occurs above high water mark, in areas influenced by wave splash and sea-spray. Features that may be present include vertical rock, boulders, gullies, ledges and pools, depending on the wave exposure of the site and its geology. Salt-tolerant species are the characteristic colonisers, and a number of distinct biotopes can be recognised under this broad habitat type. In very exposed conditions the green algae *Enteromorpha* and *Cladophora* may be found in the supralittoral rock pools and the black lichen *Verrucaria maura* on rock surfaces. Where there is more shelter from wind and spray, yellow and grey lichens such as *Caloplaca marina*, *Xanthoria parietina* and *Lecanora* spp are typically found on the rock surfaces. In pits and crevices littorinid molluscs and acarid mites are common. These biotopes are common around the UK and there is no information to suggest that there have been any significant changes in their distribution. Sites that are subject to nitrate enrichment from nearby roosting birds are not as common, but here too there is no historic information to suggest changes in distribution. These nutrient enriched areas support a distinctive biotope, characterised by the green alga *Prasiola stipitata*, which can grow over the black lichen *Verrucaria maura* or yellow and grey lichens.

1.2 Communities in the splash zone of chalk cliff areas, such as the Thanet coast, are rare because of the limited amount of coastal chalk in Europe. They are also unusual because the porosity of the rock allows several species of algae to survive in this zone. Five algal communities have been described from such situations. Two species of associated brown algae, *Kuetzingiella holmesii*, and *Pleurocladia lacustris*, have not been recorded since the 1930s and may now be extinct in the UK.

1.3 Some stretches of supralittoral rock are important haul out areas for the grey seal *Halichoerus grypus*. Boulders and rocks in this zone may also be important habitats for wintering birds such as turnstone *Arenaria interpres* and purple sandpiper *Calidris maritima*. Distinctive invertebrate faunae in such areas include terrestrial species such as bristle-tails *Petrobius maritimus* and the large sea slater woodlouse, *Ligia oceanica*, as well as marine species like the wrinkle *Littorina* spp, and the limpet *Patella* spp.

1.4 Further up the shore but still in zones of supralittoral rock, lichen species such as the scrambled egg lichen *Fulgensia fulgens*, ciliate strap lichen *Heterodermia*

leucomelos and the southern grey physcia *Physcia tribacioides* may be found. Typical coastal vascular plants in such areas include the common scurvygrass *Cochleria officinalis*, the sea lavender *Limonium recurvum*, and a variety of bryophytes.

1.5 On the south-western and northern coasts of the UK where, due to the long fetch and onshore prevailing winds, wave exposure is greatest, salt spray can be carried onto cliff faces and cliff tops. The plant communities of the vertical hard rock cliffs in the north, which are exposed to the extreme exposure of the north Atlantic, are characterised by roseroot *Sedum rosea* and Scots lovage *Ligusticum scoticum*. Cliffs may also support sea campion *Silene maritima* and thrift *Armeria maritima* and, in some rich areas, Arctic species such as purple saxifrage *Saxifraga oppositifolia* and moss campion *Silene acaulis*. These exposed cliffs are also important breeding grounds for seabirds like the black guillemot *Cephus grylle*, razorbill *Alca torda*, and guillemot *Uria aalge*.

1.6 In southern Britain the vegetation of hard rock cliffs tends to be formed by communities of thrift *Armeria maritima*, rock samphire *Crithmum maritimum*, and buck's-horn plantain *Plantago coronopus*. The rare curved hardgrass *Parapholis incurva*, and the sea lavender *Limonium recurvum* may also be present. The relatively sheltered, dry, calcareous cliffs on the south coast, are sites for the wild cabbage *Brassica oleracea* that grows on crumbling edges and sloping ledges. This species is rare in Britain and is found in association with other rare species such as early spider orchid *Ophrys sphegodes* and Nottingham catchfly *Silene nutans*.

2. Current factors affecting the habitat

2.1 Supralittoral rock habitats immediately adjacent to the littoral zone are generally robust but the associated communities may be vulnerable to damage from oil pollution. Oil which reaches the shore following a pollution incident generally gets concentrated along the high tide mark but, if sea conditions are rough, can be carried into the supralittoral zone. The potential for this in a particular area will depend on the topography of the shore and its exposure.

2.2 Factors that can affect the communities on maritime cliff and slope habitats include trampling, which can cause loss of plant species diversity, and the erosion of access paths from cliff tops to the shore. Access may also disturb nesting birds in these localities. Coast protection works are another important influence as

they can prevent the removal of eroded material by the sea which can be to the detriment of the plant and invertebrate communities that depend on the unstable surface. On the cliff top, cultivation may truncate the natural zonation between maritime and terrestrial vegetation and therefore result in loss of plant species diversity. Eutrophication associated with agricultural run-off may have a similar effect.

3. Current action

3.1 Legal status

3.1.1 Supralittoral rock is present in UK sites that have international designations. For example, the Giant's Causeway is a World Heritage Site and the islands of St.Kilda and Rum are both Biosphere Reserves. Important sites are also found within SSSIs/ASSIs, NNRs and Local Nature Reserves. SSSIs with supralittoral rock may also be declared as Special Protection Areas (SPAs) under the 1979 EC Birds Directive. In 1995, 12 candidate Special Areas of Conservation (SACs) were selected under the EC Habitats Directive. These sites are important because they contain examples of an Annex I habitat type: 'vegetated sea cliffs of the Atlantic and Baltic coasts'.

3.1.2 A number of landscape designations cover supralittoral rock habitats. Twenty Areas of Outstanding Natural Beauty (AONB), and five National Parks in England and Wales include coastal areas as do National Scenic Areas in Scotland. The habitat is also present on Heritage Coasts, which although not a statutory designation, is recognised by English and Welsh local planning authorities in Structure Plans and Local Plans. Local authorities also work with landowners and the Countryside Commission to prepare management plans for these sites.

3.2. Management, research and guidance

3.2.1 Several Planning Policy Guidance (PPG) documents are relevant to management of supralittoral rock habitats. PPG 20 (Coastal Planning) published by the Department of the Environment and the Welsh Office in 1992 sets the general context for policy. This is achieved by identifying planning policies for the coast and offering guidance on how they should be reflected in development plans. In Wales this has since been superseded by Technical Advice Note 13. National Planning Policy Guidance NPPG 13, issued by the Scottish Office in August 1997, gives similar guidance for coastal planning in Scotland. Other relevant guidance is provided in PPG 9 (Nature Conservation) and Scottish Circular 6/1995 (Habitats and Birds Directives). In documentation issued by MAFF/Welsh Office on best practice, procedures to be followed by flood defence operating authorities are specified. This

should ensure that environmental issues are afforded due consideration when flood defence works are being planned, designed and implemented.

3.2.2 Non-statutory documents such as coastal zone management plans, estuary management plans, coastal strategies and Local Environment Agency Plans may also provide advice on management of activities that may have an impact on the habitat. An important mechanism for management of such activities are bye-laws. A review of bye-law making powers at the coast is currently being undertaken by the Department of the Environment, Transport and Regions (DETR).

3.2.3 Both general and detailed research has been undertaken on supralittoral rock habitats. Information on the extent and quality of these habitats is available from publications such as the NCC Estuaries Review and the regional reports on the Coasts and Seas of the United Kingdom, published by JNCC.

4. Conservation direction

4.1 Maintain and manage in a natural state the great range of supralittoral rock habitats.

4.2 Measures to be considered further include:

! protecting sites of conservation importance from damage through contamination, physical disturbance or excessive use (eg oil pollution, trampling and recreation);

! developing and implementing strategies for the conservation and management of the wider marine environment at local, regional and national levels. For example, integrated coastal management plans, water quality objectives, pollution control and avoidance measures. Species recovery and habitat restoration programmes should be included.

5. Priority habitats in this broad habitat

5.1 Within this broad habitat, the following priority habitat has been identified for which a specific habitat action plan has been prepared:

! maritime cliff and slopes (vegetated cliffs and lichen dominated cliffs).

Supralittoral sediment

Habitat Statement

1. Current status

1.1 Supralittoral sediment occurs above high water mark, but in areas influenced by wave splash and sea-spray. Salt-tolerant species are the characteristic colonisers of this habitat and the biotopes present are strongly influenced by sediment size as well as degree of wave exposure of the shore.

1.2 Strandline communities are often present on moderately exposed sandy shores, particularly on flat, slightly mobile beaches with little or no human disturbance. Under these conditions annual vegetation can develop on the accumulations of drift material rich in nitrogenous organic matter at or near the high water mark. Characteristic vascular plants include the sea sandwort *Honckenia peploides*, saltwort *Salsola kali*, and sea beet *Beta maritima*. Rare and scarce species, such as the shore dock *Rumex rupestris* in south-west Britain, and the oysterplant *Mertensia maritima* in northern Britain, may also be present. The composition, humidity and state of decay of the organic material determine which invertebrates are present. These may include woodlouse *Armadillidium album*, the wharf borer beetle *Nacoderes melanura* (associated with driftwood), and the large ground beetle *Brosicus cephalotes* that shelters in strandline material. The amphipod *Talitrus saltator* may also be abundant.

1.3 On the upper margins shore, three major supralittoral sediment habitat types occur: coastal vegetated shingle, sand dunes, and machair.

1.4 Shingle beaches are widely distributed around the UK coastline, bordering an estimated 30% of the coastline of England and Wales. In Scotland, although shingle is found in the south-west, north-east and northern isles, it often grades into rock and cliff habitats. Shingle beaches tend to form in high energy environments where the sea can move and pile up pebbles on the shore above the tideline. The five types of shingle beach that have been recognised are: fringing beaches, spits, barriers, cusped forelands and barrier islands.

1.5 Vegetation will establish on shingle beaches when there is a matrix of finer material such as sand or silt, and where the structure is stable. However, stable shingle structures are rare with only about 4200 ha of stable or semi-vegetated shingle in Great Britain. Herb-rich open pioneer stages colonise the seaward edge with species such as sea-kale *Crambe maritima*, sea pea *Lathyrus japonicus*, thrift *Armeria maritima*, yellow horned poppy *Glaucium flavum* and sea holly *Eryngium maritimum*. Grassland, heath, scrub, and moss and

lichen-dominated vegetation of old, stable, shingle occur further inland. Many species of invertebrates are also dependent on the shingle vegetation. These include the rare jumping spider *Euophrys browni* and uncommon terrestrial species such as the millipede *Thalassiosobates littoralis* and the woodlouse *Stenophiloscia zosteriae*. Birds such as the arctic tern *Sterna paradisaea* and the little tern *Sterna albifrons*, use shingle areas as their breeding grounds.

1.6 Sand dune habitats are widely distributed around the UK coastline covering 48,000 ha in Scotland, 11,897 ha in England and 8101 ha in Wales. Distinct features within dune systems are foredunes, yellow dunes, dune grassland, dune slacks, dune heath and dune scrub. Factors such as stability and moisture retention in these different systems determine what species are present. In mobile foredunes, for example, typical species are marram grass *Ammophila arenaria* and, in northern areas of Britain, the lyme-grass *Leymus arenarius*. Dune slacks, which are areas of wetland within the dune system, may have scarce plants such as the fen orchid *Liparis loeselii* and the petalwort *Petalophyllum ralfsii*.

1.7 Machair is a distinctive sand dune formation that is only found in the north and west coast of Scotland (around 17,500 ha) and in western Ireland. It is estimated that more than two-thirds of the global extent of machair is found in Scotland. The soils are made up of wind deposited shell-sand blown inland from coastal beaches and mobile dunes, which lie over impermeable rock. The main habitats of machair are dry grassland, damp grassland, marsh and standing water and the vegetation broadly described as a herb-rich sward. Early colonisers are marram grass *Ammophila arenaria*, sea purslane *Halimione portulacoides* and the sea-sedge *Carex arenaria*, followed by trefoils *Trifolium procumbens* and *Lotus corniculatus*, which fix nitrogen making the soil more suitable for herbs and grasses. Machair also supports a rich invertebrate fauna such as the belted beauty moth *Lycia zonaria britannica* and the fossorial bee *Colletes floralis*. The large wader population of the Usits, Tiree and Coll are considered the most important in the north-west Palaeartic. The globally threatened corncrake *Crex crex* and nationally scarce corn bunting *Miliaria calandra* are both found on machair habitat.

2. Current factors affecting the habitat

2.1 Supralittoral sediment habitats immediately adjacent to the littoral zone can be susceptible to damage from oil pollution and any subsequent attempts to remove the oil

by scraping off the sediment surface. Oil which reaches the shore following a pollution incident generally gets concentrated along the high tide mark but it can be carried into the supralittoral zone depending on the topography of the shore and its exposure.

- 2.2** Along the strandline, clearance of vegetation during beach cleaning operations will affect the development of associated communities. 'Coastal squeeze' occurs when the intertidal zone is reduced by sea level change and erosion. The 'squeeze' is caused by coast protection works preventing the natural movement of the shoreline, resulting in a loss of habitat. A similar effect can be achieved by cutting off the sediment supply through badly located or unsuitably designed sea defence works.
- 2.3** The main factors affecting shingle habitats are unmanaged recreational access resulting in disturbance and compaction of the surface by vehicles, destruction of ridge systems, trampling of the unique plant communities, and disturbance to ground-nesting birds. Coastal defence infrastructure that impacts on the sediment supply reaching the shingle structure is another potential problem, and gravel extraction from the beach will destroy the surface structure of the shingle and its associated wildlife communities.
- 2.4** Sand dune habitats are affected by coastal defence works and by direct extraction of sand from the dunes. Increasing sea levels are causing steepening of the foreshore and increased wave attack at the base of the dune systems. Afforestation restricts dune development and resulting changes in the water table can affect the characteristic vegetation some distance from the plantation. Increasing tourism in coastal areas can lead to trampling of the vegetation, erosion of the dune systems and disturbance of breeding birds. Inappropriate grazing management can lead to a reduction in the diversity of plant species by excessive amounts of nutrients favouring nitrophilous weeds, leading to eutrophication of dune slacks. The spread of non-native species, such as the sea buckthorn *Hippophae rhamnoides*, is also a factor as they can lead to a loss of diversity.
- 2.5** Machair habitats have a long history of use by humans and without this interaction would not exist in their present form. The move away from the traditional cattle-based agriculture associated with crofting towards a less labour intensive system based on sheep is the main factor affecting this habitat. The main elements are: earlier cutting of grass (for silage rather than hay) which prevents seeding of flowering plants and destroys nests of birds such as the corncrake; more intensive grazing, combined with a switch from cattle to sheep which leads to a closely-cropped sward that is unsuitable for many species; increased use of fertilisers and pesticides leading to loss of variety of species; and

lack of grazing leading to rank, species-poor vegetation.

3. Current action

3.1 Legal Status

- 3.1.1** Supralittoral sediment is present in UK sites that have national and international designations. Nationally important sites are found within SSSIs/ASSIs, NNRs and Local Nature Reserves. To date, nearly 200 SSSIs/ASSIs which include shingle features and sand dune areas have been notified. The international significance of some SSSIs and ASSIs is reflected in their designation under the 1979 EC Birds Directive as Special Protection Areas (SPAs). Supralittoral sediment habitats also occur in areas selected as candidate Special Areas of Conservation (SACs) under the EC Habitats Directive. These sites are important because they contain examples of Annex I habitat types: 'perennial vegetation of stony banks', 'annual vegetation of drift lines', 'machair' and seven categories of sand dunes. The additional recognition of the importance of some NNRs is reflected in their dual classification as Biosphere Reserves. These are sites considered to represent significant world biomes. The designated reserves are the North Norfolk Coast, Braunton Burrows, Dyfi & Cors Fochno, and Caerlaverock.

- 3.1.2** A number of landscape designations include supralittoral sediment habitats. Twenty of the Areas of Outstanding Natural Beauty (AONB), and five National Parks in England and Wales include coastal areas as do National Scenic Areas in Scotland. The habitat is also present in areas of Heritage Coast, which although not a statutory designation, is recognised by English and Welsh local planning authorities in Structure Plans and Local Plans. Local authorities also work with landowners and the Countryside Commission (in England) or CCW to prepare management plans for these sites.

3.2 Management, research and guidance

- 3.2.1** Several Planning Policy Guidance (PPG) documents are relevant to management of this broad habitat type. PPG 20 (Coastal Planning) published by the Department of the Environment and the Welsh Office in 1992, sets the general context for policy, identifies planning policies for the coast and offers guidance on how they should be reflected in development plans. In Wales this has since been superseded by Technical Advice Note 13. National Planning Policy Guidance NPPG 13, issued by the Scottish Office in August 1997, gives similar guidance in relation to coastal planning in Scotland. Other relevant guidance is provided in PPG 9 (Nature Conservation) and Scottish

Circular 6/1995 (Habitats and Birds Directives). Documentation has been issued by MAFF/Welsh Office on best practice procedures to be followed by flood defence operating authorities. This will ensure that environmental issues are afforded due consideration when flood defence works are being planned, designed and implemented.

3.2.2 Non-statutory documents such as coastal zone management plans, estuary management plans, coastal strategies and Local Environment Agency Plans may also provide advice on management of activities that may have an impact on the habitat. An important mechanism for management of such activities are bye-laws and a review of bye-law making powers at the coast is currently being undertaken by the Department of Environment, Transport and the Regions.

3.2.3 Areas of machair are subject to specific measures through their designation as Less Favoured Areas. Farmers are therefore eligible for a range of support measures for such sites including two aimed specifically at crofters (relating to agricultural grants and building grants/loans). Other sources of management grants are linked to Environmentally Sensitive Areas schemes, SSSIs, and the Countryside Premium Scheme all of which can be used for management of machair. The 'Corncrake Initiative' administered by SNH, the Scottish Crofters' Union and RSPB is another example where financial incentives are provided to manage machair meadows to attract and hold corncrakes.

3.2.4 Both general and detailed research has been undertaken on supralittoral sediment habitats with information on the extent and quality of these habitats. Further details are available from publications such as the NCC Estuaries Review and the JNCC Coastal Directories Series for the United Kingdom. The conservation agencies have also commissioned botanical surveys of the main British coastal habitats to establish their size, location and quality. A sand dune inventory of Great Britain has been published by JNCC, and SNH are currently conducting an inventory of Scottish sand dunes. There has also been a Great Britain wide survey of shingle structures resulting in maps and written descriptions of the plant communities of almost 60 vegetated shingle beaches. Funding from the EU through the LIFE Nature programme is being used for conservation and restoration projects. At Orfordness, for example, the aim is to re-establish damaged shingle structures by introducing appropriate grazing regimes and controlling damaging recreational activities. At Sefton the funding is being used to support the preparation of a conservation strategy for the dune area to include restoration management of the dune habitat and species recovery work on endangered species.

4. Conservation direction

4.1 Maintain and manage in a natural state the full range of supralittoral sediment habitats.

4.2 Measures to be considered further include:

- ! protecting sites of conservation importance from damage through contamination, physical disturbance or excessive use (eg litter, oil pollution, coastal defence works and recreation);
- ! developing conservation guidelines for strandlines which discourage their removal or disturbance especially when carrying out beach cleaning activities;
- ! promoting the management of supralittoral sediment habitats in ways which avoid disrupting the dynamics of beach processes and natural coastal sediment transport;
- ! developing and implementing strategies for the conservation and management of the wider marine environment at local, regional and national levels. For example, integrated coastal management plans, water quality objectives, pollution control and avoidance measures. Species recovery and habitat restoration programmes should be included

5. Priority habitats in this broad habitat

5.1 Within this broad habitat, the following priority habitats have been identified for which specific habitat action plans have been prepared:

- ! coastal sand dunes;
- ! machair; and
- ! coastal vegetated shingle.

Littoral rock

Habitat Statement

1. Current status

1.1 Littoral rock habitats are widespread around the UK. The geology and wave exposure of the shore influence the form, which can be as varied as vertical rock, shore platforms, boulder shores, or rocky reefs surrounded by areas of sediment. These two factors are also major influences on the associated marine communities. In general littoral rock tends to be colonised by algae in wave-sheltered conditions, and by limpets, barnacles and mussels as wave-exposure increases. Relatively soft rock such as chalk and limestone can support boring species whereas colonisation of basalt and granite is limited to the rock surfaces. In all cases there is a distinct zonation of species down the shore which principally reflects the degree of immersion and emersion by the tide. Biogeographic differences are also apparent with the littoral rock areas of south-west England tending to be richer in species than similar rocky habitats in the north and east.

1.2 The marine biotope classification for Britain and Ireland (Ver. 97.06) developed by JNCC's Marine Nature Conservation Review (MNCR) identifies a number of distinct littoral rock biotopes. These are grouped into categories depending on exposure to waves and currents, and position on the shore.

1.3 Very wave exposed shores, which tend to be found on northern and western coasts and on headlands, generally support a limited range of species. The littoral fringe is encrusted with the lichen *Verrucaria maura*, the red alga *Porphyra umbilicalis*, or by sparsely distributed barnacles. If there are pools present these are likely to be colonised by coralline crusts and the red alga *Corallina officinalis*. The eulittoral (mid shore) zone is usually dominated by mussels *Mytilus edulis* and barnacles, while the lower shore may have a dense red algal turf. Deep pools in this zone can contain fucoids and kelps. At the sublittoral fringe, where conditions can also be severe, a typical coloniser is the kelp *Alaria esculenta* amongst a dense band of small mussels.

1.4 Moderately wave exposed rocky shores are more common around the UK than the very exposed shores described above, and they generally support a greater variety of biotopes. The upper littoral fringe is similar because of the presence of the lichen *Verrucaria maura* but characteristic species of the lower littoral fringe are the channelled wrack *Pelvetia canaliculata*, the spiral wrack *Fucus spiralis* and the bladder wrack *Fucus vesiculosus*. These are mixed with barnacles, red algae and limpets. The lower shore is more likely to

be dominated by the serrated wrack *Fucus serratus* or thongweed *Himanthalia elongata* and by the kelp *Laminaria digitata* at the sublittoral fringe.

1.5 Sheltered sites tend to have a denser covering of fucoids as well as the egg wrack *Ascophyllum nodosum* on the mid-shore and the kelps *Saccorhiza polyschides* and *Laminaria saccharina* on the sublittoral fringe.

1.6 Unusual communities on moderately wave exposed rocky shores include those dominated by the brown alga *Fucus ceranoides* in areas of low salinity and by the unattached brown alga *Ascophyllum nodosum* ecad *mackaii* in conditions of extreme shelter and reduced salinity. Chalk foreshores are relatively rare, forming only 0.6% of the British coastline. This percentage is nevertheless the largest expanse of intertidal chalk in northern Europe. Chalk caves may be colonised by bands of the red alga *Audouinella floridula*, the brown alga *Pilinae maritima* and, on the roofs, the green alga *Pseudendoclonium submarinum*. Filamentous green algae such as *Ulothrix flacca* occurs on open vertical chalk and, in the lower eulittoral, *Fucus serratus* as well as piddocks that can bore into the relatively soft rock.

1.7 Apart from wave exposure and position relative to the tide, the topography of the shore has an important influence on the communities present. Boulders, gullies, pools, and overhangs provide a variety of micro-habitats as do areas of mixed substrate. On sand influenced rocky shores, the tubes of the honeycomb worm *Sabellaria alveolata* can form reef-like hummocks or, on more exposed coasts, crusts on the rocks. These reefs are scarce in the UK, and restricted to areas of coast between the Solway and Cornwall. Other sand influenced shores may support beds of the mussel *Mytilus edulis*.

2. Current factors affecting the habitat

2.1 Littoral rock habitats are generally robust with little currently affecting this habitat type. The associated communities may however be vulnerable to damage from pollution. Nutrient enrichment from land-based sources or from sewage outfalls, as well as chemical discharges can alter the balance of species present on rocky shores. More diffuse sources of pollution may also have an effect. In the 1980s, the build-up of tributyl tin (TBT), a component of antifouling paints, in inlets and bays popular with recreational craft and used by commercial vessels, led to a decline of dog whelk *Nucella lapillus* populations on the adjacent rocky

shores. Littoral rock areas near major shipping lanes are also at some risk from oil pollution although any effect will depend on conditions at the time of any spill and subsequent clean-up operations.

- 2.2** Disturbance through collection of algae and animals such as peeler crabs, land claim, construction of barrages, trampling on areas such as *S. alveolata* reefs, and coast protection works are other factors which can affect this habitat. The accidental introduction of non-native species such as the vigorously growing alga *Sargassum muticum* or the slipper limpet *Crepidula fornicata* may also alter the local balance of ecology on rocky shores.

3. Current action

3.1 Legal status

- 3.1.1** Littoral rock habitat is present in UK sites that have national and international designations. Nationally important sites are found within SSSIs/ASSIs, NNRs, and Local Nature Reserves. The international significance of some SSSIs and ASSIs is reflected in their designation under the 1979 EC Birds Directive as Special Protection Areas (SPAs). Littoral rock habitats also occur in areas that have been selected as candidate Special Areas of Conservation (SACs) under the EC Habitats Directive. The three habitat types listed in Annex 1 of the directive which may include rock habitats are: 'shallow marine inlets and bays', 'submerged or partly submerged sea caves' and 'reefs'. These account for 16 of the proposed marine SACs under consideration. Littoral rock is also present in candidate SACs selected for other Annex I marine habitats. The additional recognition of the importance of some NNRs is reflected in their dual classification as international Biosphere Reserves (St. Kilda and Rum), and World Heritage Sites (the Giant's Causeway).

- 3.1.2** A number of landscape designations whose boundaries may extend to the low water mark include littoral rock habitats. Twenty Areas of Outstanding Natural Beauty (AONB), and five National Parks in England and Wales include coastal areas as do National Scenic Areas in Scotland. The habitat is also present in areas of Heritage Coast which, although not a statutory designation, is recognised by local planning authorities in Structure Plans and Local Plans. Local authorities also work with landowners and the Countryside Commission (in England) or CCW to prepare management plans for the landward component of these sites.

3.2 Management, research and guidance

- 3.2.1** Several Planning Policy Guidance (PPG) documents are relevant to management of this broad habitat type. PPG 20 (Coastal Planning) published by the Department of the Environment and the Welsh Office in 1992 sets the general context for policy, identifies planning policies for the coast and offers guidance on how they should be reflected in development plans. In Wales this has since been superseded by Technical Advice Note 13. National Planning Policy Guidance NPPG 13, issued by the Scottish Office in August 1997 gives similar guidance in relation to coastal planning in Scotland. Other relevant guidance is provided in PPG 9 (Nature Conservation) and Scottish Circular 6/1995 (Habitats and Birds Directives). Documentation has been issued by MAFF/Welsh Office on best practice procedures to be followed by flood defence operating authorities. This will ensure that environmental issues are afforded due consideration when flood defence works are being planned, designed and implemented.

- 3.2.2** Voluntary codes of conduct are another management tool. Codes have been introduced in voluntary marine conservation areas to minimise the impact of recreational use of such areas and to discourage collection of wildlife or habitat damage. Non-statutory documents such as coastal zone management plans, estuary management plans, coastal strategies and Local Environment Agency Plans may also provide advice on management of activities which may have an impact on the habitat. An important mechanism for management of such activities are bye-laws and a review of bye-law making powers at the coast is currently being undertaken by Department of the Environment, Transport and Regions (DETR). There are also opportunities to influence the management of this habitat where it occurs in sites identified by EN as 'Sensitive Marine Areas' or identified by SNH as 'Marine Consultation Areas'.

- 3.2.3** Both broad scale mapping and specific research projects have focused on littoral rock. General information is available in documents such as the 1991 Nature Conservancy Council Estuaries Review and the regional reports on the Coasts and Seas of the United Kingdom, published by the JNCC. More detailed reports have been prepared as part of the JNCC's Marine Nature Conservation Review and in other survey reports from the country conservation agencies. Monitoring work includes the long running rocky shore monitoring programme around Shetland and more recent work on the rocky shores and other habitats in Milford Haven following the *Sea Empress* oil spill.

4. Conservation direction

4.1 Maintain the extent and quality of littoral rocky habitats in the UK, including the full diversity of communities.

4.2 Measures to be considered further include:

- ! protecting sites of conservation importance from damage through contamination, physical disturbance or excessive use (eg maritime accidents, trampling and collection);
- ! minimising the risk of the introduction of non-native species;
- ! ensuring that EIAs for coastal developments, including developments above high water mark, examine potential effects on intertidal and nearshore areas;
- ! ensuring a co-ordinated framework for management of protected areas which span the coastal zone;
- ! developing and implementing strategies for the conservation and management of the wider marine environment at local, regional and national levels. For example, integrated coastal management plans, water quality objectives, pollution control and avoidance measures. Species recovery and habitat restoration programmes should be included.

5. Priority habitats in this broad habitat

Within this broad habitat, the following priority habitats have been identified for which specific habitat action plans have been prepared:

- ! Littoral chalk reefs (littoral chalk and sublittoral chalk are combined in one habitat action plan); and
- ! *Sabellaria alveolata* reefs.

Littoral sediment

Habitat Statement

1. Current status

1.1 Areas of littoral sediment are widespread around the UK forming features such as beaches, sand banks, and intertidal mudflats. A large proportion of this habitat occurs in estuaries and inlets where it can cover extensive areas. Notable examples are the Wash, Burry Inlet, Morecambe Bay, the Solway, Moray and Cromarty Firths, and Strangford Lough. Significant but smaller areas of littoral sediment also occur at the head of inlets and sea lochs. Beaches, which tend to be composed of sandier material, develop in more exposed situations and are also widely distributed. Sand flats are more common in northern and western parts of the country and finer grained flats are more common in southern and eastern areas. Muddy sediments usually occur in sheltered areas, especially estuaries.

1.2 The marine communities found in areas of littoral sediment vary depending on the sediment type, sediment mobility, and salinity of the overlying water. Mobile gravels and sands, for example, tend to be highly impoverished, whereas sheltered areas with mixed sediments can support very rich communities. There is also a zonation of species down the shore which principally reflects the degree of immersion and emersion by the tide. In general tidal flats are low in species diversity but they often support very dense populations of invertebrates so that the overall biomass of the area can be extremely high.

1.3 The Marine Biotope classification for Britain and Ireland (Ver.97.06) being developed by JNCC's Marine Nature Conservation Review (MNCR) identifies a number of distinct littoral sediment biotopes. These are grouped into four major categories (gravels and sands, muddy sands, muds, and mixed sediments) and subdivided further according to sediment size and position on the shore.

1.4 In areas of medium clean sand, the communities are likely to be characterised by burrowing amphipods and the isopod *Eurydice pulchra*. However, in areas of finer sand, amphipods and polychaetes such as *Scolecopsis squamata* and *Nephtys cirrosa*, with the occasional tellin *Angulus tenuis*, are more common. On the extreme lower shore there are communities of the burrowing heart urchin *Echinocardium cordatum* together with the razor shell *Ensis siliqua*. There may also be beds of the seagrass *Zostera marina* at the lower margins that may be exposed on low spring tides.

1.5 Areas of muddy sand tend to have a greater variety of species with the upper shore typically colonised by the

lugworm *Arenicola marina* and bivalves, or by polychaete worms and the cockle *Cerastoderma edule*. In more sheltered areas of sandy muds, the burrowing amphipod *Corophium* may be present in considerable numbers together with the cockle *Cerastoderma edule*, the Baltic tellin *Macoma baltica* and the mudsnail *Hydrobia ulvae*. As muddy sediment is most likely to be present in sheltered marine inlets, the species present may need to be able to tolerate freshwater which drains into these inlets from the surrounding land. Biotopes more characteristic of these reduced salinity conditions typically support the ragworm *Hediste diversicolor* and the bivalve *Scrobicularia plana*. In very low salinities, few species other than oligochaete worms are recorded.

1.6 The high biomass of intertidal communities on mudflats can support large numbers of waders and wintering waterfowl. Intertidal estuarine habitats in the UK support about 1.7 million waders and 650,000 wildfowl each winter, including substantial proportions of the total world populations of the barnacle goose *Branta leucopsis*, and brent goose *Branta bernicla*. Both species feeding on the eel grass beds (*Zostera* spp) in the littoral fringe and shallow sublittoral areas. There are also internationally important numbers of turnstone *Arenaria interpres*, knot *Calidris canutus* and redshank *Tringa totanus* which feed on invertebrates when the sediment shores are exposed by the tide. Offshore intertidal sand banks around the Wash, north Norfolk coast and the sheltered shores of Orkney, are some of the locations used as haul out sites by large numbers of common seals *Phoca vitulina*.

1.7 The least common littoral sediment habitats are muddy gravels. These may be found in sea lochs and other marine inlets and support large numbers of the ragworm *Hediste diversicolor*. Other species found include populations of the large bivalves *Venerupis senegalensis*, and *Mya truncata* or *Mya arenaria* which can cope with conditions of reduced salinity.

1.8 At the extreme upper margins of the littoral zone, a typical community of undisturbed muddy sheltered areas is saltmarsh. The habitat provides a transition from sand and mudflat areas on the lower marsh, where the vegetation is frequently flooded by the tide, through to the upper saltmarsh. The saltmarsh is drained by a system of creeks where the plant communities are less frequently inundated and for shorter duration. The vegetation of the low marsh includes the glasswort *Salicornia*, the saltmarsh grass *Puccinellia maritima*, the sea-blite *Suaeda maritima* and sea aster *Aster tripolium*. Some algae may also be found on the lower margins of the saltmarsh.

- 1.9** The species composition of saltmarsh is also affected by the soil conditions and management regime. Sediments deposited on the North Sea coasts tend to contain more clay and silt and are dominated by thrift *Armeria maritima*, sea lavender *Limonium humile* and *L. vulgare* and sea plantain *Plantago maritima*. The west coast saltmarshes are not as diverse as they have often supported cattle grazing for many years. On the south coast the cord grasses *Spartina x. townsendii* and *S. anglica* have invaded and dominate most of the marshes. Saltmarshes are important habitats for wintering and passage birds, as well as for breeding waders. The area of saltmarsh in the UK today is estimated to be around 45,000 ha compared to 100,000 ha some 500 years ago. This decline was most significant in the 1800s but it continues today through drainage of marshes and land claim.
- 2. Current factors affecting the habitat**
- 2.1** The sheltered conditions that favour the development of littoral sediment also fail to disperse pollution from both land-based and marine sources. This may lead to localised eutrophication, or, in the case of oil pollution incidents, smothering marine wildlife on intertidal sediment areas.
- 2.2** Certain intertidal fisheries may be of concern because of their effects on the habitat and its associated species. Extensive bait digging can cause local depletion of the target species, alter the sediment structure and potentially increase the bio-availability of lead, cadmium and other contaminants by bringing them to the surface. Other potential effects include uprooting eel grass *Zostera* spp, loosening mussel beds *Mytilus edulis* which can subsequently get washed away, and disturbing feeding waders and wildfowl. These effects can be short term or long term depending on factors such as the sediment type, timing and method of bait collection.
- 2.3** Another fishery which can affect this habitat is cockle collection, using mechanical or suction dredges. These fishing methods can lead to large declines in numbers of infauna as well as altering the sediment structure. Effects are likely to be most pronounced in areas with diverse communities and stable environmental conditions compared to sites with moderately mobile sediments. The longevity of any effects will depend on the exposure and stability of the site which are influenced by wave action, currents and the physiographic features of the site. In the case of shellfish cultivation there may be an associated risk of the introduction of non-native species such as the japweed *Sargassum muticum*, which can displace native species or alter the ecology of areas where it becomes established.
- 2.4** Saltmarsh habitats are vulnerable to damage from a number of factors. The combination of rising relative sea levels and maintenance of sea defences resulting in ‘coastal squeeze’ is a concern. Other concerns are the construction of coastal defences and dredging activities that disrupt sediment dynamics. Direct damage also occurs following land claim causing a loss in upper saltmarsh. This reduced area may increase stress on transitional communities. On the marsh itself grazing regimes can affect plant diversity, as do changes in nutrient supply, freshwater and colonisation by cord grass *Spartina anglica*.
- 3. Current action**
- 3.1 Legal status**
- 3.1.1** Littoral sediment habitats occur in sites which have been designated as NNRs, Marine Nature Reserves (MNRs), SSSIs and ASSIs. They are also present in areas which have been designated Special Protection Areas (SPAs) under the 1979 EC Birds Directive and candidate Special Areas of Conservation (SACs) proposed under the EC Habitats Directive. The habitat types listed in Annex 1 of the latter Directive which may include littoral sediment are ‘large shallow inlets and bays’, ‘estuaries’ and ‘mudflats and sand flats not covered by sea water at low tide’. There are eight candidate SACs for the latter category. Littoral sediment habitats are also present in possible and candidate SACs for some of the other marine habitat types listed in Annex I of the Directive.
- 3.1.2** A number of landscape designations whose boundaries sometimes extend to the low water mark also include littoral sediment habitats. Twenty Areas of Outstanding Natural Beauty (AONB), and five National Parks in England and Wales include coastal areas as do National Scenic Areas in Scotland. The habitat is also present in areas of Heritage Coast which, although not a statutory designation, is recognised by English and Welsh local planning authorities in Structure Plans and Local Plans. Local authorities also work with landowners and the Countryside Commission (in England) or CCW to prepare management plans for these sites. Other designations which include areas of littoral sediment are Wetlands of International Importance declared under the Ramsar Convention and the Biosphere Reserves of the north Norfolk coast, Branton Burrows, Dyfi & Cors Fochno, and Caerlaverock.

3.2 Management, research and guidance

3.2.1 Several Planning Policy Guidance (PPG) documents are relevant to management of this broad habitat type. PPG 20 (Coastal Planning), published by the Department of the Environment and the Welsh Office in 1992 sets the general context for policy, identifies planning policies for the coast and offers guidance on how they should be reflected in development plans. In Wales, this has since been superseded by Technical Advice Note 13. National Planning Policy Guidance NPPG 13, issued by the Scottish Office in August 1997, gives similar guidance in relation to coastal planning in Scotland. Other relevant guidance is provided in PPG 9 (Nature Conservation) and Scottish Circular 6/1995 (Habitats and Birds Directives). Documentation has been issued by MAFF/Welsh Office on best practice procedures to be followed by flood defence operating authorities. This will ensure that environmental issues are afforded due consideration when flood defence works are being planned, designed and implemented.

3.2.2 Voluntary codes of conduct are another management tool. Codes have been introduced in voluntary marine conservation areas to minimise the impact of recreational use of such areas and to discourage collection of wildlife or habitat damage. Non-statutory documents such as coastal zone management plans, estuary management plans, coastal strategies and Local Environment Agency Plans may also provide advice on management of activities which may have an impact on the habitat. An important mechanism for management of such activities are bye-laws and a review of bye-law making powers at the coast is currently being undertaken by Department of the Environment, Transport and Regions (DETR). There are also opportunities to influence the management of this habitat where it occurs in sites identified by EN as 'Sensitive Marine Areas' or identified by SNH as 'Marine Consultation Areas'.

3.2.3 Both broad scale mapping and specific research projects have focused on the habitats in this category. General information is available in documents such as the 1991 Nature Conservancy Council Estuaries Review and the regional reports on the Coasts and Seas of the United Kingdom, published by JNCC. More detailed reports have been prepared as part of the JNCC's Marine Nature Conservation Review and survey reports by the country conservation agencies.

4. Conservation direction

4.1 Maintain the extent and quality of littoral sediment habitats in the UK, including the full diversity of communities. In the case of estuarine habitats, where there have been considerable losses and deterioration in the past, and where there is a future threat from sea

level rise, work to enhance the extent and quality of these habitats in the UK.

4.2 Measures to be considered further include:

- ! protecting sites of conservation importance from damage through contamination, physical disturbance or excessive use (eg oil spills, shellfish dredging and marina/harbour development);
- ! promotion of the management of littoral sediment habitats within strategies (eg MAFF Shoreline Management Plans which permit the natural functioning of sediment systems);
- ! ensuring that EIAs for coastal developments, including those above high water, examine potential effects on intertidal and nearshore areas;
- ! developing and implementing strategies for the conservation and management of the wider marine environment at local, regional and national levels. For example, integrated Coastal Management plans, water quality objectives, pollution control and avoidance measures. Species recovery and habitat restoration programmes should be included.

5. Priority habitats in this broad habitat

5.1 Within this broad habitat, the following priority habitats have been identified for which specific habitat action plans have been prepared:

- ! seagrass beds;
- ! saltmarsh;
- ! mudflats; and
- ! sheltered muddy gravels.

Inshore sublittoral rock

Habitat Statement

1. Current status

1.1 For the purpose of the broad habitat classification the inshore area is defined as within six nautical miles of the shoreline. Within this area, the UK has legal authority to introduce protective measures unilaterally for fish stocks. Beyond six nautical miles EU fisheries regulations are enforced, which require negotiation with other member states.

1.2 The seabed of inshore areas is dominated by soft sediment. Where sublittoral rock habitats occur they tend to be immediately adjacent to the shore, fringing islands, headlands, open coast and rocky inlets such as rias and sea lochs. Further offshore, rocky sublittoral habitats may be present as submerged reefs, pinnacles and ledges, and are often surrounded by areas of soft sediment.

1.3 The marine biotope classification for Britain and Ireland (Ver.97.06) developed by JNCC's Marine Nature Conservation Review (MNCr) identifies a number of inshore sublittoral rock biotopes. These are grouped into three major categories depending on exposure to waves and currents (exposed, moderately exposed and sheltered rock) and subdivided further according to depth zone (infralittoral or circalittoral).

1.4 The attenuation of light through the water column results in a distinct zonation of species on inshore sublittoral rock. Well-lit areas are plant dominated, typically by kelp forests and foliose red algae, whereas deeper rock is animal dominated with ascidians, sponges, sea anemones and hydroids the typical colonisers of the rock surfaces. Wave action and tidal currents are the two other major influences on the community structure in shallower depths. In areas of severe wave action kelp is often sparse and the littoral fringe communities extend into deeper waters. The edible mussel *Mytilus edulis* can be very abundant in these areas. There may also be dense foliose algae in summer, encrusting sponges, the hydroid *Tubularia indivisa*, jewel anemones *Corynactis viridis* and the barnacle *Balanus crenatus*. Areas with moderate to strong tidal currents can support very rich forests of the kelp *Laminaria hyperborea*, the stipes of which are thickly encrusted with sponges, bryozoans and red algae. The underlying rock surface may also be encrusted with a rich understorey of species. The rocky walls of surge gullies are another situation where there may be a dense carpet of species, in this case often consisting of the ascidian *Dendrodoa grossularia*, the sponge *Clathrina coriacea* and the hydroid *Tubularia indivisa*.

1.5 Areas of rock exposed to sand scour may be colonised by the anemone *Urticina felina* or have a crust of tubes of honeycomb worm *Sabellaria spinulosa*. In tide-swept situations this type of habitat can also support a wide variety of other species including the ascidians *Molgula manhattensis* and *Polyclinum aurantium* and a turf of bryozoans such as *Flustra foliacea* and *Bugula plumosa*, as well as the featherstar *Antedon bifida*.

1.6 Most sublittoral rocky habitats are in areas exposed to water movement which keeps the rock surface free of sediment. Rocky areas in sheltered situations are not as common but do occur in Scottish sea lochs as well as the rias of south-west Britain. The presence of silt and sediment in the water in these situations limits the occurrence of algae to species such as *Antithamnionella spirographidis*, *Codium* spp and only the occasional larger brown algae such as *Laminaria saccharina*. In deeper water there tend to be few hydrozoans and bryozoans, but large numbers of ascidians on silt-free vertical surfaces or abundant covering of the sea anemone *Protanthea simplex*.

1.7 Beds formed by the horse mussel *Modiolus modiolus* are another distinctive biotope which can cover extensive areas of the seabed. This species can grow attached to rocky surfaces as well as partially buried in soft sediment. As they provide a hard substratum, this habitat has been classified under sheltered circalittoral rock in the marine biotope classification. The shells provide a surface for colonisation and a suitable habitat for crevice-dwelling species. In more exposed sites the horse mussel beds may be associated with ophiuroids and in very sheltered conditions with ascidians. A rarer association is that found in Strangford Lough where large numbers of the queen scallop *Chlamys opercularis* and sponges have colonised the mussel beds.

1.8 The nature of the rocky surface is also an important influence. Unbroken bedrock has little habitat diversity whereas a surface cut by gullies and crevices and overlain by boulders provides much more variety and localised areas of shelter. Chalk reefs which occur in parts of southern Britain and off the east coast support a diversity of flora and fauna. This includes foliose red algae and small brown algae on upward facing surfaces, turfs of hydroids and bryozoans, and an abundance of sponge and animals which bore into the soft rock, such as piddocks (*Barnea parva*, *Hiatella arctica* and *Pholas dactylus*). The bristle worm *Polydora ciliata*, as well as a number of larger fish including various species of wrasse and bib *Trisopterus luscus*, may also be found. Silt favouring species such as the sea

anemone *Sagartia troglodytes* and the ascidian *Molgula manhattensis* can be found in the gullies; crabs and smaller fish such as the tompot blenny *Parablennius gattorugine* shelter in the crevices.

- 1.9** The waters above areas of sublittoral rock are another critical part of this habitat. Some of the larger animals which use these areas for feeding, shelter and living space include seals, cetaceans and seabirds. About half the world population of the grey seal *Halichoerus grypus* occur around the British Isles and they can be seen using the waters adjacent to their rocky haul out sites as well as considerable distances from these areas. Seabirds such as razorbills *Alca torda*, guillemot *Uria aalge* and kittiwake *Rissa tridactyla*, which nest on rocky coastlines also use the adjacent waters for feeding as well as gathering to rest on the surface. Cetaceans which may be seen in this environment include the harbour porpoise *Phocoena phocoena* and bottlenose dolphin *Tursiops truncatus*. In the case of the harbour porpoise, records suggest an overall decline in European waters since the 1940s, but most especially in the southern North Sea and the English Channel.

2. Current factors affecting the habitat

- 2.1** Sublittoral rocky habitats are generally robust with little currently affecting this habitat type. The associated communities may however be vulnerable to disturbance and damage from activities such as coast protection works, discharge of contaminants, and nutrient enrichment (either as run-off or direct input in the form of sewage). For example, localised changes in benthic communities have been linked to discharge and dumping of material in the marine environment. Soft rock coastlines have been especially affected by coastal protection schemes, particularly in the south-east, where there has been a 30-50% loss of natural coastal features in Kent and Sussex. Introduced species such as the vigorously growing japweed *Sargassum muticum* may alter the local ecological balance.
- 2.2** Bottom fishing gears, especially towed gear, although generally not deployed in rocky areas, are used close inshore on occasions and can damage fragile species and communities in such areas. One example of this can be seen on the reefs in Lyme Bay where scallop dredging has caused direct damage to the mudstone ledges which form the reefs. The dredging has also dislodged and damaged fragile, long-lived species with slow recruitment, such as the sea-fan *Eunicella verrucosa* and the Ross coral *Pentapora foliacea*.
- 2.3** The licensing of inshore blocks for oil and gas exploration and production is relatively recent and could adversely affect the habitat through discharge of chemicals, disturbance to wildlife and direct damage to the seabed through disposal of spoil.

3. Current action

3.1 Legal status

- 3.1.1** Inshore sublittoral rock habitats occur in all three UK Marine Nature Reserves (MNRs). They are also present in some of the few coastal SSSIs whose seaward boundaries extend beyond low water (eg the Fal & Ruan estuary SSSI and the Salcombe & Kingsbridge estuary SSSI). Three of the habitat types listed in Annex I of the EC Habitats Directive include inshore sublittoral rock habitats ('large shallow inlets and bays', 'reefs', and 'submerged or partly submerged sea caves') and the UK has proposed a total of 15 candidate Special Areas of Conservation (SACs) under these categories with a further three possible sites currently out for consultation. Inshore sublittoral rock is also present in candidate SACs selected for other Annex I habitats and Annex II species as well as in some Wetlands of International Importance which are designated under the Ramsar Convention.
- 3.1.2** Stretches of the coastline of England and Wales have been defined as Heritage Coast. Although primarily concerned with the management of coastal land there has been an interest in conservation of the foreshore and adjacent waters in some areas and therefore inclusion of areas of inshore sublittoral rock. This is the case at Ceredigion, where a Marine Heritage Coast has been identified and on the Purbeck coast where the Heritage Coast scheme has supported the voluntary marine conservation area off Kimmeridge.
- 3.1.3** Some of the species that occur in this habitat are subject to specific conservation legislation. For example seals, cetaceans and a number of invertebrate species are given various levels of protection under the 1981 Wildlife and Countryside Act. International protection is afforded through both the EC Habitats and Birds Directives, the Bern Convention and CITES. The agreement on the conservation of Small Cetaceans of the Baltic and North Seas (ASCOBANS), a regional agreement under the Bonn Convention, has relevance for the conservation of some cetaceans in UK waters.
- 3.1.4** International legislation and agreements have a major influence on the management measures which can be introduced for the conservation of marine habitats around the UK. The most far reaching is the 1982 UN Law of the Sea Convention which was ratified by the UK in 1997 and which provides a framework for the regulation of all ocean space. It also sets out the responsibilities of coastal nations for marine habitats and wildlife and the potential for Ecological Sensitive Areas in which freedom of navigation may be limited.

3.1.5 Other international agreements tend to focus on specific activities/uses of the marine environment, or are concerned with particular geographic areas. The MARPOL Convention is concerned with pollution from shipping and includes provisions for identifying Particularly Sensitive Sea Areas and Special Areas. In such areas, specific regulations to limit ship-based pollution can be applied. Other relevant conventions include the London (Dumping) Convention, the Convention on the protection of the marine environment of the North-East Atlantic (prevention of pollution from land-based and offshore sources), and the EU Common Fisheries Policy.

3.1.6 Dumping at sea off England and Wales is regulated through licences issued by MAFF under the Food & Environment Protection Act 1985. Similarly, the statutory duty for pollution control is the responsibility of the Environment Agency. In Scotland, the Scottish Environment Protection Agency has authority and in Northern Ireland control is through DoE (NI). It is from national and international provisions, such as the Urban Waste Water Treatment Directive (91/271/EEC), which provide the legal framework for the management of inshore sublittoral rocky habitats.

3.2 Management, research and guidance

3.2.1 Statutory and voluntary measures are used to manage activities which may have an impact on areas of sublittoral rock. Bye-laws are used to regulate certain activities in MNRs and are also likely to be used in marine SACs and SPAs. Relevant authorities are required to use their powers to ensure that such sites comply with the requirements of the Habitats Directive. The nature conservation agencies have some bye-law making powers, but, to cover the full range of activities likely to affect the habitat, such powers need to be used in combination with the regulatory powers of Sea Fisheries Committees in England and Wales or SOAEFD in Scotland (who can introduce bye-laws to control fishing out to six nautical miles). Other relevant authorities include, port and harbour authorities (who have bye-law making powers within areas defined in their founding legislation), and local authorities (who can introduce regulations relating to public health up to 1000 m from the shore). Zoning schemes, supported by bye-laws, may also be introduced to aid management of marine activities in European Marine Sites (marine SACs or SPAs) and are already being used in this way in MNRs.

3.2.2 Voluntary codes of conduct are another management tool. Codes have been introduced in voluntary marine conservation areas to minimise the impact of recreational use of such areas and to discourage collection of wildlife or habitat damage. Non-statutory documents such as coastal zone management plans, estuary management plans, coastal strategies and Local

Environment Agency Plans may also provide advice on management of activities which may have an impact on the habitat. There are also opportunities to influence the management of this habitat where it occurs in sites identified by EN as 'Sensitive Marine Areas' or identified by SNH as 'Marine Consultation Areas'.

3.2.3 'Marine Environment High Risk Areas' (MEHRAs), a recommendation from the Donaldson inquiry into the prevention of pollution from merchant shipping, have not yet been established. However, criteria for identifying such areas and an initial list of potential sites are being prepared by government departments. The list is likely to include areas of inshore sublittoral rock.

3.2.4 Both broad scale mapping and specific research projects have focused on inshore sublittoral rock habitats. General information is available in the regional reports on the Coasts and Seas of the United Kingdom, published by JNCC, reports prepared as part of the JNCC's Marine Nature Conservation Review, and survey reports prepared by the nature conservation agencies.

3.2.5 A quality status report for the North Sea was published in 1993. It was drawn up by scientists from all the littoral states to provide an assessment of the health of the sea. A similar exercise is underway for the Celtic Seas so that by the year 2000 assessments will be available for the whole of the north-east Atlantic. Although predominately concerned with offshore habitats, both reports include information relevant to inshore sublittoral rock habitats.

4. Conservation direction

4.1 Maintain the extent and quality of inshore sublittoral rock habitats in the UK, including the full diversity of communities.

4.2 Measures to be considered further include:

! protecting sites of conservation importance from damage through contamination and physical disturbance (eg turbidity and towed fishing gears);

! requiring EIAs for coastal developments to examine potential effects on intertidal and nearshore areas;

! monitoring any impact of dump sites on inshore sublittoral rock habitats, communities and wildlife, and taking action as appropriate;

- ! implementing strategies for managing the coastal zone at local, regional and national levels.

5. Priority habitats in this broad habitat

5.1 Within this broad habitat, the following priority habitats have been identified for which specific habitat action plans have been prepared:

- ! sublittoral chalk reefs (littoral chalk and sublittoral chalk are combined in one habitat action plan, which will be reported against the littoral rock broad habitat);
- ! *Sabellaria spinulosa* reefs;
- ! tidal rapids; and
- ! *Modiolus modiolus* beds.

Inshore sublittoral sediment

Habitat Statement

1. Current status

1.1 For the purpose of the broad habitat classification, the inshore area is defined as within six nautical miles of the shoreline. Within this area, the UK has legal authority to introduce protective measures unilaterally for fish stocks. Beyond six nautical miles EU fisheries regulations are enforced, which require negotiation with other member states.

1.2 The seabed of inshore areas is dominated by extensive areas of soft sediment. These may be relatively flat featureless plains or worked into forms such as ripples, waves, furrows, and banks. The activities of infauna and epifauna add another dimension by creating smaller-scale features such as burrows, mounds, and tracks. The communities found on, and in, these areas are determined mainly by the sediment type and its mobility. In general, coarse clean sediments tend to occur off exposed coasts, and muddy sediments off sheltered coasts.

1.3 The marine biotope classification for Britain and Ireland (Ver. 97.06) being developed by JNCC's Marine Nature Conservation Review (MNCR) identifies a number of inshore sublittoral sediment biotopes. These are grouped into four major categories (gravels and sands, muddy sands, muds, and mixed sediments) and subdivided further according to sediment size and depth zone (infralittoral or circalittoral).

1.4 In the infralittoral zone, areas of gravel and coarse sand, particularly in tide-swept areas, may support extensive beds of the calcified red seaweeds known as maerl. The maerl lies on the surface of the sediment and can support a rich assemblage of plants and animals in the crevices between its 'twigs'. A thriving bed may contain crustaceans, bivalves, sea-firs, sponges, burrowing sea-cucumbers and a rich seasonal algal flora. Beds that are no longer living may also support many species but the communities in these areas tend to be similar to those of a fine shell gravel. In deeper water where there is insufficient light for maerl to grow, gravel and coarse sand may support large numbers of the burrowing sea-cucumber *Neopentadactyla mixta* and bivalves. Finer sand is more suitable for colonisation by the burrowing heart urchin and, in deeper waters, by the brittle star *Amphiura filiformis*.

1.5 Where there is more shelter, finer sediments can settle out. In the infralittoral zone, this provides suitable conditions for the seagrass *Zostera marina* or, where salinity is reduced, for *Ruppia maritima*. The seagrass, which may cover large areas, helps stabilise the

substratum and provides shelter and a habitat for other organisms. Algae such as *Rhodophyllum georgii*, *Ceramium rubrum*, and *Jania rubens* attach themselves to its leaves along with jellyfish and anemones. The infauna include amphipods, polychaete worms, bivalves and echinoderms. These areas are also important nursery grounds for young fish and, in some areas, for cephalopods.

1.6 Very sheltered areas of inshore sublittoral sediment also occur in saline lagoons, features which may be separated from the sea by a barrier of sand or shingle, ponded waters in depressions on soft sedimentary shores or partially separated from the sea by a rocky sill or artificial construction. Important factors determining which species are present are the degree of isolation, salinity and depth. The sediment habitat in the low salinity conditions of lagoons supports the tassel weeds *Ruppia spiralis* and *R. maritima* and charophytes such as *Lamprothamnium papulosum*. Other filamentous green and brown algae are also recorded. The greatest diversity of species occurs in tide-swept channels which connect the lagoon to the open sea. Increased water movement can lead to the development of dense carpets of sponges and sea squirts with rocky beds dominated by encrusting coralline algae and maerl.

1.7 In more muddy conditions typical infauna may be polychaetes such as *Scoloplos armiger*, the phoronid *Phoronis muelleri*, and oligochaete worms such as *Tubificoides swirencoides* and *T. benedii*. Areas of stable mud, which are either in deep water or in very sheltered conditions such as in some sea lochs, may have populations of the Dublin Bay prawn *Nephrops norvegicus* and other burrowing megafauna, as well as seapens such as *Virgularia mirabilis* and *Funiculina quadrangularis* on the surface.

1.8 Where the sediment is a mixture of muddy gravel or shell gravel, burrowing sea anemones such as *Mesacmaea mitchellii* and *Cereus pedunculatus*, as well as ascidians, can be abundant. In areas of muddy fine sand, beds formed by the native oyster *Ostrea edulis* may be present in amongst dead shells; these beds can support large numbers of ascidians as well as a turf of algae. Native oyster beds are now considered scarce around the UK due to a combination of disease affecting the species and a directed fishery.

1.9 The sheltered sediment areas in estuaries provide the habitat for the flounder *Platichthys lesus* and nursery grounds for juvenile fish including Dover sole *Solea solea*.

1.10 The waters above areas of sublittoral sediment are another critical part of this habitat. Some of the larger animals use these areas for feeding, shelter and living space include seals, cetaceans and seabirds. About 25% of the eastern Atlantic subspecies of the common seal *Phoca vitulina* occur around the British Isles. They can be seen in the waters adjacent to sandbanks used as haul out sites as well as considerable distances from these areas. Seabirds such as puffin *Fratercula arctica*, terns *Sterna* spp and cormorant *Phalacrocorax carbo* also feed in these waters taking fish such as sandeels, herring and sprat. Cetaceans which may be seen in this environment include the harbour porpoise *Phocoena phocoena* and bottlenose dolphin *Tursiops truncatus*. However, the harbour porpoise records suggest an overall decline in European waters since the 1940s, but most especially in the southern North Sea and the English Channel. Some species, like the basking shark *Cetorhinus maximus*, may concentrate feeding activity along fronts which form at the mouths of estuaries and inlets as well as further offshore.

2. Current factors affecting the habitat

2.1 Many activities can damage or disturb inshore sublittoral sediment habitats and the associated communities. They include discharge of contaminants, nutrient enrichment (either as run-off or direct input in the form of sewage), laying of cables and pipelines, aquaculture, maintenance dredging and aggregate extraction. In areas that are intensively used by shipping, or where conditions are particularly hazardous for navigation, there may be an increased risk of shipping accidents and therefore a threat of accidental pollution.

2.2 Fisheries that use equipment operating on or near the seabed are another concern. Beam trawlers and scallop dredgers mobilise and sort sediments and can cause direct damage to epifauna and shallow infauna as well as to the habitat. Apart from depletion of the target species there are also indirect effects linked to discards and by-catch from certain fisheries.

2.3 The licensing of inshore blocks for oil and gas exploration brings with it concern over the discharge of chemicals, disturbance to wildlife and direct damage to seabed in the vicinity of installations, and the risk of major pollution incidents. The effects are mostly localised around existing platforms and include contamination of the seabed from drill cuttings leading to changes in the benthos and elevated levels of chemical contaminants down-current of platforms.

2.4 In southern Britain there have been changes in species composition of seabed habitats in inlets following colonisation by alien species. An estimated 60% of the epibenthic biomass of Poole Harbour is made up of

three alien species. One of these, the slipper limpet *Crepidula fornicata*, also dominates the benthic fauna of the Solent and is the most widespread and abundant benthic species in the Blackwater estuary. Another example of the changes in species composition can be seen in the Helford where there has been a reduction in area covered by seagrass beds. A possible cause of this reduction could be disturbance and natural die-back.

3. Current action

3.1 Legal status

3.1.1 Inshore sublittoral sediment habitats occur in all three UK Marine Nature Reserves (MNRs). They are also present in some of the few coastal SSSIs, which include areas that are permanently inundated (eg the Cromarty Firth, the Burry Inlet, the Wash). Four of the habitat types listed in Annex I of the EC Habitats Directive include inshore sublittoral sediment habitats ('large shallow inlets and bays', 'estuaries', 'lagoons', and 'sandbanks which are slightly covered by sea water all the time'). The UK has proposed a total of 25 candidate Special Areas of Conservation (SACs) under these categories. Inshore sublittoral sediment habitats are also present in candidate SACs which have been selected for other marine habitat types listed in Annex I of the Directive. The same applies in some Wetlands of International Importance which are designated under the Ramsar Convention.

3.1.2 Some of the species that occur in this habitat are subject to specific conservation legislation. For example, seals and cetaceans as well as a number of invertebrate species are given various levels of protection under the 1981 Wildlife and Countryside Act. Listing also occurs under the EC Habitats and Birds Directives, the Bern Convention and CITES. The agreement on the conservation of Small Cetaceans of the Baltic and North Seas (ASCOBANS), a regional agreement under the Bonn Convention, is also relevant to the conservation of some cetaceans in UK waters.

3.1.3 International legislation and agreements have a major influence on the management measures which can be introduced for the conservation of marine habitats around the UK. The most far reaching is the 1982 UN Law of the Sea Convention which was ratified by the UK in 1997 and which provides a framework for the regulation of all ocean space. It also sets out the responsibilities of coastal nations for marine habitats and wildlife and the potential for Ecological Sensitive Areas in which freedom of navigation may be limited.

3.1.4 Other international agreements tend to focus on specific activities/uses of the marine environment, or are

concerned with particular geographic areas. The MARPOL Convention is concerned with pollution from shipping and includes provisions for identifying Particularly Sensitive Sea Areas and Special Areas. In such areas, specific regulations to limit ship-based pollution can be applied. Other relevant conventions include the London (Dumping) Convention, the Convention on the protection of the marine environment of the North-East Atlantic (prevention of pollution from land-based and offshore sources), and the EU Common Fisheries Policy.

- 3.1.5** Dumping at sea off England and Wales is regulated through licences issued by MAFF under the Food & Environment Protection Act 1985. Similarly, the statutory duty for pollution control is the responsibility of the Environment Agency. In Scotland, the Scottish Environment Protection Agency has authority and in Northern Ireland control is through DoE (NI). It is from national and international provisions, such as the Urban Waste Water Treatment Directive (91/271/EEC), which provide the legal framework for the management of inshore sublittoral sediment habitats.

3.2 Management, research and guidance

- 3.2.1** Statutory and voluntary measures are used to manage activities which may have an impact on areas of sublittoral sediment. Bye-laws are used to regulate certain activities in MNRs and are also likely to be used in marine SACs and Special Protection Areas (SPAs). Relevant authorities will be required to use their powers to ensure that such sites comply with the requirements of the Habitats Directive and the Birds Directive. The nature conservation agencies have some bye-law making powers but, to cover the full range of activities likely to affect the habitat, such powers need to be used in combination with the regulatory powers of Sea Fisheries Committees (who can introduce bye-laws to control fishing out to six nautical miles). Other relevant authorities include, port and harbour authorities (who have bye-law making powers within areas defined in their founding legislation), and local authorities (who can introduce regulations relating to public health up to 1000 m from the shore). Zoning schemes, supported by bye-laws may also be introduced to aid management of marine activities in European Marine Sites (SACs or SPAs) and are already being used in this way in MNRs.

- 3.2.2** Voluntary codes of conduct are another management tool. Codes have been introduced in voluntary marine conservation areas to minimise the impact of recreational use of such areas and to discourage collection of wildlife or habitat damage. Non-statutory documents such as coastal zone management plans, estuary management plans, coastal strategies and Local Environment Agency Plans may also provide advice on management of activities which may have an impact on

the habitat. There are also opportunities to influence the management of this habitat where it occurs in sites identified by EN as 'Sensitive Marine Areas' or identified by SNH as 'Marine Consultation Areas'.

- 3.2.3** One proposed management measure is for the establishment of 'Marine Environment High Risk Areas', a recommendation from the Donaldson inquiry into the prevention of pollution from merchant shipping. Criteria for identifying such areas and an initial list of potential sites, are being prepared by government departments.

- 3.2.4** Both broad scale mapping and specific research projects have focused on inshore sublittoral sediment habitats. General information is available in documents such as the 1991 Nature Conservancy Council Estuaries Review and the regional reports on the Coasts and Seas of the United Kingdom, published by JNCC. More detailed reports have been prepared as part of JNCC's Marine Nature Conservation Review and survey reports by the country conservation agencies.

- 3.2.5** Government fisheries departments and laboratories are involved in the development, promotion and enforcement of technical measures concerned with the management of fisheries. They are also sponsoring research into the effects of fisheries activities on the marine environment. These can be used to assist the conservation of marine wildlife and habitats of inshore sublittoral sediment.

- 3.2.6** A quality status report for the North Sea was published in 1993. It was drawn up by scientists from all the littoral states to provide an assessment of the health of the sea. A similar exercise is underway for the Celtic Sea so that by the year 2000 it covers the whole of the north-east Atlantic. Although predominately concerned with offshore habitats, both reports include information relevant to inshore sublittoral sediment habitats.

4. Conservation direction

- 4.1** Maintain the extent and quality of sublittoral sediment habitats in the UK, including the full diversity of communities.

- 4.2** Measures to be considered further include:

! protecting sites of conservation importance from damage through contamination and physical disturbance or excessive use (eg nutrient enrichment, dredging and development);

! requiring EIAs for coastal developments to examine potential effects on nearshore areas;

- ! monitoring any impact of dump sites on inshore sublittoral sediment habitats, communities and wildlife, and take action as appropriate;
- ! developing and implementing strategies for the conservation and management of the wider marine environment at local, regional and national levels. For example integrated Coastal Management Plans, water quality objectives, pollution control and avoidance measures. Species recovery and habitat restoration programmes should be included.

5. Priority habitats in this broad habitat

5.1 Within this broad habitat, the following priority habitats have been identified for which specific habitat action plans have been prepared:

- ! seagrass beds (to be reported against the littoral sediment broad habitat);
- ! maerl beds;
- ! saline lagoons;
- ! mud habitats in deep water;
- ! serpulid reefs; and
- ! sublittoral sands and gravels.

Offshore shelf rock

Habitat Statement

1. Current status

1.1 Offshore shelf rock habitat represents naturally occurring hard substrata in the area of sea beyond the inshore six nautical mile zone and the start of the continental shelf slope at around 200 m depth. It includes isolated rocks, which are entirely dominated by marine influences and that support no terrestrial habitats of any significance, and the overlying water column. The document does not consider separately man-made structures such as oil rigs and wrecks. Where these occur on rocky substrata they support communities which closely resemble those of the surrounding area and do not add significantly to the biodiversity.

1.2 Offshore environments in the UK waters are dominated by areas of sandy and muddy sediments. The very few offshore rock habitats mostly occur where geological formations project above the mean level of the sea-bed to form isolated reefs swept by strong tidal currents. Those that extend into waters shallower than about 10 m are also exposed to heavy swell and wave action which can be extreme along the UK's western seaboard where most offshore rock is found. Offshore hard substratum habitats are isolated from the influence of most coastal processes and so are colonised by unusual assemblages of animals adapted to withstand strong surf and current flows. The ecology of these remote and exposed habitats is poorly known. Paradoxically the best information available on the settlement of organisms on isolated hard offshore substrata has probably come from the studies undertaken on the fouling of oil and gas platforms in the North Sea where there is little or no natural hard rock.

1.3 Rock type is important, but almost without exception offshore reefs are composed of hard rocks (volcanic or granitic), which have been able to withstand not only the present erosion by waves, but also erosion by ice during the last glaciation when sea levels were some 140 m lower. Some specialised hard substrata have been created by biological activities, for example, calcareous concretions are laid down in the vicinity of methane seeps, and cold-water corals including *Lophelia pertusa* occur along the Hebridean Shelf.

1.4 Isolated reefs also attract large numbers of fish and often support a high biomass. Rocks near the surface, in deep water, are colonized by large seaweeds such as kelp where the species are determined by wave exposure and depth. In the clear offshore waters, brown algae can grow in depths down to about 50 m. Below that, an assortment of red algae remain. The

high structural diversity of these algal communities creates numerous micro-habitats, which are inhabited by a rich variety of animals. At depths where the light has become too dim to support algal growth, a succession of suspension-feeding animals is found.

1.5 Productivity may be enhanced to some extent by the physical presence of the reef structures. During summer, thermal stratification of the water column may be prevented by turbulence caused by the water flowing over the reef. This tends to mix water containing nutrients from below the thermocline with the near-surface water and maintain higher than average rates of primary productivity downstream of the reef.

1.6 The rock habitats of the south-west will be associated with the Lusitanian biogeographical region, whereas rock habitats to the north-east fall within the Boreal biogeographical region.

2. Current factors affecting the habitat

2.1 The remoteness of many offshore rocky habitats affords them considerable protection from many human activities. The principle cause for concern is contamination by long lasting and bioaccumulating compounds. These inputs are much the same as for habitats consisting of sediments and result in direct toxicity and bioaccumulation. They reach offshore environments in a number of ways :

! discharges from nuclear facilities, cooling waters from power plants, riverine inputs of industrial effluents, storm drains, agricultural run-off, soil and waste tip erosion and leachates;

! precipitation of certain heavy metals such as lead, mercury and agricultural sprays;

! direct discharges from ships, such as dumped materials, garbage, tank washings, accidental discharges, and cooling waters;

! leachates of biocides and anti-fouling substances (eg tri-butyl tin) and other hormone disruptors;

! hydrocarbon spills during exploration, and exploitation;

! discharges of drilling cuttings from hydrocarbon installations.

| | | |
|-------|--|--|
| 2.2 | The majority of offshore rock habitats are situated in the cleaner waters to the south-west and north-west of Britain. They are generally well flushed by tidal currents, so impacts will usually be less extreme. However, a marine accident may result in a single large input of contaminants which may seriously affect a local reef for several years until the damaged communities re-establish themselves. | |
| 2.3 | Around offshore reefs, fishing activity is limited to static gear, typically bottom set nets or long lines. These techniques cause relatively little damage to rocky habitats, and are effective at catching target species. Tangle nets can be more damaging (eg to spider crabs and crawfish). | ! the MARPOL convention which covers pollution from shipping and includes provisions for identifying Particularly Sensitive Sea Areas and Special Areas, where stronger regulations to limit ship-based pollution apply; |
| 3. | Current action | ! the Oslo and Paris Conventions (OSPAR) which aim to prevent pollution of the marine environment of the north-east Atlantic from land-based sources, and dumping from ships and aircraft. Unlike the previous two conventions, which are global, these are only regional but cover a range of sources; |
| 3.1 | Legal status | |
| 3.1.1 | There are no nationally or internationally protected sites in this area of sea. The UK is able to explore and exploit resources within the area which forms part of the UK Waters, but it is also responsible for conserving and managing these resources. | ! the EU Common Fisheries Policy which aims to manage the fish stocks in UK waters, along with those of other EU coastal states; |
| 3.1.2 | National provisions include: | |
| | ! licences for the exploration for, and exploitation of, hydrocarbon resources in the UK waters, which are awarded by the Department of Trade and Industry (DTI). Many licences for hydrocarbon exploration were awarded under the 17th licensing round in new offshore areas. New industrial activity in offshore waters, which is likely to have significant effects on the environment or which are above certain thresholds, will require an environmental statement. This allows any such effects to be assessed before Government consent can be given to a project. | ! the UN agreement on straddling stocks which is aimed at achieving the holistic management of migratory stocks; ! the EC Habitats Directive. The UK has a current obligation under this directive to provide protection for certain marine habitats and species within the 12 nautical mile limit of territorial waters. However, the interpretation that the Habitats Directive applies only to territorial waters and not to the Exclusive Economic Zone of EU countries, is subject to periodic, but continued challenge from some sectors; |
| 3.1.3 | International legislation and agreements include: | ! the International Whaling Commission which has banned the commercial exploitation of whales; |
| | ! the 1982 UN Convention on the Law of the Sea which was ratified by the UK in 1997 and which provides a framework for the regulation of all ocean space. It also sets out responsibilities of coastal nations for marine habitats and wildlife. Other international agreements tend to focus on specific activities and uses of the marine environment, or are concerned with particular geographical areas; | ! the Bonn Convention which aims to improve the status of all threatened migratory species through national and international agreements between range states of particular groups of species. For example, the Agreement on the Conservation of Small Cetaceans in the Baltic and the North Sea (ASCOBANS). |
| | ! the London (Dumping) Convention which is concerned with the protection of the marine | 3.1.4 Many other national and international requirements have an indirect effect on the quality of the offshore |

shelf sediment by regulating matters such as ship construction and other safety issues.

3.2 Management, research and guidance

- 3.2.1** Information about offshore rock habitats is sparse and highly variable in quality, most of it being anecdotal; almost no survey data have been collected and recorded systematically. However, the present expansion of the hydrocarbon industry's activities offshore should provide an opportunity to collect extensive environmental information as part of the licensing conditions for oil exploration.

4. Conservation direction

- 4.1** Maintain the extent and quality of offshore rocky habitats in the UK, including the full diversity of communities.

- 4.2** Measures to be considered include:

- ! implementing strategies for minimising contamination of the seas at national and international levels by toxic, long lasting and bioaccumulating contaminants;
- ! protecting sites of conservation importance from damage by contamination and physical disturbance;
- ! continuing efforts to minimise impacts caused by new and existing industrial activities;
- ! including the monitoring of the effects of hydrocarbon exploration and exploitation as a stipulation for licensing. All information collected in this way should be made publicly available and included in the Environment Statement for any proposed exploration drilling or production activity.

5. Priority habitats in this broad habitat

- 5.1** None identified.

Offshore shelf sediment

Habitat Statement

1. Current status

1.1 The offshore shelf sediment habitat comprises unconsolidated benthic material and the overlying water column beyond the inshore six nautical mile zone out to the continental shelf-break at a depth of about 200 m. It represents a common habitat type, covering most of the seabed of the UK Waters with the exception of a few areas of rocky bottom. The approximate extent of the UK Waters is shown in figure 1. It is roughly the same area as the UK's land surface.

1.2 There is a strong latitudinal gradient in species composition, since the UK straddles the Lusitanian/Boreal biogeographical boundary. All along the western margin the faunas are strongly influenced by the effects of the shelf current which flows along the 500 m isobath just beyond the shelf-break. This current introduces a Lusitanian fauna, originating from latitudes south of 45°N, and maintains temperate water temperatures even to the north of Scotland. Even so, cross-slope exchanges of water are restricted to the north-west of Scotland, so that there is a sharp divide between neritic and oceanic species. The water flows into the North Sea around the north of Scotland, introducing oceanic water and organisms via the Fair Isle Current between Shetland and Orkney. This inflow feeds a gyre of current that circulates mostly to the north of 57°N. Further south, a weak anti-clockwise circulation in the central and southern North Sea is supplemented by a weak flow from the south through the Strait of Dover. These flows result in the water of the UK sector of the North Sea completely turning over in a year.

1.3 The characteristics of the communities and assemblages of this habitat are strongly influenced by abiotic physio-chemical factors and sediment type. Sediments of continental shelves are predominantly terrigenous in origin, consisting mostly of rock fragments, quartz sands and clay-rich muds. Local accumulations of carbonates (molluscan shells, calcareous algae, and foraminiferan test) are important. Riverine input is the dominant source of material; secondary sources include coastal erosion, the products of sediment re-working and a small aeolian input. Much of the present seabed morphology reflects patterns of terrestrial erosion and deposition which occurred during the glaciations (e.g. river channels, glacial moraines and even ice-berg plough marks at the edge of the shelf). Many of these relict sediments have subsequently been, and are still being, re-worked by tidal currents and in shallower waters by wave action. Marked local variations in the interactions between the tidal regime and the seabed morphology generate mosaics in the local sediment type

and hence in the faunas. For example, in those areas where tidal currents remain, mud deposition is low and these areas are often utilised as spawning grounds by demersal fishes. Where there is strong tidal scour, active sand waves develop or the sediment cover is eroded away exposing the underlying rock. Boundaries between the elements of the mosaics are generally gradual and are rarely clearly defined. The clearest boundaries occur at tidal fronts where the tidal currents become strong enough to prevent the water column from thermally stratifying during summer.

1.4 Tidal fronts are clearly visible in remotely sensed images of sea-surface temperature and chlorophyll concentrations. Within the frontal zone both primary and secondary production are enhanced, and this attracts fish, birds and cetaceans. The location of the fronts are geographically fixed by the bathymetry and the maximum tidal stream velocities. They are quasi-permanent, and are underlain by rich associations of benthic suspension feeders maintained by the local high productivity. Tidal fronts occur off Flamborough Head in the North Sea, in the Irish Sea close to the Isle of Man, and close to the Channel Islands.

1.5 Benthic and pelagic ecology in shallow shelf seas are inextricably linked, particularly where and when the water column is unstratified. Mixing processes in the water column rapidly obliterates any fine-scale patchiness that develops, so pelagic conditions are generally only weakly linked with locality. In contrast, benthic habitats are more structured by abiotic factors particularly at fine scales, so location is of greater significance. Shallow waters are often turbid as a result of either resuspension from the seabed or riverine and outfall discharges or high productivity. Therefore, in the absence of hard substrates and reductions in light penetration, primary production on the seabed is restricted to depths of less than 50 m. Inputs of organic matter to shelf sediments is from productivity in the upper water column, or laterally transported from shallower regions.

1.6 Benthic communities are subdivided into broad size categories (megabenthos, macrobenthos, meiobenthos), modes of life (infauna, epifauna and mobile fauna) and feeding types (suspension-feeders, deposit-feeders, predators/scavengers). Knowledge of distribution, ecology, and conservation status is inadequate for most taxa and declines with body-size. Systematic surveys have been conducted in the North Sea sector by the International Council for the Exploration of the Sea (ICES). Data have also been gathered during environmental impact assessment (EIA) studies

associated with hydrocarbon exploration and development.

2. Current factors affecting the habitat

2.1 Despite the remote nature of this habitat from the coast there is concern regarding the degradation by inputs of contaminants resulting in direct toxicity, eutrophication and increases in turbidity. The bioaccumulation of long-lasting compounds is a particular area of concern. Contaminants reach offshore environments in a number of ways:

- ! direct discharges include dumping, tank washings, accidental spills and cooling waters from shipping;
- ! transported contaminants may originate from sewage and licensed chemical outfalls, discharges from nuclear facilities, cooling waters from power plants, riverine inputs of industrial effluents, storm drains, agricultural run-off, soil and waste tip erosion and leachates;
- ! aerial inputs particularly of certain heavy metals such as lead, mercury and agricultural sprays;
- ! leachates of biocides and anti-fouling substances (eg tri-butyl tin - TBT) and other hormonal disruptors;
- ! hydrocarbon spills during exploration and exploitation;
- ! discharges of drilling cuttings from hydrocarbon installations;
- ! garbage, flotsam, jetsam and lagan;

2.2 Fishing activities which lead to:

- ! over-exploitation;
- ! mechanical modification of seabed habitats;
- ! disruption of food-webs directly or via effects of discards.

2.3 Aggregate extraction creates semi-permanent depressions in the sea-bed, which may alter its sedimentological characteristics and can be particularly damaging to spawning grounds.

2.4 Pipeline and cable laying.

2.5 Past dumping activities, notably of industrial materials, mining tailings, munitions (notably Beaufort's Dyke), and radioactive waste discharges (pipeline discharges from Sellafield (Cumbria) continue to be traced around the north of Scotland and into the North Sea and discharges from Le Hague (Cherbourg peninsula) are carried through the Strait of Dover). Dumping of industrial wastes was licensed at numerous shelf-sea sites until the early 1980s.

2.6 Introductions of exotic (non-native) species via ballast waters will mainly influence inshore waters, but some species have spread throughout our shelf seas, such as the Indonesian diatom *Biddulphia sinensis* which was first reported from UK waters in 1903.

3. Current action

3.1 Legal status

3.1.1 There are no nationally or internationally protected sites in this area of sea. The UK is able to explore and exploit resources within the area which forms part of the UK Waters, but it is also responsible for conserving and managing these resources.

3.1.2 National provisions include:

- ! control of dumping at sea by licences issued under the Food and Environment Protection Act, part II, 1985;
- ! the licensing of the exploration for, and exploitation of, hydrocarbon resources in the UK Waters by the Department of Trade and Industry (DTI). Many licences for hydrocarbon exploration were awarded under the 17th and 18th licensing rounds, and 'out of rounds' awards, in new offshore areas. New industrial activity in offshore waters which is likely to have significant effects on the environment or which are above certain thresholds, will require an environmental statement. This allows any such effects to be assessed before Government consent can be given to a project.

3.1.3 International legislation and agreements include:

- ! the 1982 UN Convention on the Law of the Sea, which was ratified by the UK in 1997 and which provides a framework for the regulation of all ocean space. It also sets out responsibilities of coastal nations for marine habitats and wildlife. Other international agreements tend to focus on specific activities/uses of the marine environment, or

are concerned with particular geographic areas;

Conservation of Small Cetaceans in the Baltic and the North Sea (ASCOBANS).

- ! the London (Dumping) Convention which is concerned with the protection of the marine environment from pollution from ships, aircraft and man-made structures and resulting from normal operations (ie not from deliberate dumping). It covers a wide range of substances with some, generally biodegradable or innocuous bulky, substances specifically excluded. It includes a ban on incineration at sea;
- ! the MARPOL Convention which covers pollution from shipping and includes provisions for identifying Particularly Sensitive Sea Areas and Special Areas, where stronger regulations to limit ship-based pollution apply;
- ! the Oslo and Paris Conventions (OSPAR) which aim to prevent pollution of the marine environment of the north-east Atlantic from land-based sources, and from dumping from ships and aircraft. Unlike the previous two conventions, which are global, these are only regional but cover a wider range of sources;
- ! the EU Common Fisheries Policy which is aimed at the management of the fish stocks in the UK Waters, along with those of other EU coastal states;
- ! the UN agreement on Straddling Stocks which is aimed at achieving the holistic management of migratory stocks;
- ! the EC Habitats Directive which places the UK under an obligation to provide protection for marine habitats within the 12 nautical mile limit of territorial waters. However, the interpretation that the Habitats Directive applies only to territorial waters and not to the Exclusive Economic Zone of EU countries, is subject to periodic but continued challenge from some sectors;
- ! the International Whaling Commission which has banned the commercial exploitation of whales;
- ! the Bonn Convention which aims to improve the status of all threatened migratory species through national and international agreements between range states of particular groups of species. For example the Agreement on the

3.1.4 Many other national and international requirements have an indirect effect on the quality of the offshore shelf sediment by regulating matters such as ship construction and other safety issues.

3.2 Management, research and guidance

3.2.1 There are no marine reserves associated with offshore sediments, nor are there any initiatives associated specifically with sedimentary offshore areas. Pelagic species such as cetaceans, turtles, seals and basking shark are targeted by conservation measures, and catches of exploited species are regulated through the Common Fisheries Policy (CFP). Knowledge of the distribution of species in these offshore areas is inadequate and there have been few attempts at either conducting systematic surveys or compiling databases of distributions. Hence, it is difficult to identify areas in which changes have occurred, or habitat types that may be either fragile or vulnerable. This lack of information has been highlighted in the Environmental Screening Reports produced for the 17th Offshore Round licensing tranches for hydrocarbon exploration and production on the seabed.

3.2.2 Plankton communities have been well characterised by several decades of monitoring achieved by the Continuous Plankton Recorder Survey, which have revealed long-term cycles of variation in plankton communities possibly related to a 70-year cycle in the North Atlantic. Systematic sampling and recording of the benthos of the North Sea has been co-ordinated by the North Sea Task Force during the last few years, and studies have been targeted at identifying the impact of the hydrocarbon industry on benthic ecosystems. No comparable effort has been achieved in the South-west Approaches or the Hebridean Shelf despite the recent expansion of the oil exploration in the 'Atlantic Frontier'.

3.2.3 This lack of information is inhibiting investment in programmes which can provide a basis for rational management of these sediment communities. The ICES Advisory Committee on Fishery Management points out that the majority of exploited species suffer declining spawning stocks and high fishing mortalities. The almost universal recommendation is that fishing mortalities must be substantially reduced (by 20-40%) for most stocks. The controversy over the industrial fishing take of sand eels, mostly from a small area, the Wee Bankie (offshore of the Firth of Forth), amounting to nearly 1% of total global catch of fish, brings into question the effectiveness of the methods used in assessing the impact of the fishing on the wider ecosystem. Not the least of these concerns is the interaction such fisheries have on other dependant species, eg piscivorous birds.

- 3.2.4** The intensity of fishing activity inhibits scientific observations requiring moorings and the long-term deployment of instruments on the seabed. Consequently, basic data needed for effective management and monitoring impacts of long-term climate change are not being gathered as intensively as might be desired.
- 3.2.5** A full description of pipelines and cables is given in the *Mariners Handbook* published by the Hydrographic Office, and the Sea Fish Industry Authority (SFIA) provides a free service to the fishing industry, plotting all pipeline and cable routes in UK waters on the SFIA Kingfisher Charts.
- 4. Conservation direction**
- 4.1** Maintain the extent and quality of offshore shelf sediment habitats in the UK Waters, including the full diversity of communities.
- 4.2** Measures to be considered include:
- ! a case for 'no-take' reserves to conserve spawning stocks and reduce fishing mortality of commercial species. This will ensure that sufficient areas of seabed remain undisturbed so that representative examples of seabed communities receive adequate protection. Additionally this will provide areas where baseline scientific study and observation can be conducted without hindrance;
 - ! the development of guidelines to ensure that site surveys of areas to be explored and exploited by the hydrocarbon industry collect adequate baseline data. This data should be used to underpin future monitoring around the sites. Operations should also be designed in such a way as to minimise impacts;
 - ! support by the UK government for the implementation of Annex V to the Oslo and Paris Convention (OSPAR);
 - ! carry out systematic surveys of UK shelf waters similar to those conducted in the North Sea and make the data freely available. Novel data sources such as the sound records from defence hydrophones should be exploited;
 - ! compile an inventory of materials dumped in the past and survey a few key sites to assess what impact the sites still have on the ecology of the vicinity.
- ! reduce the environmental impact of fisheries, including the extent of discards and the size of by-catches of non-target species;
 - ! continue attempts to improve water quality in the UK shelf seas, by reducing discharges from ships and shore facilities as much as is practical, and also examining ways of reducing aerial inputs;
 - ! curtail the manufacture and use of organic molecules that persist in the marine environment;
 - ! continue the development of controls preventing introduction and spread of exotic species;
 - ! seek the establishment of an interdepartmental committee to co-ordinate all aspects of coastal and shelf seas management and protection;
 - ! support all actions to minimise shipping and offshore accidents through safety procedures and response planning.
- 5. Priority habitats in this broad habitat**
- 5.1** Within this broad habitat, the following priority habitat has been identified for which a specific habitat action plan has been prepared:
- ! sublittoral sands and gravels (to be reported against the inshore sublittoral sediment broad habitat).

Continental shelf slope

Habitat Statement

1. Current status

1.1 Shelf slope is the band of seabed that slopes steeply down from the edge of the continental shelf (the shelf break), at about 200 m depth, to the deep ocean floor at between 1000 m and 2000 m depth. The habitat includes both the seabed and the overlying water. UK Waters includes three areas of the European shelf slope which have sharply contrasting characteristics:

! a very small area in the South-West Approaches to the west of Little Sole Bank where the continental margin has many canyons;

! the Rockall sub-region bordering the Rockall Trough and the Malin/Hebridean Shelf. In the south of this sub-region, the lower boundary to the slope is at a depth of around 2000 m but further north to west of St Kilda it levels off at about 1000 m. At the shelf-break, sediments are predominantly sand but, below depths of 1000 m, where bottom currents tend to be weaker, they become progressively muddier and richer in inorganic carbon. The slope is intermittently scarred with the results of mass wasting events, most dating from the Pliocene and Pleistocene eras (the last five million years). Between the Hebrides Terrace Seamount and the shelf-break in the south of the Rockall sub-region, the slope is carved into numerous small down-slope channels and gullies some of which are partially buried. To the north of the seamount is the Barra Fan, a deltaic structure probably laid down during glacial periods of low sea level. Along the shelf-break to the west of St Kilda there are moraines and just to the south of the Wyville-Thomson Ridge is the Sula Sgeir Fan, which also has a morainic ridge at its head and is covered with a series of channels and partially buried gullies;

! the Shetlands sub-region which includes all UK Waters in the Faeroes-Shetland Channel. In this sub-region the slope mainly consists of debris flows and glacial deposits, and is subject to contour-current sedimentation. In the far north of the UK Waters, the slope just impinges on the North Sea Fan.

1.2 Hydrographically the habitat is dominated by the slope current. The axis of this current is at a depth of around 500 m. It flows polewards at speeds of about a knot, transporting warm North Atlantic Central Water (originating in the Bay of Biscay) over the Wyville-Thomson Ridge and through the Shetland sub-region into the Norwegian Sea. At a depth of 600 m in the Rockall sub-region, water temperatures are still quite high at around 7°C and there is a salinity maximum of Mediterranean water origin. In the Shetland sub-region water temperatures drop rapidly to less than 0°C below about 550 m, the sill depth of the Wyville-Thomson Ridge. Consequently the fauna living deeper than 550 m is boreal in the Shetland sub-region and temperate in the Rockall sub-region.

1.3 Primary productivity (the growth of phytoplankton) in the region follows a seasonal succession that is typical of temperate latitudes. It is low during the winter when day lengths are short and the upper water column is mixed to depths of several hundred m. Between spring and early summer, as weather conditions moderate and day length and solar radiation increase, the upper few tens of m of the water column become thermally stratified. Phytoplankton ceases to be either light- or nutrient-limited and some species, particularly diatoms, grow rapidly. A spring bloom develops rapidly using up all the available nutrients. The stratification inhibits replacement by vertical mixing, so the bloom collapses. Heavy deposition of phyto-detritus usually follows the collapse of the bloom and stimulates a marked seasonal response in the seabed communities.

1.4 Post-bloom, productivity remains at a relatively low level throughout the summer until autumnal storms begin to erode the stratification. When the early storms do not totally disrupt this stratification, there is a short-lived autumnal bloom before the onset of winter conditions. Along the shelf-break there is a front between shelf (neritic) and oceanic waters. Oceanic fronts are sites of enhanced productivity because nutrients tend to be re-supplied to the euphotic zone by upwelling. Another important process enhancing productivity at the shelf-break, particularly in the South-West Approaches, is the generation by tidal oscillations of packages of internal waves (solitons) which break, under certain circumstances, vertically mixing the water. The shelf-break front marks a sharp change in the species composition. Offshore there is a marked increase in species richness in benthic and pelagic communities, and the mean size of phytoplankton generally becomes smaller.

1.5 The high production of plankton at the shelf-break make it an important feeding ground for large shoals of

fish, flocks of oceanic birds and cetaceans. Several commercially exploited fish species spawn along the shelf-break including mackerel *Scomber scombrus* and blue whiting *Micromesistius poutassou*. Large cetaceans tend to follow the line of the shelf-break during their seasonal migrations.

1.6 Species richness in both pelagic and benthic taxa increases with depth reaching a maximum at 1000 to 2000 m, despite community biomass generally decreasing by an order of magnitude from the shallowest depths. However, the decline in benthic biomass is erratic and high concentrations of biomass occur especially where internal waves result in re-suspension and a localised increase in suspended material. Colonies of the cold water coral *Lophelia pertusa* and other species of cold-water corals occur along the slope. In the Rockall Trough and South-West Approaches these occur at depths of about 500 m, but in the Shetland subregion they are shallower. About 250 other species have been identified living with the corals on the Faeroes slope, and about 400 in the Porcupine Seabight near the South-West Approaches.

1.7 The sharp contrasts in the hydrographic regimes between the Rockall and Shetland sub-regions result in the faunas at more than 550 m depth being totally distinct on either side of the Wyville-Thomson Ridge. Norwegian Sea water cascades over the sill and down-slope into the head of the Rockall Trough, causing significant seabed erosion down the flanks of the Ridge and the Ymir Rise. Studies from the Rockall sub-region indicate that there is a bathymetric succession of benthic species with depth. The numbers of fish species caught rises to a maximum at a depth of 1000 m, and then declines slowly into deeper water. Mean body size and longevity tend to increase with depth, whereas fecundity declines. Consequently deeper-living species are more susceptible to over-exploitation.

1.8 A fishery for orange roughy *Hoplostethus atlanticus* began in 1991 but already stocks of this long-lived, slow-growing, low fecundity species have fallen to near extinction levels. Other species caught regularly include blue ling *Molva dypterygia*, roundnose grenadier *Coryphaenoides rupestris* and a variety of deep-sea sharks (including *Centrophorus* spp, *Centroscymnus* spp and *Etmopterus* spp).

2. Current factors affecting the habitat

2.1 The following factors have been identified as possible influences on the quality of this habitat:

! fishing has extended into deep water as stocks on the shelf have dwindled. Some trawling and lining has been conducted for

demersal species to depths of 1000 to 2000 m. There is little regulation of this activity at present and some species have been driven to very low stock levels;

! input of contaminants and discarded materials from shipping. This is being reduced but monitoring is difficult offshore;

! the environmental impacts of aerial sources of contaminants offshore is not known;

! the most recent potential threat posed by the development of the Atlantic Frontier oil fields. This will cause contamination and disturbance to the seabed and will also increase the risk of oil spills.

3. Current action

3.1 Legal status

3.1.1 There are no nationally or internationally protected sites in this area of sea. The UK is able to explore and exploit resources within the area which forms part of the UK Waters, but it is also responsible for conserving and managing these resources. However, international legislation and agreements have a major influence on the management measures which can be introduced by the UK.

3.1.2 National provisions include:

! the control of dumping at sea by licences issued under the Food & Environment Protection Act, part II, 1985;

! the licensing of the exploration for, and exploitation of, hydrocarbon resources in the UK Waters by the Department of Trade and Industry (DTI). Many licences for hydrocarbon exploration were awarded under the 17th licensing round in new offshore areas. New industrial activity in offshore waters which is likely to have significant effects on the environment or which are above certain thresholds, will require an environmental statement. This allows any such effects to be assessed before Government consent can be given to a project.

3.1.3 International agreements and regulations include:

! the 1982 UN Convention on the Law of the Sea, which was ratified by the UK in 1997 and which provides a framework for the

regulation of all ocean space. It also sets out responsibilities of coastal nations for marine habitats and wildlife;

! the London (Dumping) Convention which is concerned with the protection of the marine environment from pollution from ships, aircraft and man-made structures and resulting from normal operations (ie not from deliberate dumping). It covers a wide range of substances with some generally biodegradable or innocuous bulky substances specifically excluded. It includes a ban on incineration at sea;

! the MARPOL Convention which covers pollution from shipping and includes provisions for identifying Particularly Sensitive Sea Areas and Special Areas, where stronger regulations to limit ship-based pollution apply;

! the Oslo and Paris Conventions (OSPAR) which aim to prevent pollution of the marine environment of the north-east Atlantic from land-based sources, and from dumping from ships and aircraft. Unlike the previous two conventions, which are global, these are only regional but cover a wider range of sources;

! the EU Common Fisheries Policy which is aimed at the management of the fish stocks in the UK waters, along with those of other EU coastal states;

! the UN agreement on Straddling Stocks which is aimed at achieving the holistic management of migratory stocks;

! the International Whaling Commission which has banned the commercial exploitation of whales. Not all nations agree with these measures, for example Norway continues to catch minke whales;

! the Bonn Convention which aims to improve the status of all threatened migratory species through national and international agreements between range states of particular groups of species, for example the Agreement on the Conservation of Small Cetaceans of the Baltic and North Sea (ASCOBANS);

3.1.4 Many other national and international requirements have an indirect effect on the quality of the oceans by regulating matters such as ship construction and other safety issues.

3.1.5 There are no nationally or internationally protected sites in this area of the sea. However, OSPAR is developing a policy for applying nature conservation measures throughout the north-east Atlantic.

3.2 Management, research and guidance

3.2.1 Recent global change-related research has clarified the pivotal role of the marine environment in our life supporting system and as a component of the Earth's climate system.

3.2.2 There is little management of the fisheries for the deep-living fish species in the region, with the result that many species are in danger of over exploitation. Some of these deep-living species are so over-fished that the International Council for the Exploration of the Seas (ICES) is recommending substantial reductions in the fishing industry.

3.2.3 Scottish marine and fishery laboratories have over a century of experience in carrying out stock assessments and conducting hydrographic surveys to investigate the relationship between fish recruitment and variations in ocean currents. During the last 20 years Dunstaffnage Marine Laboratory (DML) has been collaborating in the hydrographic surveys, often in association with European laboratories. DML biologists have carried out one of a very few long-term investigations of benthic communities, in their studies of the Rockall Trough. A component of a major research project along the Hebridean margin studying cross-slope fluxes has been conducted by the Natural Environmental Research Council as part of the Land Ocean Interaction Studies programme.

3.2.4 The hydrocarbon industries have carried out extensive surveys of the biology and geology of the slope region in the vicinity of the West Shetlands oilfield. These will provide baseline data needed to assess changes that may result from the development of the oil-fields, if the data are placed in the public domain and future routine monitoring is carried out to assess any impacts.

4. Conservation direction

4.1 There is a need to:

! improve co-ordination and co-operation between government departments and agencies;

! reduce fishing mortality of the fish stocks in the slope regions to the level recommended by ICES;

- ! reduce the inefficient exploitation of fish stocks resulting from policies that encourage discards and fishing practices that result in by-catches of non-targeted species;
- ! consider designating part of the slope region as a no-take reserve in which there will be no fishing or non-living resource extraction to provide: a refuge for exploited stocks; a source for future recruitment for any slope areas impacted by industrial exploitation; a control baseline area for monitoring; and areas where scientific observations can continue to be conducted without interference;
- ! encourage OSPAR in its efforts to develop conservation measures for the north-east Atlantic;
- ! survey biologically and chemically one or more of the scuttled ships loaded with chemical warfare weapons in slope waters, to ascertain what detectable impacts they may still be having on the surrounding environment;
- ! place monitoring data in the public domain.

5. Priority habitats in this broad habitat

- 5.1** Within this broad habitat, the following priority habitat has been identified for which a specific habitat action plan has been prepared:

- ! *Lophelia pertusa* reefs.

Oceanic seas

Habitat Statement

1. Current status

1.1 The area of oceanic seas beyond the continental slope within the UK Waters is restricted to the region to the north and west of Scotland. It covers the northern half of the Rockall Trough which reaches a maximum depth of 2450 m on the southern boundary, and then shoals both westwards towards the Rockall Bank and northwards towards the North Feni Ridge and the Wyville-Thomson Ridge. Much of the Rockall Bank is more than 200 m deep. Rockall itself projects 22 m above the surface, but for much of the time it is obscured by breaking seas. Other bathymetric features include:

! the Anton Dohrn Seamount in the centre of the Rockall Trough,

! the George Bligh Bank and the eastern end of the Hatton Bank to the north of Rockall and flanked by the North Feni Ridge,

! the Rosemary Bank to the north-east of Rockall.

1.2 The habitat includes both the water column (from the surface to the seabed) and the underlying seabed. An awareness of the complex movements within this water column is essential to understanding the ecology of the region.

1.3 The surface waters are dominated by two flows of Atlantic water entering the area. One, from the south-west, consists of the Slope Current flowing along the eastern flank of the Rockall Trough with a weaker flow through the middle of the Trough. The second comes from the Iceland Basin flowing south-east between the Rockall Bank and the Faeroes Bank. These two flows converge and exit the area northwards over the Wyville-Thomson Ridge and into the Norwegian Sea. These flows are variable because they are strongly influenced by the difference in atmospheric pressure between the Icelandic Low and the Azores High (the North Atlantic Oscillation Index) which varies on a number of time scales up to 70 years.

1.4 Bottom water enters the Rockall Trough from several sources. Occasional cascades of very cold Norwegian Sea water spill over the sill of the Wyville-Thomson Ridge and exit the area along the eastern flank of the Rockall Bank. At the bottom of the Rockall Trough is water which originates in the Labrador Sea and may have taken up to 10 years to spread eastwards into the

Trough. Another type of deep water that occurs is rich in dissolved silicate, and originates as the Antarctic Bottom Water. At depths of around 1000 m in the Rockall Trough a weak salinity maximum is produced by remnants of high salinity water that spills out of the Mediterranean via the Straits of Gibraltar.

1.5 These water movements transport pelagic communities into the area from widely different sources with the communities strongly influenced by gradients of temperature, light intensity, food availability and hydrostatic pressure within the water column. As a result they are vertically zoned into epipelagic (0-250 m), mesopelagic (250-1000 m) and bathypelagic communities (deeper than 1000 m). Many pelagic species undertake extensive vertical migrations daily, seasonally or during their development. Many benthic species have a dispersive phase in their life-cycle by having planktonic larvae.

1.6 Primary production (the growth of phytoplankton) occurs only in the upper 50-100 m, and is dependent on there being sufficient light and nutrients available in the surface waters. Primary production undergoes a strong seasonal cycle and has a major influence on the ecology of the water column and the underlying seabed communities. A spring bloom in production occurs around late May/early June, but its exact timing is influenced by the weather patterns affecting solar radiation and the strength and frequency of storms. From year to year the timing fluctuates unpredictably by several weeks and is critical in determining the size of the peak in productivity. In summer, dense blooms of the coccolithophorid *Emiliania huxleyi* often cover the ocean surface over much of the area. These blooms have a very high reflectance so the swirls and eddies of the surface circulation can clearly be seen in satellite images.

1.7 Phytoplankton from primary production provides food for the growth of zooplankton (secondary production), and the sedimentation of particles and aggregates produced by primary and secondary production transmits near-surface variations down to the seabed. The quality of the organic material produced and the quantities of organic matter that eventually reach the seabed is determined by the strength of the spring bloom in production, and the variability is a major determinant of the wide and unpredictable fluctuations in recruitment of animal populations including commercial fishes.

1.8 Large scale eddies in the water, mostly 100-200 km in diameter, are another significant source of variability. These eddies are analogous to atmospheric cyclones

and anticyclones, but contain far more dynamic energy and so can persist for up to two years. They generally develop from meanders along fronts between contrasting water types and so transport assemblages of pelagic animals into regions where they do not usually occur.

- 1.9 Seasonal cycles have a major influence on the behaviour of many mobile species. Cetaceans and various fish species migrate through the region taking advantage of the optimum feeding and temperature conditions. Many planktonic species, although unable to undertake horizontal migrations, undertake extensive vertical migrations to overwinter in deep water.
- 1.10 The benthic communities respond to the varying characteristics of the substrata. Even where strong bottom currents erode away mobile sediments, hard rocky substrata are rare; sunken wrecks are often the only hard substrata available over wide areas of seabed. The grain size of the sediments is related to water depth and the local geological origins. The deeper sediments are generally finer and contain more clay. In the Rockall Trough sediments at depths of 2000 m have higher organic and inorganic carbon contents than at 1000 m.
- 1.11 Rockall Bank is composed of continental rocks and sands, draped in places with sediments of pelagic origin. Where bottom currents are strong, such as along its steep eastern boundary, turbidity is high and the strongly erosional environment leaves only coarse sandy sediments. Similarly, over the summit of the Bank wave action and strong tidal flows keep fine material in suspension leaving coarse sands. The isolated sea-mounts are volcanic in origin and the extent to which they are draped with pelagic sediments varies with the local hydrographic regime.
- 1.12 Maximum species richness in both pelagic and benthic communities tends to occur at depths of between 1000 and 2000 m. Since the area is a confluence of waters originating from diverse sources, it is populated by communities which are a mix of boreal and temperate faunas. Where the bottom currents are generally slow, fine-grained and relatively organic-rich sediments accumulate and the bottom communities are dominated by deposit feeders such as holothurians. Where the currents are stronger, fine material is kept in suspension (or resuspended) and suspension-feeders are dominant, especially where there is a hard substrate on which they can anchor. Many deep-living demersal fish, including commercially exploited species like the orange roughy *Hoplostethus atlanticus* and the roundnose grenadier *Coryphaenoides rupestris*, rely predominantly on prey from the water column rather than from the benthos.

2. Current factors affecting the habitat

- 2.1 Numerous ships containing a wide variety of cargoes were sunk in the area during both World Wars. In the period 1946-1957, 11 redundant vessels containing chemical warfare munitions were scuttled at depths ranging from 800 to 2500 m in the Rockall Trough. No deleterious effects have been reported, but no environmental monitoring of these wrecks has ever been carried out.
- 2.2 Transport of water-borne contaminants across the continental shelf is trivial as most substances discharged from land are deposited in estuaries and inshore waters. Consequently contaminants come predominantly from ships or the atmosphere. However, operational discharges from ships have been reduced and most intentional dumping has now been banned. The prevailing south-westerly winds keep aerial inputs from the UK and continental Europe to a minimum but will increase those from North America. Aerial inputs of lead derived from car exhausts have been reduced over the last decade, but are still substantially higher in the Northern Hemisphere than in the Southern Hemisphere.
- 2.3 Hydrocarbon exploration is taking place on the eastern flank of the Rockall Bank. This exploration and any subsequent production will be technically challenging because of the extreme wind and wave conditions experienced over the Rockall Bank and the strength of the deep currents associated with the Norwegian overflow water. These developments may therefore give rise to new sources of pollution.
- 2.4 Fishing activity is moderately high in the region but, as shelf stocks and quotas are reduced, greater effort is being expended on catching deep-water species. Little information is available on which to base rational conservation of these fish stocks.

3. Current action

3.1 Legal status

- 3.1.1 There are no nationally or internationally protected sites in this area of sea. The UK is able to explore and exploit resources within the area which forms part of the UK Waters, but it is also responsible for conserving and managing these resources. However, international legislation and agreements have a major influence on the management measures which can be introduced by the UK.

3.1.2 National provisions include:

- ! control of dumping at sea by licences issued under the Food & Environment Protection Act, part II, 1985;
- ! the licensing of the exploration for, and exploitation of, hydrocarbon resources in the UK Waters by the Department of Trade and Industry (DTI). Many licences for hydrocarbon exploration were awarded under the 17th licensing round in new offshore areas. New industrial activity in offshore waters which is likely to have significant effects on the environment or which are above certain thresholds will require an environmental statement. This allows any such effects to be assessed before Government consent can be given to a project.

3.1.3 International agreements and regulations include:

- ! the 1982 UN Convention on the Law of the Sea which was ratified by the UK in 1997 and provides a framework for the regulation of all ocean space. It also sets out responsibilities of coastal nations for marine habitats and wildlife. Other international agreements tend to focus on specific activities/uses of the marine environment, or are concerned with particular geographic areas;
- ! the London (Dumping) Convention which is concerned with the protection of the marine environment from pollution from ships, aircraft and man-made structures and resulting from normal operations (ie not from deliberate dumping). It covers a wide range of substances with some, generally biodegradable or innocuous bulky, substances specifically excluded. It includes a ban on incineration at sea;
- ! the MARPOL Convention which covers pollution from shipping and includes provisions for identifying Particularly Sensitive Sea Areas and Special Areas, where stronger regulations to limit ship-based pollution apply;
- ! the Oslo and Paris Conventions (OSPAR) which aim to prevent pollution of the marine environment of the north-east Atlantic from land-based sources, and from dumping from ships and aircraft. Unlike the previous two

conventions, which are global, these are only regional but cover a wider range of sources;

- ! the EU Common Fisheries Policy which is aimed at the management of the fish stocks in the UK waters, along with those of other EU coastal states;
- ! the UN agreement on Straddling Stocks which is aimed at achieving the holistic management of migratory stocks;
- ! the EC Habitats Directive which places the UK under an obligation to provide protection for marine habitats within the 12 nautical mile limit of territorial waters. However, the interpretation that the Habitats Directive applies only to territorial waters and not to the Exclusive Economic Zone of EU countries, is subject to periodic but continued challenge from some sectors;
- ! the International Whaling Commission which has banned the commercial exploitation of whales;
- ! the Bonn Convention which aims to improve the status of all threatened migratory species through national and international agreements between range states of particular groups of species, for example the Agreement on the Conservation of Small Cetaceans in the Baltic and the North Sea (ASCOBANS).

3.1.4 Many other national and international requirements have an indirect effect on the quality of the oceans by regulating matters such as ship construction and other safety issues.

3.2 Management, research and guidance

3.2.1 Considerable hydrographic research has been conducted in this region. Fishery research in the past has focused on the effect of changes in the Rockall Trough and Faeroes-Shetland Channel on the fishing grounds in the northern North Sea. However, investment in research has declined in recent years and most effort is now devoted to stock assessments. The Natural Environment Research Council (NERC) has co-ordinated a number of research programmes jointly conducted by universities and research institutes into oceanic processes in the area, but less emphasis is now placed on supporting oceanic research by NERC. A similar trend has occurred in the Framework programmes of the EU. The Marine, Science and Technology (MAST) programme specifically targeted marine research, but in the next Framework

programme the criteria are broader and do not specifically target marine problems.

4. Conservation direction

4.1 Maintain the extent and quality of oceanic habitats in the UK Waters, including the full diversity of communities.

4.2 Measures to be considered include:

! encouraging research to rectify the general lack of biological knowledge about the region and to prepare guidelines for the design of environmental impact assessments and monitoring programmes for developments in the area;

! monitoring the impact of developments on habitats, communities and wildlife, and taking remedial action if appropriate;

! establishing protected areas where these will benefit the conservation of oceanic species and habitats.

5. Priority habitats and species in this broad habitat

5.1 Within this broad habitat, action plans have been prepared for the following species:

! baleen whales;

! toothed whales;

! dolphins;

! turtles;

! basking shark *Cetorhinus maximus*;

! commercial fish species;

! deep-water fishes;

! harbour porpoise *Phocoena phocoena*.

Annex 1. List of abbreviations and acronyms

| | |
|-------------------|---|
| ASCOBANS | Agreement on the Conservation of Small Cetaceans of the Baltic and North Seas |
| ASSI | Area of Special Scientific Interest (Northern Ireland) |
| CC | Crofters Commission |
| CCW | Countryside Council for Wales |
| CEC | Crown Estate Commissioners |
| CFP | Common Fisheries Policy |
| CITES | Convention on the International Trade of Endangered Species |
| DANI | Department of Agriculture for Northern Ireland |
| DCMS | Department for Culture, Media and Sport |
| DCS | Deer Commission for Scotland |
| DETR | Department of the Environment, Transport and the Regions |
| DfEE | Department for Education and Employment |
| DfID | Department for International Development |
| DTI | Department of Trade and Industry |
| EA | Environment Agency |
| EC | European Community |
| EHS | Environment and Heritage Service (Northern Ireland) |
| EIA | Environmental Impact Assessment |
| EMP | Estuary Management Plan |
| EN | English Nature |
| ESA | Environmentally Sensitive Area |
| FC | Forestry Commission |
| FE | Forest Enterprise |
| FRS | Fisheries Research Services |
| HMCE | HM Customs and Excise |
| ICES | International Council for the Exploration of the Sea |
| ICES ACFM | ICES Advisory Committee on Fisheries Management |
| IUCN | International Union for the Conservation of Nature |
| IWC | International Whaling Committee |
| JNCC | Joint Nature Conservation Committee |
| LA | Local Authority |
| MAFF | Ministry of Agriculture, Fisheries and Food |
| MARPOL | International Convention for the Prevention of Pollution from Ships |
| MNCR | Marine Nature Conservation Review |
| MoD | Ministry of Defence |
| NAW | National Assembly for Wales |
| NEAFC | North East Atlantic Fisheries Commission |
| NERC | Nature and Environment Research Council |
| NGO | Non-governmental organisation |
| NHM | Natural History Museum, London |
| NIO | Northern Ireland Office |
| NNR | National Nature Reserve |
| NTS | National Trust for Scotland |
| OSPAR | Oslo and Paris Conventions |
| RSPB | Royal Society for the Protection of Birds |
| SAC | Special Area of Conservation |
| SAC (as actionee) | Scottish Agricultural College |
| SE | Scottish Executive |
| SEPA | Scottish Environmental Protection Agency |

| | |
|-------|---|
| SFC | Sea Fisheries Committee |
| SFIA | Sea Fish Industry Authority |
| SMP | Shoreline Management Plan |
| SNH | Scottish Natural Heritage |
| SPA | Special Protection Area |
| SSSI | Site of Special Scientific Interest (Britain) |
| TAC | Total Allowable Catch |
| UKOOA | UK Offshore Operators Association |

Annex 2. Action plan costings

Summary table showing estimated additional costs in £K per year for the first and second five years of each Species Action Plan(not including republished plans)

| | | 1st five years | 2nd five years |
|---|---------------------------|----------------|----------------|
| Mammals | | | |
| <i>Baleanoptera</i> | Baleen whales | 669.8 | 663.4 |
| | Small dolphins | 465.4 | 340 |
| | Toothed whales | 373.4 | 280.8 |
| Reptiles | | | |
| | Marine turtles | 173.1 | 75.5 |
| Fish | | | |
| <i>Cetorhinus maximus</i> | Basking shark | 170.8 | 167.6 |
| <i>Raja batis</i> | Common skate | 184.2 | 180.8 |
| | Commercial marine fish | 544.1 | 520.7 |
| | Deep-water fish | 237.6 | 237.6 |
| Molluscs | | | |
| <i>Atrina fragilis</i> | a fan shell | 8.3 | 34.4 |
| <i>Ostrea edulis</i> | Native oyster | 161.9 | 132.9 |
| <i>Thyasira gouldi</i> | Northern hatchett shell | 5.3 | 3.6 |
| Sea anemones | | | |
| <i>Amphianthus dohrnii</i> | Sea-fan anemone | 41.5 | 3.9 |
| Coral | | | |
| <i>Eunicella verrucosa</i> | Pink sea-fan | 47.3 | 9.7 |
| <i>Leptosammia pruvoti</i> | Sunset cup coral | 38.9 | 32.5 |
| Algae | | | |
| <i>Anotrichium barbatum</i> | a red alga | 22 | 2.3 |
| <i>Ascophyllum nodosum</i> <i>ecad mackii</i> | a brown alga | 36 | 7 |
| | Annual total (£K) | 3179.6 | 2692.6 |
| | Total five year cost (£K) | 15898 | 13463 |

Costs exclude 10% administration, and the contribution of agri-environment schemes which is being estimated separately.

Annex 3. List of species and habitats, with Contact Points, Lead Partners and Lead Agencies/Departments

Table 1, below, lists the Contact Points and Lead Partners for the species action plans published in this volume. A list of species statements included in this volume is given in Table 2. Table 3 lists the Lead Agencies/Departments for the habitat action plans.

Table 1: Species Action Plans

| Species | Contact Point | Lead Partner |
|---|---|--|
| Mammals | | |
| <i>Phocoena phocoena</i> harbour porpoise | Department of the Environment, Transport and the Regions | Joint Nature Conservation Committee |
| single grouped plan for baleen whales | Department of the Environment, Transport and the Regions | Joint Nature Conservation Committee |
| single grouped plan for toothed whales | Department of the Environment, Transport and the Regions | Joint Nature Conservation Committee |
| single grouped plan for small dolphins | Department of the Environment, Transport and the Regions | Joint Nature Conservation Committee |
| Reptiles | | |
| single grouped plan for marine turtles | Scottish Natural Heritage | Marine Conservation Society and Herpetological Conservation Trust |
| Fish | | |
| <i>Cetorhinus maximus</i> basking shark | English Nature | Wildlife Trusts, Shark Trust and World Wide Fund for Nature - UK |
| <i>Raja batis</i> common skate | Scottish Natural Heritage | Shark Trust |
| single grouped plan for commercial fish | Ministry for Agriculture, Fisheries and Food | Ministry for Agriculture, Fisheries and Food |
| Single grouped plan for deep-water fish | Ministry for Agriculture, Fisheries and Food | Scottish Executive |
| Molluscs | | |
| <i>Atrina fragilis</i> a fan shell | Environment and Heritage Service | Marine Conservation Society |
| <i>Ostrea edulis</i> native oyster | English Nature | English Nature |
| <i>Thyasira gouldi</i> northern hatchett shell | Scottish Natural Heritage | Scottish Natural Heritage |
| Sea anemones | | |
| <i>Amphianthus dohrnii</i> sea-fan anemone | English Nature | Wildlife Trusts and World Wide Fund for Nature - UK |

| Species | Contact Point | Lead Partner |
|--|-------------------------------|---|
| <i>Edwardsia ivelli</i> Ivell's sea anemone | English Nature | World Wide Fund for Nature - UK |
| <i>Nematostella vectensis</i> starlet sea anemone | English Nature | World Wide Fund for Nature - UK |
| Corals | | |
| <i>Eunicella verrucosa</i> pink sea-fan | English Nature | Wildlife Trusts and World Wide Fund for Nature - UK |
| <i>Leptopsammia pruvoti</i> sunset cup coral | English Nature | Wildlife Trusts and World Wide Fund for Nature - UK |
| Algae | | |
| <i>Anotrichium barbatum</i> a red alga | Countryside Council for Wales | Countryside Council for Wales |
| <i>Ascophyllum nodosum</i> ecad <i>mackaii</i> a brown alga | Scottish Natural Heritage | Plantlife |

Table 2: Species Statements

| Species name | Common name |
|----------------------------------|--------------------------|
| <i>Gammarus insensibilis</i> | lagoon sand shrimp |
| <i>Clavopsella navis</i> | a brackish water hydroid |
| <i>Funiculina quadrangularis</i> | a sea pen |
| <i>Styela gelatinosa</i> | a sea squirt |
| <i>Tenellia adpersa</i> | lagoon sea slug |
| <i>Armandia cirrhosa</i> | lagoon sandworm |
| <i>Chara baltica</i> | Baltic stonewort |
| <i>Chara canescens</i> | bearded stonewort |
| <i>Lamprothamnium papulosum</i> | foxtail stonewort |
| <i>Tolypella nidifica</i> | bird's nest stonewort |

Table 3: Lead Agencies/Departments for the Habitat Action Plans

| Priority Habitat Action Plan | Lead Agency/Department |
|-------------------------------------|--|
| Maritime cliff and slopes | Countryside Council for Wales |
| Coastal sand dunes | Scottish Natural Heritage |
| Machair | Scottish Natural Heritage |
| Coastal vegetated shingle | English Nature |
| Littoral and sub-littoral chalk | English Nature |
| <i>Sabellaria alveolata</i> reefs | English Nature |
| Coastal saltmarsh | Environment Agency |
| Mudflats | Environment Agency |
| Sheltered muddy gravels | to be determined |
| <i>Sabellaria spinulosa</i> reefs | English Nature |
| Tidal rapids | Environment and Heritage Service, Northern Ireland |
| <i>Modiolus modiolus</i> beds | Countryside Council for Wales |
| Seagrass beds | Environment and Heritage Service, Northern Ireland |
| Maerl beds | Scottish Natural Heritage |
| Saline lagoons | English Nature |
| Mud habitats in deep water | Scottish Natural Heritage |
| Serpulid reefs | Scottish Natural Heritage |
| Sublittoral sands and gravels | English Nature |
| <i>Lophelia pertusa</i> reefs | Department of the Environment, Transport and the Regions |