

**GOOD PRACTICE GUIDELINES FOR
PORTS AND HARBOURS
OPERATING WITHIN OR NEAR
UK EUROPEAN MARINE SITES
JULY 1999**

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Good practice guidelines for ports and harbours operating within or near UK European marine sites

Preface

The 1990s are witnessing a “call to action” for marine biodiversity conservation. The global Convention on Biodiversity, the European Union’s Habitats Directive and recent developments to the Oslo and Paris Convention have each provided a significant step forward. In each case marine protected areas are identified as having a key role in sustaining marine biodiversity.

The Habitats Directive requires the maintenance or restoration of natural habitats and species of European interest at favourable conservation status, with the management of a network of Special Areas of Conservation (SACs) being one of the main vehicles to achieving this. Among the habitats and species specified in the Annexes I and II of the Directive, several are marine features and SACs have already been selected for many of these in the UK. But to manage specific habitats and species effectively there needs to be clear understanding of their distribution, their biology and ecology and their sensitivity to change. From such a foundation, realistic guidance on management and monitoring can be derived and applied.

One initiative now underway to help implement the Habitats Directive is the UK Marine SACs LIFE Project, involving a four year partnership (1996-2001) between:

- English Nature,
- Scottish Natural Heritage,
- Countryside Council for Wales,
- Environment and Heritage Service, Department of the Environment for Northern Ireland,
- Joint Nature Conservation Committee, and
- Scottish Association of Marine Science.

The overall goal of the Project is to establish management schemes on 12 of the candidate marine SAC sites. A key component of the Project is to assess the interactions that can take place between human activities and the Annex I and II interest features on these sites. This understanding will provide for better management of these features by defining those activities that may have a beneficial, neutral or harmful impact and by giving examples of management measures that will prevent or minimise adverse effects.

Seven areas where human activity may impact on marine features were identified for study, ranging from specific categories of activity to broad potential impacts. They are:

- port and harbour operations,
- recreational user interactions,
- collecting bait and shoreline animals,
- water quality in lagoons,
- water quality in coastal areas,
- aggregate extraction, and
- fisheries.

These seven areas were selected on the grounds that each includes issues that need to be considered by relevant authorities in managing many of the marine SACs. In each case, the

existing knowledge is often extensive but widely dispersed and needs collating as guidance for the specific purpose of managing marine SACs.

The reports from these studies are the result of specialist input and wide consultation with representatives of the nature conservation, user and interest bodies. They are aimed at staff from the relevant authorities who jointly have the responsibility for assessing activities on marine SACs and ensuring appropriate management. But they will also provide a valuable resource for industry, user and interest groups who have an important role in advising relevant authorities and for practitioners elsewhere in Europe.

The reports provide a sound basis on which to make management decisions on marine SACs and also on other related initiatives such as the Biodiversity Action Plans and Oslo and Paris Convention. As a result, they will make a substantial contribution to the conservation of our important marine wildlife. We commend them to all concerned with the sustainable use and conservation of our marine and coastal heritage.

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Good practice guidelines for ports and harbours operating within or near UK European marine sites

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Summary

Objectives and scope of the guidelines

The EC Habitats Directive aims to promote the conservation of habitats and species within the European Union by designating sites known as Special Areas of Conservation (SACs). Over 70 ports and harbours operate within or near SACs proposed for designation for their marine habitats and species. These guidelines have been prepared to provide guidance on the operations taking place within these ports and harbours as part of the UK Marine SACs Project.

The UK Marine SACs Project aims to promote the implementation of the Habitats Directive in marine areas through trialing the establishment of management schemes on twelve sites in the UK and by providing proven good practice and guidance to practitioners in the UK and Europe. To support the establishment of these management schemes, the Project is undertaking a series of tasks to collate and develop the understanding and knowledge needed. One of the areas for providing guidance to those developing the schemes concerns the interaction between human activities and marine features. Human activities have an important role in the management of marine features and may have both beneficial and damaging impacts.

The guidelines bring together our understanding of the potential impacts of port and harbour operations, identifying operations where the potential for adverse effect exists and suggesting means to avoid, minimise or address these impacts. They draw on the best available scientific and technical information, together with a wealth of practical experience of those involved in managing the marine environment.

The target audiences for guidelines are:

- relevant authorities - to assist the development and implementation of management schemes and to assist them in meeting their statutory obligations,
- port and harbour authorities, operators, users, and related industries - to provide guidance on how to minimise and avoid adverse impacts on European marine sites and to promote good environmental practice,
- country conservation agencies - to improve understanding of the operations and environmental management undertaken in ports and harbours, and
- European practitioners - to guide those involved in implementing the Habitats Directive in Europe.

The scope of the guidelines has been developed in conjunction with representatives of ports and harbours, maritime industry, country conservation agencies and key interest groups who contributed towards two workshops held in Southampton, October 1997, and York, December 1998.

The guidelines focus principally on the management of marine SACs, however they are equally applicable to those involved in managing marine Special Protection Areas (SPAs) classified under the EC Birds Directive and for ports and harbours operating in or near marine SPAs. Together marine SPAs and SACs are referred to as European marine sites. Generic guidance has been provided for SPAs and consideration has been made of the potential impacts of port and harbour operations on the intertidal habitats that support bird populations. A running theme throughout the guidelines is the general duty of ports and harbours to care for the environment under the Transport and Works Act 1992 and the Habitats Regulations.

The guidelines consider port and harbour activities that will be managed under the management scheme, including shipping and boating operations, cargo handling, port and harbour maintenance activities, maintenance dredging and disposal, and the management of ship and boat generated wastes. The management scheme may also provide guidance for the assessment of plans and projects, particularly those of a minor or repetitive nature, which are operations that require specific statutory consent, authorisation, licence or other permission. The guidelines do not attempt to provide detailed guidance on plans and projects, with the exception of maintenance dredging and disposal, and small repetitive works required to maintain harbour and marina structures.

Potential impacts of port and harbour operations

The guidelines seek to identify a range of activities where the potential for adverse effects on marine interest exists as a result of port and harbour operations. The following table provides a summary of where there is potential for interaction between port and harbour operations and the Annex I habitats/Annex II species for which UK marine SACs are proposed for designation and marine SPAs.

The extent to which port and harbour operations might affect marine features within a site depends upon a number of variables. These might include the magnitude and frequency of operation, the presence of sensitive habitats/species and their proximity to the operation, and the local conditions at the site of operation (hydrodynamic conditions, sediment characteristics and background water quality).

The many variables that need to be considered in determining whether an operation or activity is likely to have an adverse effect on European marine sites and the conservation features within them, means that this judgement will have to be made on a site by site basis, and will often be specific to individual habitats or areas within a site. Therefore, specific guidance on what operations will affect marine SACs cannot be provided within the limitations of this report. Instead the report provides generic guidance on the range of potential impacts that may occur as a result of port and harbour operations.

The first column in the table lists a range of port and harbour operations and gives a summary of their potential environmental impacts. It should be stressed that the impacts listed in the table are representative of the range of possible impacts that might occur in the UK marine environment. The table does not suggest that any or all of the ‘worst case’ impacts will be realised at any individual site.

In order to provide a link in the relationship between port and harbour operations and the ecological requirements of the marine habitats and species, the table identifies the key ‘processes’ (also referred to as ‘factors’). For example, the key processes that may result from a dredging operation include, siltation, direct physical disturbance (extraction), and changes in levels of non-toxic contaminants (suspended sediments, turbidity, and nutrient/organic enrichment) and toxic contaminants. The operations to which the marine features and sub-features of a site are most vulnerable can be identified on a site-to-site basis by considering their sensitivity to the effects of the processes and their exposure to those processes to which they are sensitive. The country conservation agencies are in the process of developing the processes/factors approach and its application in their advice on operations which may cause deterioration or disturbance to interest features.

Shaded cells in the table indicate issues that are within the power of ports and harbours to take actions to avoid, minimise or address potential effects. However, it is not within the power of a port and harbour authority to control, in any meaningful manner, some of the potential environmental impacts that may occur as a result of certain operations, particularly issues associated with vessel movements such as noise. In such cases the potential for environmental effects will be minimised by continued compliance with the existing relevant regulations and by providing support for programmes and initiatives led by other relevant authorities or organisations.

The table also identifies the potential impacts on saltmarsh habitats and the intertidal habitats of SPAs. The term saltmarsh refers collectively to five Annex I habitats, namely *Salicornia* and other annuals colonising mud and sand, *Spartina* Swards, Atlantic salt meadows, Mediterranean salt meadows and Mediterranean saltmarsh scrubs.

The terms ‘issue’ and ‘key process’, used in this table, may differ from the terms used by the Country Conservation Agencies when giving advice on operations which may cause damage or deterioration. These are, however, more differences of terminology than of substance. The terminology used by English Nature and the Countryside Council for Wales is described in Section 2.3.3 on pages 33 & 34.

Summary of port and harbour operations, the processes they influence and the potential impacts on habitats and species in European marine sites in the UK

(No = No known effect, Ben = Beneficial, Min = Minimal, Adv = Adverse, N/A = Not Applicable)

| ISSUE | CONSIDERATIONS | MARINE SAC ANNEX I HABITATS | | | | | | | | MARINE SAC ANNEX II MAMMALS | | | MARINE SPA |
|--|--|-----------------------------|------------------|--------|------|------------|----------|----------------------|--------------------|-----------------------------|-------------|-----------|-----------------------------|
| | | Estuary | Inter-tidal flat | Lagoon | Reef | Salt Marsh | Sea cave | Shallow inlets & bay | Subtidal sand bank | Bottle-nose dolphin | Common seal | Grey seal | Intertidal habitats & birds |
| OPERATION: VESSEL MOVEMENTS | SECTION 3.3 | | | | | | | | | | | | |
| <p>Issue: Ship and boat wash</p> <p>Key process: Changes in physical regime (waves & sediment transport)</p> <p>Non-toxic contamination (sediment suspension)</p> <p>Potential impact: Wash from ship and boat movements may cause changes to the hydrodynamic regime which may result in erosion of intertidal and shallow subtidal habitats and disturbance to communities.</p> | The effects are difficult to distinguish from natural events or other human activities. Effects depend upon vessel size, type and speed; level of activity, proximity to sensitive intertidal and shallow subtidal habitats. | Min/Adv | Min/Adv | No | No | Min/Adv | No | Min/Adv | Min | No | No | No | Min/Adv |
| <p>Issue: Seabed disturbance by vessel movements & propellers</p> <p>Key process: Non-toxic contamination (Sediment suspension)</p> <p>Potential impact: Boat and propeller induced temporary increases in suspended solids and turbidity may cause localised disturbance of benthic animals and plants.</p> | Effects depend on the types of vessel, level of activity, sediment type and quality, water depth and background suspended solid levels. | Min | Min | No | Min | Min | No | Min | Min | No | No | No | Min |
| <p>Issue: Collisions with marine mammals</p> <p>Key process: Physical damage (collision)</p> <p>Potential impact: Collisions with high-speed vessels may cause the injury or death of marine mammals.</p> | Collisions are rare in UK waters, but do occur. This problem is more commonly associated with high-speed recreational vessels. Limited research on marine mammal strandings is ongoing, but very little information is available relating to ship/boat collisions. | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | Min/Adv | Min/Adv | Min/Adv | |
| <p>Issue: Vessel noise</p> <p>Key process: Non-physical disturbance (noise)</p> <p>Potential impact: Disturbance to marine mammals and fish may occur from engine noise.</p> | Mainly a concern over disturbance to cetaceans (dolphins and porpoises). There is some documented evidence of noise disturbance to cetaceans from vessels, however few studies determine whether there are effects or not. Limited research is ongoing, but little information is available relating specifically to noise from ships/boats. | No | N/A | N/A | N/A | N/A | N/A | No | N/A | Min | Min | Min | Min |

| ISSUE | CONSIDERATIONS | MARINE SAC ANNEX I HABITATS | | | | | | | | MARINE SAC ANNEX II MAMMALS | | | MARINE SPA |
|---|--|-----------------------------|------------------|----------|----------|------------|----------|----------------------|--------------------|-----------------------------|-------------|-----------|-----------------------------|
| | | Estuary | Inter-tidal flat | Lagoon | Reef | Salt Marsh | Sea cave | Shallow inlets & bay | Subtidal sand bank | Bottle-nose dolphin | Common seal | Grey seal | Intertidal habitats & birds |
| OPERATION: VESSEL MOVEMENTS (Continued) SECTION 3.3 | | | | | | | | | | | | | |
| <p>Issue: Vessel groundings</p> <p>Key process: Physical damage (abrasion, siltation & smothering)</p> <p>Potential impact: Grounding, due to navigation error or accident, may result in localised damage and disturbance to benthic communities, re-suspension of sediments and smothering.</p> | Levels of disturbance will depend upon location of incident, size of vessel, length of time vessel is aground, and sensitivity of habitat and communities affected. | Min | Min | No | Min/ Adv | Min/ Adv | No | Min | Min | N/A | N/A | N/A | Min |
| <p>Issue: Marine accidents or groundings with loss of cargo or fuel</p> <p>Key process: Physical damage (abrasion, siltation & smothering) Toxic contamination Non-toxic contamination</p> <p>Potential impact: Marine accidents or groundings resulting in releases of cargo or fuel may cause a wide range of impacts on habitats and species, including a deterioration in water quality, contamination of sediments, and smothering (see cargo handling and waste management below).</p> | The effects are highly specific depending upon the type and quantities of cargoes/fuels entering the marine environment, location of incident, sensitivity of habitats and communities, and, where appropriate, the effect of emergency response. | Min/ Adv | Min/ Adv | Min/ Adv | Min/ Adv | Min/ Adv | Min/ Adv | Min/ Adv | Min/ Adv | Min/ Adv | Min/ Adv | Min/ Adv | Min/ Adv |
| <p>Issue: Mooring and Anchoring</p> <p>Key process: Physical damage (abrasion) Non-physical disturbance (noise & visual presence)</p> <p>Potential impact: Anchoring vessels may disturb or damage sensitive benthic communities, in both rocky and soft substrates. The use of permanent moorings may cause direct loss of intertidal habitat and bird feeding areas, some disturbance through noise and vessel movements, particularly adjacent to areas used by birds.</p> | Disturbance from anchoring depends upon the frequency, magnitude and location of activity, type of sediments, and the sensitivity of benthic communities. Where the bottom sediments are soft and there are no sensitive communities, less impact is likely to be caused. The impacts arising from mooring vessels depend on the type of mooring used. | Min | Min | No | Min/ Adv | No | No | Min | Min/ Adv | No | No | No | Min/ Adv? |

| ISSUE | CONSIDERATIONS | MARINE SAC ANNEX I HABITATS | | | | | | | | MARINE SAC ANNEX II MAMMALS | | | MARINE SPA |
|---|--|-----------------------------|------------------|---------|---------|------------|----------|----------------------|--------------------|-----------------------------|-------------|-----------|-----------------------------|
| | | Estuary | Inter-tidal flat | Lagoon | Reef | Salt Marsh | Sea cave | Shallow inlets & bay | Subtidal sand bank | Bottle-nose dolphin | Common seal | Grey seal | Intertidal habitats & birds |
| OPERATION: CARGO HANDLING AND STORAGE SECTION 3.3 | | | | | | | | | | | | | |
| <p>Issue: Non-toxic discharges and emissions to water</p> <p>Key process: Non-toxic contamination (turbidity & organic enrichment)</p> <p>Potential impact: Operational and accidental spills and releases of dusts during the handling of dry bulk cargo (for example china clay, grain, coal) may cause a temporary local deterioration in water quality. Discharges and dust emissions into the marine environment may temporarily increase turbidity and organic cargoes (such as animal feed) may cause the localised removal of oxygen from the water, possibly disturbing marine animals.</p> | <p>The effects depend on the types and quantities of dusts and discharges entering the marine environment. Generally, the levels of most dry-bulk cargo dusts generated will have little or no effect, with the possible exception of high levels of organic dusts, which may cause the localised removal of oxygen from the water.</p> | Min/Adv | Min/Adv | No | No | No | No | Min/Adv | No | No | No | No | Min/Adv |
| <p>Issue: Hazardous discharges and emissions to water</p> <p>Key process: Toxic contamination Non-toxic contamination (turbidity & organic enrichment)</p> <p>Potential impact: Accidental release of hazardous substances during the handling of cargoes, such as oil, liquefied gas, pesticides or industrial chemicals, may cause the pollution or contamination of marine habitats and disturbance or damage to communities.</p> | <p>The effects are highly specific depending upon the type and quantities of cargoes entering the marine environment, location of incident in relation to marine features, sensitivity of habitats and communities, and, where appropriate, the effect of emergency response. The impacts of oil pollution are discussed further below (see Waste Management).</p> | Min/Adv | Min/Adv | Min/Adv | Min/Adv | Min/Adv | Min/Adv | Min/Adv | Min/Adv | Min/Adv | Min/Adv | Min/Adv | Min/Adv |
| <p>Issue: Noise from cargo handling</p> <p>Key process: Non-physical disturbance (noise)</p> <p>Potential impact: Waterfowl and marine mammals, such as seals when on land, may be disturbed by noise generated from port and harbour operational activities, such as cargo handling and traffic.</p> | <p>Little information is currently available. Although there may be some disturbance, birds are thought to adjust to long-term continuous noise levels. The effects will depend on level and type of noise and proximity of birds to the source. Sensitivity may increase during particular periods, such as breeding periods.</p> | Min | No | No | No | No | No | Min | No | No | Min | Min | Min |

| ISSUE | CONSIDERATIONS | MARINE SAC ANNEX I HABITATS | | | | | | | | MARINE SAC ANNEX II MAMMALS | | | MARINE SPA |
|--|---|-----------------------------|------------------|---------|---------|------------|----------|----------------------|--------------------|-----------------------------|-------------|-----------|-----------------------------|
| | | Estuary | Inter-tidal flat | Lagoon | Reef | Salt marsh | Sea cave | Shallow inlets & bay | Subtidal sand bank | Bottle-nose dolphin | Common seal | Grey seal | Intertidal habitats & birds |
| OPERATION: MAINTENANCE | SECTION 4.4 | | | | | | | | | | | | |
| <p>Issue: Maintenance wastes and runoff</p> <p>Key process: Toxic contamination Non-toxic contamination</p> <p>Potential impact: Wastes from the cleaning of port and harbour infrastructure and boat/ship maintenance areas can contain harmful contaminants that may have toxic effects on marine wildlife. Cleaning agents include biocides, bleach, and detergents. The combined effects of these substances needs further study.</p> | <p>The effects depend on scale of maintenance operations, background water quality, maintenance techniques used, amounts/types of contaminant in wastes and proximity of marine features. Effects are likely to be localised and temporary due to dilution, however there may be more of a problem in enclosed areas or areas with low tidal flushing. Cleaning agents tend to only be a problem when used in high concentrations and often present the only effective means of ensuring safety in harbour areas.</p> | Min/Adv | Min/Adv | Min/Adv | Min/Adv | Min/Adv | Min/Adv | Min/Adv | Min/Adv | Min/Adv | Min/Adv | Min/Adv | |
| <p>Issue: Anti-fouling paints</p> <p>Key process: Toxic contamination</p> <p>Potential impact: Most anti-fouling paints contain biocides which are by their very nature toxic to marine organisms. When they leach from the hulls of vessels and accumulate in sediments they can be toxic to non-target marine organisms.</p> <p>The adverse effects of TBT on marine life are well known, particularly with regard to the adverse effects on shellfish and molluscs. They also accumulate up the food chain and can be found in high concentrations in fish-eating birds and marine mammals.</p> <p>Copper-based anti-fouling paints are less toxic to non-target species, but may still have toxic effects in high concentrations.</p> | <p>Copper antifouling paints are the most commonly used paints in recreational boating. The use of TBT anti-fouling paints on commercial vessels in the UK remains at present the most effective option available. However, the IMO have recently decided to ban the use of TBT in antifouling paints. Research and development is ongoing to find and test alternative coatings.</p> <p>Copper anti-fouling paints have been relatively widely used on vessels and are the BPEO available to the marine industry at present. Toxic effects from copper to non-target species are only likely as a result of high amounts in sediments due to continued spills or careless maintenance operations. Non-toxic alternatives are also available, but are less effective.</p> | Min/Adv | Min/Adv | Min | Min | Min | Min | Min/Adv | Min/Adv | Min | Min | Min | Min/Adv |

| ISSUE | CONSIDERATIONS | MARINE SAC ANNEX I HABITATS | | | | | | | | MARINE SAC ANNEX II MAMMALS | | | MARINE SPA |
|---|---|-----------------------------|------------------|--------|---------|-------------|----------|----------------------|--------------------|-----------------------------|-------------|-----------|-----------------------------|
| | | Estuary | Inter-tidal flat | Lagoon | Reef | Salt marsh | Sea cave | Shallow inlets & bay | Subtidal sand bank | Bottle-nose dolphin | Common seal | Grey seal | Intertidal habitats & birds |
| MAINTENANCE DREDGING & DISPOSAL SECTION 5.3 | | | | | | | | | | | | | |
| <p>Issue: Impacts during maintenance dredging</p> <p>Key process: Physical damage (siltation & extraction) Non-toxic contamination (suspended sediments, turbidity & organic/nutrient enrichment) Toxic contamination</p> <p>Potential impact: Dredging causes the removal of benthic animals at the dredge site and temporary increases in the level of suspended sediments in the water column that may cause the following potential impacts: -reduction of algal/plant growth due to turbidity, -disturbance to sensitive marine life, -oxygen depletion due to release of organic material, -nutrient enrichment possibly increasing algal growth & increasing food supplies, -uptake of contaminants by marine life, -smothering of benthic communities & saltmarsh.</p> | <p>The removal of benthic animals is unavoidable, however the communities within regularly dredged channels are likely to be degraded and there is relatively rapid recovery. The suspension of sediments is inevitable, the extent depends on magnitude and frequency of dredging, background water quality, type of material, methods used, channel size and depth, hydrodynamics and the proximity of marine features/sensitive communities. The effects tend to be short term (<1 week after dredge activity) and near-field (<1km from activity). Dredging often generates no greater suspended sediments than natural events or other human activities.</p> | Min/Adv | Min/Adv | No | Min/Adv | Min/Adv | No | Min/Adv | Min | No | No | No | Min/Adv |
| <p>Issue: Impacts at disposal site</p> <p>Key process: : Physical damage (siltation & smothering) Toxic contamination Non-toxic contamination (suspended sediments, turbidity & organic/nutrient enrichment)</p> <p>Potential impact: Disposal of dredged material at sea causes smothering of benthic communities at the disposal site and may cause disturbance and damage to adjacent subtidal and intertidal communities from increased suspended sediments (possibly containing contaminants, organic matter and nutrients) and smothering (see above). Disposal of dredged material may lead to the creation of new subtidal or intertidal habitat, either inadvertently or through planned sediment recharge schemes (see below).</p> | <p>Smothering is inevitable at disposal site. The communities within regularly used sites are often degraded. Extent of smothering depends on the magnitude and frequency of disposal, background water quality, type and quality of material, size and depth of receiving area, hydrodynamics and the proximity of marine features/sensitive communities. The finer the material and the greater the energy at the disposal site, the higher possibility of increased suspended sediments and far-field effects. Potential effects at the disposal site are minimised under the FEPA licensing process.</p> | Ben/Min/Adv | Ben/Min/Adv | Min | Min/Adv | Ben/Min/Adv | Min | Ben/Min/Adv | Ben/Min/Adv | Min | Min | Min | Ben/Min/Adv |

| ISSUE | CONSIDERATIONS | MARINE SAC ANNEX I HABITATS | | | | | | | | MARINE SAC ANNEX II MAMMALS | | | MARINE SPA |
|--|---|-----------------------------|------------------|---------|---------|------------|----------|----------------------|--------------------|-----------------------------|-------------|-----------|-----------------------------|
| | | Estuary | Inter-tidal flat | Lagoon | Reef | Salt marsh | Sea cave | Shallow inlets & bay | Subtidal sand bank | Bottle-nose dolphin | Common seal | Grey seal | Intertidal habitats & birds |
| WASTE MANAGEMENT (Continued) | SECTION 6.3 | | | | | | | | | | | | |
| <p>Issue: Garbage disposal & litter</p> <p>Key process: Physical damage (abrasion & smothering)</p> <p>Potential impact: Marine mammals and birds can become entangled in or ingest plastic litter which can lead to injury or fatality. Ship-generated garbage may cause localised smothering of benthic communities.</p> | <p>It is difficult, although possible, to distinguish the effects due to ship's litter and other sources of marine litter. Effects depend on amounts and types of litter. Problems are mostly associated with persistent plastics. Smothering is only likely to be localised and temporary. Entanglement and ingestion of plastic litter by birds and mammals occurs in UK waters, but the incidence rate is unknown.</p> | Min | Min | Min | Min | Min | Min | Min | Min | Min/Adv | Min/Adv | Min/Adv | Min/Adv |
| <p>Issue: Sewage discharge from recreational craft</p> <p>Key process: Non-toxic contamination (organic/nutrient enrichment & turbidity) Toxic contamination</p> <p>Potential impact: Discharges of high concentrations of sewage may cause a localised deterioration in water quality, which may result in oxygen depletion, increased turbidity, nutrient enrichment and increased risk of algal blooms which may disturb animals and plants. Chemical additives in portable toilets and holding tanks are toxic to marine life. Generally impacts of sewage discharged by recreational craft are minimal compared with the far greater amounts discharged from land-based sources.</p> | <p>Potential impacts depend on numbers of vessels, amounts of sewage, water quality, temperature and depth, tidal movement and proximity of sensitive species. Impacts are generally localised and temporary. Greatest effects are likely to occur when many vessels congregate in enclosed areas or shallow water with little or no tidal exchange in summer and autumn. In some cases nutrient enrichment from sewage may increase productivity, the benefits of which are likely to be seen in higher organisms in estuaries or bays, such as feeding bird populations. However, despite small possible incidental benefits, this should not be to the detriment of water quality in the site.</p> | Min/Adv | Min/Adv | Min | Min/Adv | Min | Min/Adv | Min/Adv | Min/Adv | Min | Min | Min | Min/Adv |
| <p>Issue: Discharge of ballast water</p> <p>Key process: Introduction of non-native species</p> <p>Potential impact: The introduction of non-native animals and plants in ships' ballast water may have a range of effects, from undetectable to the complete detriment of native communities. Species introduced to the UK in ballast water include bloom forming phytoplankton, fouling organisms, benthic animals that compete with native communities and an American cordgrass plant which crossed with a native species to form a cordgrass which has spread throughout GB replacing native saltmarsh.</p> | <p>In the UK, around 80% of introduced species have no effect, however 20% from a number of sources do have some effect on native communities, in many cases causing disturbance and damage. The introduction and potential effects of harmful non-native species are highly unpredictable, but can be very serious.</p> | Min/Adv | Min/Adv | Min/Adv | Min/Adv | Min/Adv | Min/Adv | Min/Adv | Min/Adv | Min/Adv | Min/Adv | Min/Adv | Min/Adv |

How to use the good practice guidelines

These guidelines reflect the guiding principles of sustainable development and continued human use, alongside the conservation of biodiversity. According to the Habitats Directive, the Habitats Regulations and DETR/Welsh Office guidance on European marine sites, only operations which may cause deterioration of or significant disturbance to the habitats and species for which a site has been designated need to be subject to action under a management scheme. European marine sites containing ports have been selected for their existing ecological interest, which has in most cases co-existed with port and harbour operations for many years. It is likely that in practice most current port and harbour operations will not have a significant impact and so will not need to be subject to any additional management measures. However, it is evident from the table that a wide range of port and harbour operations may cause deterioration of or significant disturbance to marine habitats and species and may have already caused damage. The following guidelines have been compiled to suggest ways in which ports and harbours can review their operations in order to identify which operations may have an impact and to suggest ways in which these impacts can be avoided, minimised or addressed.

In the highly complex, dynamic and largely unobserved marine environment it is extremely difficult to predict the effects of man-made changes with certainty. Information regarding the interaction of port and harbour operations with specific marine features and cause-effect relationships between certain of these operations and identified impacts is often limited. In a number of cases links between port and harbour operations and impacts on marine features have yet to be firmly established. In such cases a precautionary approach should be taken which means that where there are real risks to the site, lack of full scientific certainty should not be used as a reason for postponing measures that are likely to be cost effective in preventing such damage. Therefore, a very important task of the management scheme is to make a reasoned judgement about the impacts which are a genuine cause for concern, to identify the authority that has the power to address them and then to help that authority develop pragmatic solutions.

Therefore, ports and harbours will only require new additional management measures if:

- an activity will cause a deterioration of the conservation interest of the site and significant disturbance to the habitats or species for which the site has been designated and the associated biological and physical processes which support them, either directly or indirectly, and
- existing management measures are shown to be insufficient to prevent the impact.

When using the good practice guidelines the following general principles should be considered:

- It is always desirable to seek ways of addressing the environmental impacts of port and harbour operations that do not impact adversely on the commercial activities of existing ports, placing them at a disadvantage to other ports.
- There are benefits of seeking win-win outcomes that meet both the environmental and commercial goals simultaneously, rather than resorting to ‘compromise’ and ‘balance’, where both ports and the environment lose out.
- Respect for the marine environment and the wildlife that lives there is an important aspect of maritime tradition and is based largely on the principle of self-management.
- When considering how to address impacts on European marine sites it is always desirable to consider voluntary measures and partnerships first. Harbour authorities may be required to use their statutory powers, including those to introduce and enforce byelaws, but this course of action should only be used where it is clear that voluntary measures would be ineffective. Consideration of appropriate action depends on the type of activities, how damaging they are, and the frequency of damage sustained.

Good practice guidelines for port and harbour operations

In order to avoid, minimise and address the potential environmental impacts arising from their operations, ports and harbours operating within or near European marine sites should:

- Consider improving the transparency of actions taken in the normal course of port operations that also protect the environment, such as the preparation of an environmental review, implementation of an environmental management system and the development of codes of practice.
- Consider producing own environmental guidelines or codes of conduct to provide guidance to educate port users and employees, promoting sensitive operation in relation to designated marine features.
- Inform port users, operators and employees of the site's designation as a marine SAC/SPA, the reasons why it has been designated and the sensitivity of these features to commercial port and harbour operations. This can be achieved through the production of leaflets or booklets, annotated charts, notice boards and running regular workshops. Where appropriate information should encourage good practice and sensitive operation among those working within or visiting the port.
- Consider how motivation and incentive can best be given to vessel operators to avoid and minimise the potential environmental effects from vessel movements.
- Continue to review vessel traffic management techniques to ensure safe navigation to avoid and minimise the environmental consequences of marine accidents, including groundings, collisions and the increased risks resulting from higher traffic levels and congested waters.
- Investigate voluntary approaches to find management solutions to navigation problems resulting from conflicts between commercial shipping and other port users, using regulation as a last resort. However, in some cases regulation may be necessary for the port authority to fulfil its duty to ensure that their activities do not have an adverse impact on the SAC/SPA features.
- Consider the zoning of activities, in space or time, for environmental protection and marine safety purposes, keeping activities within suitable areas where the impact on designated features will be avoided or minimised. Zones can be enforced by byelaws to address adverse impacts, such as the possible effects of disturbance, wash or noise. Zoning schemes should only be developed and used where they are needed to protect the designated marine features and like all management measures, need to be agreed by all relevant authorities before they can form part of a management scheme.
- Comply with relevant environmental and safety legislation to avoid and minimise potential environmental effects from vessel movements, operational emissions and cargo handling operations.
- Consider re-routing traffic through alternative channels, if they exist, where there are adverse environmental impacts associated with current patterns in vessel movements and where other appropriate measures have been considered and applied.
- Investigate the feasibility of protecting intertidal features from ship wash by creating break waters where there is evidence that ships wash is causing the erosion of designated intertidal flats or saltmarsh habitat, where all other appropriate measures have been undertaken or as a precautionary approach. This approach may also provide a beneficial use for dredged materials. This should not be considered where the costs of undertaking such a scheme would greatly outweigh the potential environmental gain or where there are long-term adverse impacts to the site.
- Make data routinely collected by the port available to country conservation agencies who have the statutory duty to monitor the condition of the SAC. Consider facilitating the monitoring programmes set up by country conservation agencies by, for example, allowing survey instrumentation to be mounted on harbour craft and port structures. A collaborative approach to monitoring and data sharing among all relevant authorities will facilitate the development and ongoing implementation of management schemes, and may foster greater understanding of the working practices and objectives of different bodies.
- Liaise closely with country conservation agencies, 'in confidence' if necessary, to facilitate early identification of potential impacts, and to ensure mutual appreciation and understanding.

Good practice guidelines for maintenance activities

In order to avoid, minimise and address the potential environmental impacts arising from their operations, ports and harbours operating within or near European marine Sites should:

- Educate, encourage and train staff to avoid and minimise pollution from maintenance activities, as much as practically possible. This can be achieved by providing information to all staff to raise awareness of:
 - the importance of the area in which they work for its marine conservation features and the reasons why it has been designated as a marine SAC or SPA,
 - the potential environmental impacts that may occur as a result of maintenance activities undertaken in the harbour area, and
 - more environmentally sensitive ways of undertaking maintenance activities, illustrating practical and economic benefits where they exist.
- Ensure that all employees follow simple good housekeeping practices to minimise the amounts of harmful substances entering the marine environment as a result of maintenance operations. Staff should be required to:
 - sweep up all solid waste such as paint chippings and sandblasting wastes and place these in skips for land disposal,
 - mop up any spills of harmful substances and excess chemicals after cleaning operations,
 - place ground sheets under boats during cleaning operations, where practical, and
 - use, handle and store harmful substances in a responsible manner in compliance with health and safety regulations.
- Use environmentally sensitive alternatives to harmful chemical agents when cleaning harbour surfaces, such as pressure washing with harbour water (where this method is effective enough to ensure public safety). Where there is no suitable effective alternative to the cleaning agent already used, consider only using cleaning agents such as bleach on harbour walkways where there is a safety risk to the public or staff from algal growth.
- Give high priority to finding effective alternative means of cleaning harbour structures and vessels with the aim to discontinue the use of products that contain phosphates and chlorine. Consider, where appropriate and practical, introducing new surfaces which require less cleaning.
- Provide adequate reception facilities for the safe disposal of maintenance wastes, including bins and skips for non-hazardous sweepings and debris and special points for the disposal of hazardous substances, such as concentrated cleaning chemicals, oils, antifouling paints and contaminated scrapings.
- Where good working practices are considered insufficient to prevent an identified pollution problem, harbour infrastructure in outside maintenance areas can be modified to minimise the amounts of contaminants entering the marine environment. This may include the following steps which will require a cost to the harbour that should be considered against the potential for environmental improvement:
 - installing permanent ‘scrub-off’ facilities to collect maintenance residues from boat cleaning operations,
 - constructing a bund around maintenance areas and collecting wastes in a sump to allow debris to settle out before the water runs into the harbour or sewage drain system, and
 - investing in a separator for oil to be removed from wash down wastes.
- Increase public awareness of the steps taken in harbours to protect the environment from the possible effects of maintenance activities.

Good practice guidelines for maintenance dredging and disposal

In order to avoid, minimise and address the potential environmental impacts arising from their operations, ports and harbours operating within or near European marine sites:

- Prepare contracts which meet the requirements of all licenses, consents and agreements applicable
- Fully brief contractors prior to the commencement of dredging and disposal works. The port or harbour should agree contractor method statements for operations before the works are allowed to proceed. Consideration should be given to:
 - hydrodynamic conditions at the excavation and disposal location,
 - marine features for which the site was designated, if appropriate areas which are particularly sensitive to the effects of dredging at specific times of year, and
 - particular areas of the dredging and disposal operations where contractor error can cause adverse effects on marine features.
- Endeavour to regularly monitor the operations of the contractor during dredging and disposal activities.
- Ensure that dredging is undertaken in a manner that limits, as far as practically possible, the disturbance and dispersion of sediments from the dredger and barges, during dredging operations and transport.
- Consider timing of operation to avoid or minimise environmental effects. Seek guidance at the earliest stages from local country conservation agencies, and other environmental agencies where relevant, on the identification of the most appropriate times to undertake dredging to avoid or minimise disturbance to marine features, particularly sensitive species, such as shellfish, young and migratory fish and over wintering waterfowl. But common sense must be applied when considering timing of operations and full consideration given to seasonal operational constraints.
- Ensure that the most suitable dredging equipment (Best Available Technology Not Entailing Excessive Costs - BATNEEC) is used in order to minimise the suspension of any fine sediments and contaminants at the dredge site, where considered appropriate.
- Consider investigating practical means of reducing the amounts of material dredged, where possible.
- Use the best practicable environmental option for the disposal of dredged material, promoting its beneficial use wherever practical and keeping it within the local sedimentary system.
- Investigate the possibility of using dredged material for intertidal recharge schemes to combat erosion of intertidal habitats caused by coastal squeeze and rising sea levels. Seeking advice from country conservation agencies, licensing authorities and the environment agencies who will take a long-term view of such proposals and localised short-term damage will be accepted where there are long-term benefits, in terms of sustainable management of broader areas of intertidal habitats.
- Consider establishing post dredge monitoring programmes to verify the effect of dredging and disposal on marine ecology and sediment regimes, where MAFF have identified potentially sensitive features to be monitored if considered necessary.
- Endeavour to keep organised, up-to-date records of dredging operations, incorporating data from regular hydrographic surveys. The records may clearly demonstrate the need to dredge, or otherwise, identify areas within ports and harbours where dredging can be reduced (or not undertaken at all) and may facilitate the renewal of disposal licences. Feed all available data back into the SAC management scheme.
- Consider carefully the proposal of dredging methods in the port or harbour which are not presently regulated under the FEPA licensing process, such as water injection dredging, sea bed levelling or agitation dredging, and where practical, undertake the above recommendations to minimise the potential impacts. Furthermore, ports and harbours should consider consulting the country conservation agencies when these types of dredging are proposed within the port area to ensure that nature conservation considerations are taken into account.

Good practice guidelines for the management of ship/boat generated waste

In order to avoid, minimise and address the potential environmental impacts arising from their operations, ports and harbours operating within or near European marine sites should:

- Develop and implement port waste management plans according to the Merchant Shipping Regulations, the DETR and/or BMIF/RYA guidelines. Provide adequate reception facilities for oil, chemical and garbage wastes, and remove, as far as is practicable, any disincentives to landing waste in the port. As part of this process ports and harbours should:
 - consider consulting with local representatives of country conservation agencies, in addition to statutory and relevant consultees, to improve understanding of waste management planning and to ensure that environmental considerations are addressed,
 - consider incorporating brief information on the marine SAC in port waste management plans,
 - encourage the responsible management of waste, including minimisation and recycling, at the point of generation on ships, reception in ports/harbours, transportation and disposal, and
 - ensure that port and harbour employees and users dispose of garbage and other wastes responsibly in facilities provided and report any spills or large pieces of floating garbage to the port authority.
- Prepare, implement and practice oil spill contingency plans according to the Merchant Shipping (OPRC) Regulations and MCA guidelines in order to provide guidance and direction to those responding to oil and chemical spills and to set in motion the necessary actions to stop or minimise the pollution and reduce its effects on the environment. As part of this process ports and harbours should:
 - undertake a thorough risk assessment of the area to be covered by the plan, with particular attention to sensitive marine features and the response times necessary to minimise the potential adverse effects on them,
 - give the highest priority of response, where practicable, after human safety, to sensitive habitats and species that are likely to be adversely effected by potential spills. These sensitive areas should be clearly shown on the response guide chart,
 - identify areas where the use of dispersants presents little or no concern, and areas containing sensitive marine features where their use should be avoided, unless this increases risk of adverse effects of oil pollution on marine features, and
 - ensure, as far as practical, that clean-up operations are undertaken in such a way as to avoid or minimise damage to sensitive intertidal animals and plants.
- Assist the MCA to make sure shipowners comply with IMO guidance for ‘the control and management of ship’s ballast water to minimise the transfer of harmful aquatic organisms and pathogens’. The guidelines recommend that ports and harbours should:
 - inform local agents and/or ships of areas and situations where uptake of ballast water should be avoided, such as near sewage outfalls, areas known to be contaminated with harmful organisms or in very shallow water where there is a risk of sediment being introduced to ballast tanks, and
 - encourage the exchange of ballast water at sea, where it is considered safe to do so.
- Encourage all boat owners to use the shore-side toilet facilities as much as possible.
- Provide onshore reception facilities in ports, harbours and marinas for pumping-out sewage wastes and undertake regular consultation with boat users over the adequacy of these facilities.
- Encourage the use of holding tanks where fitted and the disposal of waste at shore side pump-out facilities whenever possible, and while underway as far offshore as possible in areas where strong currents will ensure dilution and dispersion.
- Discourage, or where considered necessary prohibit, discharge of sewage wastes where doing so would affect water quality and harm marine features in ports and harbours and surrounding waters.

European marine site management process

In the UK, management schemes may be established on European marine sites as a key measure in meeting the requirements of the Habitats Directive. Each scheme will be prepared by a group of authorities having statutory powers over the marine site - the relevant authorities, including port and harbour authorities. A scheme may be established by one or more of the relevant authorities and it is expected that one will normally take the lead. Once established, all the relevant authorities have an equal responsibility to exercise their functions in accordance with the scheme. These responsibilities and liabilities are not combined under the management scheme. Each site can have only one management scheme.

Within the Regulations, the nature conservation bodies have a special duty to advise the other relevant authorities as to the conservation objectives for a site and the operations that may cause deterioration or disturbance to the habitats or species for which it has been designated. This advice forms the basis for developing the management scheme.

Management schemes provide a framework within which activities will be managed, either voluntarily or through regulation, in order to achieve the conservation objectives of the European marine site. It has long been established that the relevant authorities shall not have new powers. Where new regulation is needed the measures may be based entirely on upon the existing powers of the relevant authorities if they are capable of being used to achieve the objectives of designation. However, in other cases, relevant authorities may need to seek changes to the ways in which their existing statutory jurisdiction is applied using the established procedures for that purpose. This is the case for harbour authorities who need to apply for new powers by means of a Harbour Revision Order (HRO) under the Harbours Act 1964.

Whilst only relevant authorities have the responsibility for establishing a management scheme, government policy strongly recommends that other groups including owner and occupiers, users, industry and interest groups be involved in developing the scheme. To achieve this, it suggests the formation of advisory groups and a process for regular consultation during the development and operation of the scheme.

The management scheme process involves the management group in deciding ‘what action is need by whom?’ The management scheme document will contain a statement detailing “action to be taken to implement the strategy”. A relevant authority will declare the actions it proposes to take and win management group consensus for its proposals so that they can be outlined in the management scheme document.

The scheme will encourage the wise use of an area without detriment to the environment, based on the principle of sustainability. European marine sites have been selected with many activities already taking place and it is recognised that these are normally compatible with the conservation interest at their current levels. Only those activities that would cause deterioration or disturbance to the features for which a site has been designated need to be subject to restrictions under a management scheme. It is not the aim to exclude human activities from European marine sites, but rather to ensure that they are undertaken in ways that do not threaten the nature conservation interest.

The main working assumptions of the management process are as follows:

- The scheme will function most effectively if measurable and reportable objectives relating to features included in the designation are represented by specific attributes, with target values and range values where knowledge allows.
- Any procedure contains opportunities for delay. The scheme of management must guard against the risk of delay and should assist in focusing on real issues.
- Collective activity should be restricted to general agreements and assignment of tasks to individual relevant authorities.

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- Zoning within the SAC is a mechanism that can be used to prioritise the natural assets. Permissive zoning allows an operation or activity to take place. This is non-exclusive and seeks to establish a 'presumption in favour' of an operation or activity without necessarily offering any view on the operation outside the permitted zone. Restrictive zoning seeks to prevent or regulate an operation or activity within a prescribed zone.
- The management process allows for the possibility that the monitoring process identifies an effect from a zoned activity, which may require the conditions relating to the zone to be reviewed. However, this only makes sense if there is a clear presumption in favour of the activity and that the link between cause and effect, together with evidence that the impact is sufficient to affect the integrity of the site has been properly and scientifically established. In effect, the introduction of a permissive zone means that the application of the precautionary principle will be deferred until stronger evidence has been presented.
- Although the management scheme focuses on operations and activities, there are circumstances in which it will need to become involved in plans and projects and could certainly be used to inform the planning process.
- A working assumption is that the voluntary estuary mechanisms will act as the channel of communication for broadly based consultation, but they will need to demonstrate their capability and acceptability to all concerned.
- It is important that the precautionary approach is used in the manner described in the DETR and Welsh Office guidelines on the management of European marine sites (DETR & WO 1998).
- Linkage with other existing plans (statutory and non-statutory) will benefit all concerned, for example SAC management measures may be wholly or partly implemented by cross-referencing to other plans, avoiding duplication of effort.
- Sharing of information among relevant authorities and others will facilitate/expedite SAC management.

1. Introduction

1.1 The UK Marine SACs Project

These guidelines have been prepared as part of the UK Marine SACs Project. The overall aim of this Project is to promote the implementation of the Habitats Directive in marine areas through the establishment of management schemes on twelve sites in the UK (Figure 1) and by providing proven good practice and guidance to practitioners in the UK and Europe.

To support the establishment of these management schemes, the Project is undertaking a series of tasks to collate and develop the understanding and knowledge needed. One of the areas for providing guidance to those developing the schemes concerns the interaction between human activities and marine features. Human activities have an important role in the management of marine features and may have both beneficial and damaging impacts. This report is one of the following seven studies bringing together guidance on these impacts and promoting the means of avoiding significant damage to features:

- port and harbour operations,
- recreational user interactions,
- collecting bait and other shoreline animals,
- water quality in lagoons,
- water quality in coastal areas,
- aggregate extraction, and
- fisheries.

1.2 Objectives and scope of these guidelines

The objectives of these guidelines are:

- to identify and agree the operations and circumstances where the impact on conservation features is minimal or beneficial,
- to identify and agree the operations and circumstances where potential for adverse effect does exist, and
- to identify existing guidance and procedures which can be used to exercise appropriate controls for avoiding, minimising or addressing these impacts.

The target audiences for the guidelines are:

- relevant authorities - to inform in the development and implementation of management schemes in European marine sites and to assist them in meeting their statutory obligations,
- port and harbour authorities, operators, users, and related industries - to provide guidance on how to minimise and avoid adverse impacts on European marine sites and to promote good environmental practice,
- country conservation agencies - to improve understanding of the operations and environmental management undertaken in ports and harbours, and
- European practitioners - to act as a guide for those involved in implementing the Habitats Directive throughout Europe and to provide an example of how the development and implementation of management schemes can be facilitated.

The guidelines draw on the best available scientific and technical information together with the wealth of practical experience and specialist knowledge of those involved in managing the marine environment. The scope of the guidelines has been developed in conjunction with representatives of ports and harbours, maritime industry, country conservation agencies and key interest groups who contributed towards two workshops held in Southampton, October 1997 and York, December 1998.

The guidelines focus principally on the management of marine SACs, however they are equally applicable to those involved in managing marine Special Protection Areas (SPAs) classified under the EC Birds Directive and for ports and harbours operating in or near marine SPAs. Generic guidance has been provided for SPAs and consideration has been made of the potential impacts of port and harbour operations on the intertidal habitats that support bird populations. In ports and harbours similar management issues arise in both marine SACs and marine SPAs, which are collectively known as European marine sites. Although, because of the remit of the project, the good practice guidelines focus on marine SACs, in many cases the use of the term ‘marine SAC’ is interchangeable with ‘European marine site’.

A running theme throughout the guidelines is the general duty of ports and harbours to care for the environment. Ports have a statutory duty under the Transport and Works Act 1992 to balance nature conservation with their other operations and under the Habitats Regulations 3(4) to operate their functions with regard to the requirements of the Habitats Directive.

The guidelines focus closely on port and harbour activities that will be managed under the management scheme, which include:

- shipping and boating operations,
- cargo handling,
- port and harbour maintenance,
- maintenance dredging and disposal, and
- the management of ship and boat generated wastes.

The management scheme may also provide guidance for the assessment of plans and projects, particularly those of a minor or repetitive nature, which are defined as “any operations which require an application to be made for specific statutory consent, authorisation, licence or other permission”. The guidelines do not attempt to provide detailed guidance on plans and projects, with the exception of those likely to be managed within the management scheme, such as maintenance dredging and disposal, and small repetitive developmental activities required to maintain harbour and marina structures.

The guidelines only briefly discuss certain issues relating to recreational harbour operations which will be covered comprehensively by *Recreational user interactions: Framework for reviewing and managing potential recreational impacts*, another report from the UK Marine SACs Project.

1.3 Structure of these guidelines

For the purpose of the guidelines, port and harbour operations have been divided into four broad groups, which are discussed in the following sections:

- Section 3 - Commercial operations
- Section 4 - Recreational operations and maintenance activities
- Section 5 - Maintenance dredging
- Section 6 - Waste management and pollution

Each of the four groups of operations will be discussed as follows:

- A description is made of the type, range and extent of operations undertaken in ports and harbours in or near European marine sites.
- A brief outline is provided of the main existing regulations, international and national, influencing port and harbour operations.
- The range of potential environmental impacts on designated marine features that may arise as a result of these operations are discussed, based on the findings of a review of available literature, practical experience and specialist knowledge. Wherever possible, the discussion details the physical, biological and human variables that influence whether an impact is likely to occur at a specific site, or not, and whether the identified effect is likely to be beneficial, minimal or adverse or cover a range of these magnitudes.
- Suggestions are then made for means of avoiding, minimising and addressing the potential impacts described before. These suggested actions include management practices that are already undertaken by ports and harbours to safeguard the environment as part of everyday operations and also in some cases new, or an expansion of existing, management practices.
- A table is provided near the end of each section to review the key points made, providing a summary of:
 - the key process or factor resulting from the port and harbour operation (such as physical damage, smothering or toxic contamination),
 - the potential impacts that may occur as a result of port and harbour operations,
 - the variables that should be considered when determining whether an impact is likely to occur,
 - the likely magnitude of the impact (beneficial, minimal or adverse or a range of these magnitudes), and
 - suggested means for addressing identified potential impacts.
- At the end of each section a list of good practice guidelines is recommended for ports and harbours operating within or near European marine sites to follow in order to avoid, minimise and address with potential adverse environmental effects.

Before entering a discussion of port and harbour operations in European marine sites, some useful background information is provided in Section 2 of the guidelines on the following topics:

- The Habitats and Birds Directives, UK marine SACs, management schemes.
- Ports and harbours in European marine sites.
- The process of assessing and addressing environmental affects.

A glossary of terms used in the guidelines is contained in **Appendix A**. **Appendix B** contains a list of consultees who received a copy of the consultation draft of the good practice guidelines and who have contributed toward its development and finalisation. Contact details of various national bodies and organisations, which may be useful to those managing European marine sites, are provided in **Appendix C**.

2. Background

2.1 Background to European marine sites

2.1.1 Habitats and Birds Directives

In May 1992, the member states of the European Union adopted the ‘Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora’. This is more commonly referred to as the Habitats Directive. The main aim of the Directive is to promote the maintenance of biodiversity and, in particular, it requires member states to work together to maintain or restore to favourable conservation status certain rare, threatened, or typical natural habitats and species. These are listed in Annex I and II respectively.

One of ways in which member states are expected to achieve this aim is through the designation and protection of a series of sites, known as Special Areas of Conservation (SACs).

The Birds Directive (‘Council Directive 79/409/EEC on the conservation of wild birds’) complements the Habitats Directive by requiring member states to protect rare or vulnerable bird species through designating Special Protection Areas (SPA’s). Together, the terrestrial and marine SPAs and SACs are intended to form a coherent ecological network of sites of European importance, referred to as Natura 2000.

2.1.2 Habitats Regulations

The requirements of the Habitats Directive have been transposed into UK legislation through the Conservation (Natural Habitats &c.) Regulations 1994 and the Conservation (Natural Habitats &c.) (Northern Ireland) 1995, known as the Habitats Regulations.

Unlike on land where SACs and SPAs are underpinned by Sites of Special Scientific Interest (SSSIs), there is no existing legislative framework for implementing the Habitats Directive in marine areas. Therefore the Regulations have a number of provisions specifically for new responsibilities and measures in relation to marine areas.

The Regulations place a general duty on all statutory authorities exercising legislative powers to perform these in accordance with the Habitats Directive. The term European marine site is defined to mean any SPA and SAC or part of a site that consists of a marine area, including intertidal areas (**Box 1**). The new duties in connection with the management of marine sites are summarised below.

Box 1. European Marine Sites

A European marine site is described in the Habitats Regulations as a **European site** so far as it consists of **marine areas**.

A **European site** includes SACs and SPAs.

A **marine area** is any land covered continuously or intermittently by tidal water, or any part of the sea, in or adjacent to the UK, up to the seaward limit of territorial waters.

2.1.3 UK marine SACs

In the UK, candidate SACs have been selected for ten of the marine features listed in Annex I and II of the Directive and shown in **Table 1**. These ten marine features are described in **Appendix D**. There are presently 39 sites that have been forwarded to European Commission as candidate SACs and a further 3 are proposed and subject to on-going consultation (**Figure 1 and Appendix D**).

Table 1. Annex I habitats and Annex II species in UK candidate marine SACs

| Annex I habitat | Annex II species |
|---|--------------------|
| Estuaries | Bottlenose dolphin |
| Large shallow inlets and bays | Common seal |
| Sandbanks which are slightly covered by seawater at all times | Grey seal |
| Mud and sandflats not covered by sea water at low tide | |
| Reefs | |
| Lagoons | |
| Submerged or partially submerged sea caves | |

Sites have been selected for other coastal habitats or species such as saltmarsh, sand dunes or the shore dock plant. Whilst these are intertidal areas and therefore strictly European marine sites, they are generally part of ecological systems that extend above high water and come under the provisions of the Habitats Regulations relating to terrestrial SACs. For this reason, these coastal SACs lie outside the remit of this report, although reference is made to them, particularly to saltmarsh habitats, where considered relevant to the management of human activities on marine SACs selected for the marine features in Table 1 above.

Saltmarsh habitat comprises five Annex I habitats, namely *Salicornia* and other annuals colonising mud & sand, *Spartina* Swards, Atlantic salt meadows, Mediterranean salt meadows and Mediterranean saltmarsh scrubs, but will be collectively referred to in the guidelines as saltmarsh. The Annex II species otter is generally associated with river habitats, however in Scottish waters the otter is more estuarine in nature and can be considered a marine species.

In addition to the marine SAC sites, there are also around 126 classified and potential SPAs in the UK with an intertidal element (**Appendix E**). Many marine sites are proposed for both SAC and SPA designation.

2.1.4 Management schemes

In the UK, management schemes may be established on European marine sites as a key measure in meeting the requirements of the Habitats Directive. Each scheme will be prepared by a group of authorities having statutory powers over the marine area - the relevant authorities (**Box 2**). The Regulations set out which authorities have responsibilities for managing these sites and how they are to be managed, as described below:

- Relevant authorities are those who are already involved in some form of relevant marine regulatory function and would therefore be directly involved in the management of a marine site, and may include the following:
 - country conservation agencies,
 - local authorities,
 - the environment agencies,
 - water or sewerage undertakers,
 - navigation authorities,
 - port and harbour authorities,
 - lighthouse authorities,
 - river purification boards,
 - district salmon fisheries boards, and
 - sea fisheries committees.

- A scheme may be established by one or more of the relevant authorities. It is expected that one will normally take the lead. Once established, all the relevant authorities have an equal responsibility to exercise their functions in accordance with the scheme.
- Each site can have only one management scheme.

Box 2. Relevant authorities and management scheme terminology

Relevant authorities are those regulatory authorities with local powers or functions, which have, or could have, an impact on a marine area within or adjacent to a European marine site. Relevant authorities have powers to establish a management scheme for a European marine site.

The **management group** is the body of relevant authorities formed to manage the European marine site.

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

The **management scheme** is the resulting management document (DETR 1998).

Whilst only relevant authorities have the responsibility for establishing a management scheme, government policy (DETR & Welsh Office guidance on “European marine sites in England and Wales”) strongly recommends that other groups including owner and occupiers, users, industry and interest groups be involved in developing the scheme. To achieve this, it suggests the formation of advisory groups and a process for regular consultation during the development and operation of the scheme.

Within the Regulations, the nature conservation bodies have a special duty to advise the other relevant authorities as to the conservation objectives for a site and the operations that may cause deterioration or disturbance to the habitats or species for which it has been designated. This advice forms the basis for developing the management scheme.

The scheme will encourage the wise use of an area without detriment to the environment, based on the principle of sustainability. European marine sites have been selected with many activities already taking place and it is recognised that these are normally compatible with the conservation interest at their current levels. Only those activities that would cause deterioration or disturbance to the features for which a site has been designated need to be subject to restrictions under a management scheme. It is not the aim to exclude human activities from European marine sites, but rather to ensure that they are undertaken in ways that do not threaten the nature conservation interest (Box 3).

Box 3. Bruno Julien’s statement on SAC management

At a seminar on the role and influence of managers within and around their sites held in Rochefort in September 1997, Bruno Julien of the European Commissions DGXI stated:

“You cannot protect nature against those who manage it daily. Furthermore if sites are designated, it is because people who live there have already preserved the habitats and species to be safeguarded. So the Commission considers, on the one hand, that the Natura 2000 sites should not be museums (apart from very rare exceptions) and that the presence of human activity is compatible with the objectives of the Directive, and on the other hand, that the site management methods should be decided in partnership once the sites have been identified. The directive should, on the whole, be construed as an insurance against new destructive behaviour rather than as a new constraint on existing activities.”

The primary focus of a management scheme is to manage operations and activities taking place within a European marine site, promoting its sustainable use. However, it may also provide guidance for the assessment of plans and projects, particularly those of minor or repetitive nature. A plan or project is any operation, which requires an application to be made for a specific statutory consent, authorisation, licence or other permission. Not all types of plan or project fall within the statutory functions of relevant authorities, but are consented or authorised by other statutory bodies, termed competent authorities (e.g. central government departments).

The process involved in setting up and running a management scheme for a European marine site is discussed more fully in Section 2.3.

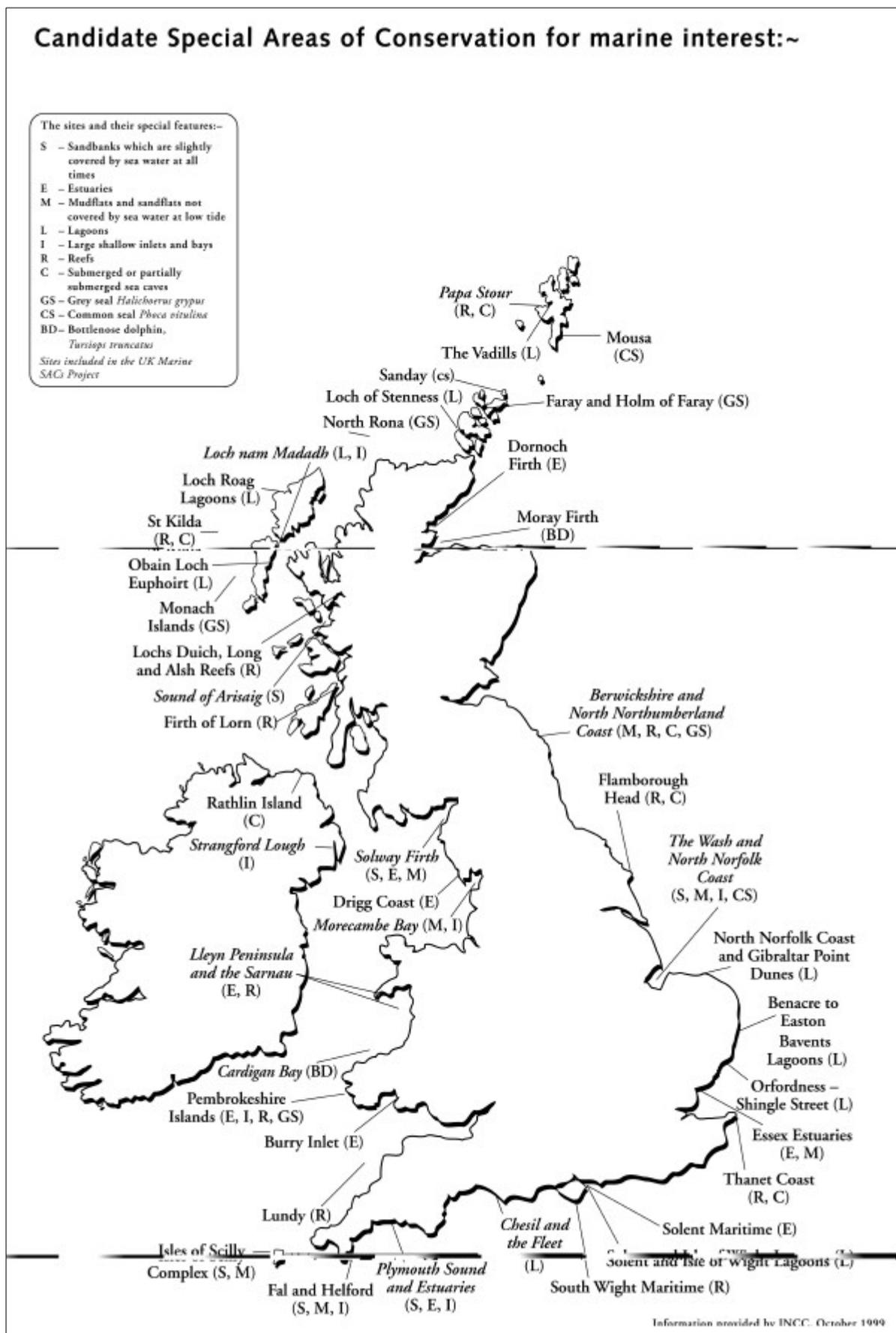


Figure 1. Candidate and possible marine SACs in the UK

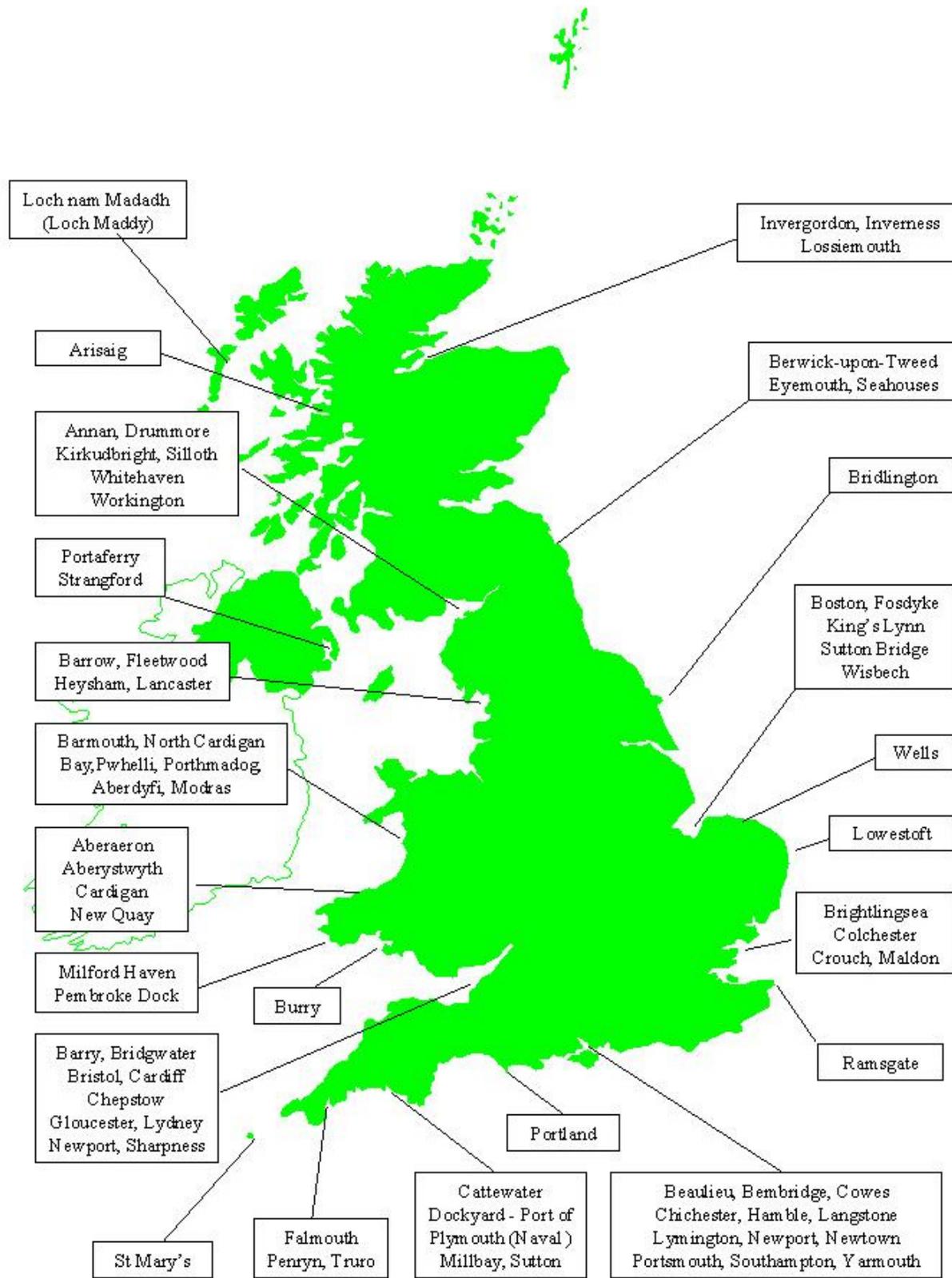


Figure 2. Ports and harbours within or near UK Marine SACs

2.2 Background to ports and harbours in European marine sites

2.2.1 Ports and harbours in European marine sites

There are over 70 ports and harbours located in or adjacent to possible and candidate marine SACs in the UK (**Figure 2** and **Appendix D**). When also considering those ports and harbours located in or near classified and potential SPAs with an intertidal element (**Appendix E**), there are altogether over 110 ports and harbours which operate within and around European marine sites. The terminology used related to ports, harbours and harbour authorities is discussed in **Box 4**.

Box 4. Ports and Harbours

There are a variety of slightly different definitions of harbours used for different statutory purposes. The Harbours Act 1964 definitions of harbour and harbour authority may be summarised as follows:

The term **harbour** means any harbour, whether natural or artificial, and any port, haven, estuary, tidal or other river or inland waterway navigated by sea-going ships, and includes a dock, a wharf, and in Scotland a ferry or boat slip being a marine work.

A **harbour authority** is any person in whom are rested powers or duties of improving, maintaining or managing a harbour whether under the Harbours Act 1964 or other enabling Act, order or instrument.

Generally, the terms port and harbour are used interchangeably, for most purposes. In these guidelines they can be described and distinguished as follows:

Port is the commercial harbour or commercial part of a harbour in which are situated the quays, wharves, enclosed docks and facilities for working cargo, and operated by a statutory port operator.

Harbour is the stretch of water where vessels can anchor, secure to buoys or alongside wharves to obtain protection from sea and swell, the protection may be afforded by natural or artificial features.

There are many harbours which have no harbour authority. There are many harbours where there are two or more ports. Port limits (the limits of statutory control of a port or harbour authority) do not delimit the seaward extent of a natural harbour.

In terms of recreational use, the Yacht Harbour Association (1992) describes yacht harbours and marinas as follows:

A **yacht harbour** is a sheltered area permanently or regularly covered by water, suitable for the safe anchoring or mooring of pleasure craft.

A **marina** is a facility for the berthing of pleasure craft, providing direct walkway to each boat and the required amenities.

On closer examination many estuaries, inlets and bays contain smaller ports, harbours and piers, which are not indicated in **Figure 2**. There are a large number of ports which are not regarded by DETR ports division as commercial trading ports, but which report fishing statistics via the Ministry of Agriculture, Fisheries and Food (MAFF) or the Scottish Office Agriculture, Environment and Fisheries Department (SOAEFD). For example, in addition to the eight principle ports located along the shores of the Solway Firth, there are a further 14 small piers, harbours, ports and slipways found within or near the marine site which straddles the border between England and Scotland (Solway Firth Partnership 1996). Therefore the total number of ports and harbours actually within or near European marine sites will be higher.

The ports and harbours found within or near European marine sites are highly varied in terms of their location, size, and function, and as a result undertake a wide range of different operations and activities which vary greatly in terms of their frequency of occurrence and extent. For example, in marine SACs there are:

- the major commercial ports of Southampton, Milford Haven and Bristol,
- the important recreational harbours of the Solent and the South West, including the harbours of Plymouth Sound and Falmouth Bay and Estuary; and
- the fishing harbours of the North West, such as Loch Maddy and those found in the Solway Firth and Morecambe Bay.

In addition, there are a number of important commercial ports located in or near marine SPAs, including the ports of Felixstowe, Immingham, Grimsby, Mersey, Tees, Medway and London.

The purpose for designation of a marine SAC in which a port or harbour is located also varies greatly. For example, Cardigan Bay is recommended for a single species, the Bottlenose dolphin, whereas many sites are recommended for a range of both marine and coastal habitats, such as the Wash, Solway Firth and the Pembrokeshire Islands. The potential impacts of port and harbour operations within these different sites are therefore highly variable and must be considered and managed on a site-by-site and port-by-port basis.

2.2.2 Responsibilities of ports and harbours

The rights and responsibilities of port and harbour authorities derive from the legislation that creates them and gives them powers. The authority can only operate within its powers. Most harbour authorities are governed by their own local legislation, which is specific to each authority and tailored to meet the needs of each port/harbour. Under these local acts and regulations, the port and harbour authority is responsible for administering the ports and coastal waters within its jurisdiction, for the main purposes of ensuring the navigation and safety of vessels using them. Ports and harbours have a legal responsibility over the marine environment as local lighthouse authorities under the Merchant Shipping 1894 Act.

The concept of environmental management in ports and harbours is not new. They have a statutory duty to balance nature conservation with their other duties, under the Transport and Works Act 1992. However, before this duty to the environment was introduced, ports and harbours had been managing the marine environment for decades, but the process has been largely informal. Each major function of the port requires consideration of the environment within its normal management operation. The task of formalising the environmental management process, without duplicating or dislocating tried and tested systems, in each department is formidable. Yet, the absence of a formal identifiable environmental management system has made it difficult to explain to those outside the port and harbour industry the sheer extent of environmental activity that takes place. It should be noted that the conduct of ports is governed by their financial vulnerabilities which need to be balanced with the Transport and Works Act's general injunction that they should discharge all their responsibilities with environmental considerations in mind.

Many ports and harbours located in or near European marine sites already conduct their every day activities and operations according to environmental codes of conduct or good practice guidelines. Some ports have developed their own guidelines, others follow existing guidelines, such as those produced by the European Sea Ports Organisation (ESPO) and British Marine Industries Federation (BMIF), or abide by environmental guidelines provided by local estuary management plans and strategies.

The Habitats Regulations require port and harbour authorities to have regard to the requirements of the Habitats Directive in the exercise of any of their functions, and enables relevant authorities, including port and harbour authorities, to develop a single scheme of management for a European marine site. Whilst this places new duties on port and harbour authorities, it also empowers them to play an active and equal part in the development and implementation of a management scheme (Section 2.3).

The implementation of the Habitats Directive in the UK has raised a number of concerns for ports and harbours with regard to the potential impacts of marine SACs on their operations. Their key concern is the need to provide assurance of continued shipping and boat access to ports and harbours and the necessity of allowing ports and harbours to evolve with the needs of their customers within the context of the Habitats Directive. The overwhelming message from representatives of the port industry, country conservation agencies and other interested bodies at the ports and SACs workshops was the need to adopt a pragmatic approach to SAC management. The production of these guidelines is a first step in this process.

2.3 The management process

While some relevant authorities named under the Habitats Regulations 1994 may welcome the designation of marine SACs, others are concerned about the potential for restricting their core statutory operations, and about the amount of resources, both in terms of time and money, that their duties under the Regulations may involve. However, compliance with the Habitats Regulations and acting as a relevant authority with regard to the management of a marine site must now be added to their responsibilities. Should conflicts arise between these various duties, they must be resolved in a rational way. What follows is a description of one way in which a structured approach to SAC management can be developed, which draws extensively on the increasing amount of guidance being developed by the country conservation agencies and other interested bodies (Box 5).

Box 5. Selection of useful guidance on the management of European marine sites

- Advice on operations which may cause deterioration of disturbance to interest features (Burt *et al* in preparation).
- European marine sites in England and Wales – A guide to the Conservation (Natural Habitats &c.) Regulations 1994 and to the preparation and application of management schemes (DETR & Welsh Office 1998).
- Marine Special Areas of Conservation (English Nature 1996).
- Natura 2000: European marine sites: an introduction to management (CCW 1996).
- Natura 2000. European marine sites: an introduction to management (SNH *et al* 1997).
- Natura 2000. European marine sites: Guidance relating to statutory conservation objectives and operations which may cause deterioration or disturbance (English Nature *et al* 1998).
- Severn SAC draft management plan process (CCW & ABP 1998).
- Statement on common standards for monitoring designated sites (JNCC 1997).
- Scotland's seas and Habitats Directive: Proposed Special Areas of Conservation in the marine environment (Scottish Office 1995).

2.3.1 Forming the management group

According to Government guidance the first step in the development of a management scheme for a European marine site is to form the management group of relevant authorities as described in **Section 2.1.4**. There may be existing management structures that may be adapted for this purpose, such as estuary management plans, a coastal forum or a shadow SAC management scheme, but in other cases any relevant authority may take the initiative to establish the management scheme. For the larger, or more complex European marine sites it may be appropriate to set up the management scheme in a number of stages or to divide the site geographically whilst retaining the framework of the scheme.

Careful consideration needs to be given to how the management scheme could effectively build on, or run in parallel with, other plans to secure the conservation objectives of the site. The scheme of management focuses on operations and activities that may directly or indirectly cause deterioration or significant disturbance to the features for which the site is designated and the typical species associated with them. In any particular SAC, anything outside this remit need not be covered by the scheme of management, but may be considered by a voluntary estuary or coastal plan, and should be taken into account by all relevant authorities as part of their general 'duty of care'. However, in practice, other features of management have been included within SAC management schemes on a voluntary basis with the agreement of all relevant authorities. Although there is no statutory backing to these elements, their inclusion within the management scheme draws all agreed management practices into one document.

It is important to involve non-statutory organisations in the management process. The advisory group is the only mechanism in the management scheme able to maximise the potential for developing effective voluntary mechanisms where possible. Consultation should also take place between relevant authorities and those competent authorities that are not relevant authorities (such as central government bodies) to ensure that they can fulfil their duty in a way that is consistent with the management scheme.

2.3.2 Setting conservation objectives

The development of the management scheme is based upon the advice of the country conservation agencies, which have a special duty to advise the relevant authorities as to the conservation objectives for a site. At the time the sites were proposed, a citation was produced which identified the interest or conservation **features** for which the site would be designated. The **conservation objectives** for the site should ensure the interest features are being maintained in a **favourable condition** on the site. Once the management group has been formed, either voluntarily or formally, the agencies will propose draft objectives for discussion with the aim of establishing agreed objectives.

The following discussion on setting and providing advice on the conservation objectives draws largely from the guidance recently developed by the country conservation agencies (EN *et al* 1998). In relation to setting conservation objectives, the UK common standards for monitoring designated sites (JNCC 1998) ensure that:

- “*Conservation objectives will be prepared for **interest features** on all sites. These objectives will define what constitutes favourable condition of each feature by describing **broad targets**, which should be met if the feature is to be judged favourable.*
- *Each interest feature of a site will have one or more **attributes** that can be used to help define favourable condition. For each species these may include population size, structure, habitat requirements and distribution. Attributes of habitats may include area covered, key species, composition and structure and supporting processes.*
- *Broad targets will be identified for those attributes that most economically define **favourable condition** of the interest feature. Because all features are subject to some degree of change, the targets may express how much change would be accepted while still considering the feature to be in favourable condition. If a feature changes to the extent that it falls outside the thresholds expressed then this acts as a trigger for remedial action or further investigation.*
- *In some cases relatively little may be known about the interest feature so it may be difficult to define favourable condition. In such circumstances the use of **current condition** will be considered as the definition of favourable condition, in the absence of any evidence that the current condition was unfavourable”.*

In line with these common standards, the UK country conservation agencies will aim to ensure that when setting conservation objectives, they are:

- **specific** - relate to a particular interest feature and define the condition(s) required to satisfy the conservation objective;
- **measurable and reportable** - enabling monitoring to be undertaken to determine whether the conservation objectives are being met and for the purposes of Article 7 of the Habitats Directive;
- **realistic** - given a reasonable time-frame and application of resources;
- **consistent in approach** - the structure of conservation objectives should, as far as is possible, be the same across all European marine sites, and at sites supporting the same interest feature, use similar attributes and targets to describe favourable condition; and
- **comprehensive** - the attributes and targets should cover the properties of the interest feature necessary to describe its condition as either favourable or unfavourable.

Natural variation

Country conservation agencies and relevant authorities will need to assess the effectiveness of management measures towards achievement of the conservation objectives, and to do this, they will need to be able to make judgements in the future about how the observed condition compares to the favourable condition of an interest feature. This is complex because over time there are natural variations in the size of species populations and the species composition of habitats.

The scale and extent of natural variation is often difficult to predict so for a number of interest features selected under the Habitats Directive it will be difficult to precisely define favourable condition. In these cases it will be particularly important to exercise caution when defining the favourable condition and perhaps more importantly when subsequently comparing the observed condition with the favourable condition. For some attributes natural variation is cyclic, whilst for others the trend may be successional, for example through the silting up of inner estuaries. These differences will be reflected in the different ways that targets are expressed for interest features.

In many cases the favourable condition of an interest feature will need to refer to the condition of the feature at the time the site was designated and monitoring undertaken relative to this value(s). Over time the understanding of variability should improve with a view to establishing more precise targets for all features in European marine sites. Such information will be produced as a result of **surveillance** and **monitoring** and may be augmented by targeted studies. The country conservation agencies will draw on the best available information from all sources, including local expert knowledge.

Discussion and advice on conservation objectives

The conservation objectives for the interest feature of each site will include their associated targets (where such targets have been identified). Discussions will take place with relevant authorities and others on the conservation objectives before finalising the advice, in order to draw on the knowledge and experience of these authorities. For most European marine sites, a management scheme will be developed in wide consultation with interested parties, and conservation objectives will be part of such schemes.

The spatial extent of interest features within a site, and therefore the related conservation objectives and targets, will be mapped with reference to known landmarks or seascape features within the site boundary so that the feature can be unambiguously located. Within the context of the management scheme this could be developed into a zoned approach where activities, interest features and conservation objectives are visually demonstrated in a clear manner. Such zoning may not be applicable to all European marine sites.

2.3.3 Advice on operations which may cause deterioration or disturbance to interest features

The country conservation agencies are also required to advise relevant authorities as to operations which may cause deterioration of habitats or disturbance to species for which the site has been designated (Regulation 33(2)). This advice on operations will inform the development of the management scheme, by enabling relevant authorities to focus attention and management actions where needed on those activities, under their control, that pose the greatest potential threat to the favourable condition of interest features on the site. The approach for issuing this advice is currently being developed by the country conservation agencies (Burt *et al* in preparation; Cooke & McMath in preparation).

In order to support the process of providing clear and concise advice, the **processes** or **factors** that link the operation with ecological requirements of the interest features will be identified. For example, the key processes or factors that may result from a dredging operation include, siltation, direct physical damage, and changes in levels of toxic and non-toxic (suspended sediments, turbidity, and nutrient/organic enrichment) contaminants. This common approach has been adopted by the different country conservation agencies, however the terminology used by each varies slightly. The advice given by English Nature will be provided under six broad categories of **operations** which may cause deterioration or disturbance (physical damage), each of which are subdivided into a number of component effects or **processes** (abrasion and selective extraction) that link the operational category to the interest feature (**Table 2**).

A similar approach has been adopted by CCW (Cooke & McMath in preparation) who characterise each maritime activity by a series of seven component effects or **primary factors** (physical disturbance), which can be subdivided into **secondary** (abrasion and removal) and **tertiary factors**. Work is currently in progress to move towards using common terminology. However in both cases the methodology is appropriately robust to reassure relevant authorities that despite the huge range of maritime activities, it is possible to have a relatively definitive list of factors/processes and once issued the advice should need only infrequent review.

The operations to which the marine features and sub-features of a site are most vulnerable can be identified on a site-to-site basis by considering their sensitivity to the effects of the processes/factors and their exposure to those processes/factors to which they are sensitive. This will be achieved by using simple, user-friendly tables against which relevant authorities can assess the activities under their jurisdiction.

The advice on operations is provided in the light of current activities and patterns of usage at the site. It is important that future consideration of this advice takes account of changes in the usage patterns that have occurred at the site. In contrast, the sensitivity of the interest features, or sub-features, is relatively stable and will only change as a result with an improvement of scientific knowledge. Advice for sites will be kept under review and may be updated from time to time through discussions of the relevant authorities and other interested bodies.

Table 2. English Nature's proposed list of categories of operations which may cause deterioration or disturbance to interest features and sub-features, together with the processes that link the operation to the ecological requirements of the interest feature and examples of activities which may cause such effects (Burt *et al* in preparation)

| Categories of operations which may cause deterioration or disturbance to interest features of sub-features | Processes (with examples of maritime activity) |
|--|--|
| Physical loss of interest feature or sub-feature | Removal (e.g. land claim, harvesting) Smothering (e.g. disposal of dredged material) |
| Physical damage to interest feature or sub-feature | Siltation (e.g. dredging) Abrasion (e.g. fishing trawls, direct human contact) Selective extraction (e.g. aggregate dredging) |
| Non-physical disturbance to interest feature or sub-feature | Noise (e.g. cargo handling) Visual presence (e.g. recreational activity) |
| Toxic contamination of interest feature or sub-feature | Introduction of synthetic compounds (e.g. TBT) Introduction of non-synthetic (e.g. heavy metals) Introduction of radio-nuclides. |
| Non-toxic contamination of interest feature or sub-feature | Nutrient enrichment (e.g. waste-water discharge) Organic enrichment (e.g. waste-water discharge) Changes in suspended sediment and turbidity (e.g. dredging) Changes in salinity (e.g. water abstraction) Changes to thermal regime |
| Biological disturbance to interest feature or sub-feature | Introduction of microbial pathogens (e.g. industrial and waste water outfalls) Introduction of non-native species and translocation (e.g. ballast water exchange) Selective extraction of species (e.g. commercial and recreational fisheries) |

2.3.4 Action: The role of relevant authorities in SAC management

Management schemes provide a framework within which activities will be managed, either voluntarily or through regulation, in order to achieve the conservation objectives of the European marine site. In light of the identification of operations that may cause deterioration or disturbance to the interest features of the site and the evaluation of existing use, the management group should develop a strategy for meeting the conservation objectives.

In many cases it may not be necessary to regulate, with action being applied on voluntary basis in some cases and in others action may be simply to endorse the status quo. It has long been established that the relevant authorities shall not have new powers. Where new regulation is needed the measures may be based entirely on upon the existing powers of the relevant authorities if they are capable of being used to achieve the objectives of designation. However, in other cases, relevant authorities may need to seek changes to the ways in which their existing statutory jurisdiction is applied using the established procedures for that purpose. This is the case for harbour authorities who need to apply for new powers by means of a Harbour Revision Order (HRO) under the Harbours Act 1964.

It is important to note that the responsibilities and consequent liabilities of relevant authorities are not combined under a management scheme. The main purpose of the management group must, therefore, be to assign any sphere of activity to one or more relevant authorities. The process of assigning

activities, comparing information and monitoring feedback allows relevant authorities to develop consensus and consistency, and to address any conflicts without the need to resort to a legalistic process. Under the Habitats Regulations the country conservation agencies have powers to act where there is no other relevant authority or where the relevant authority is unable to act for legal or practical reasons.

Having been assigned a sphere of activity by the management group, the decision on the action required is the responsibility of the relevant authorities concerned. That relevant authority will inform and consult with the management group over the action it proposes to take (or not to take), however the management group has no authority to approve or disapprove of that action. A main function of the management scheme is to build consensus between relevant authorities. There are express powers of intervention given to Ministers in cases when it becomes clear that local liaison, co-ordination and consultation is inadequate, if there are undue delays or if the conservation objectives for the site are not being achieved. In addition to helping to resolve these local issues, Government support may also give greater weight to the enforcement of byelaws identified as being relevant to the scheme of management.

Therefore, in undertaking the challenge of setting up and implementing a management scheme and in considering the operation of relevant authorities within the context of a scheme, there are a number of essential requirements:

- The management scheme should find ways of fulfilling the obligations of the relevant authorities that do not conflict with their core operations, especially those that are also statutory duties. The management scheme should also seek ways of fulfilling the obligations of those relevant authorities that are also commercial organisations that do not put them at a competitive disadvantage.
- Clear, specific conservation objectives that are quantified where possible and good advice on operations which may cause deterioration or disturbance are required. This advice is currently being devised by the country conservation agencies, as described above.
- Responsibilities of relevant authorities need to be explicit and additional duties need to be funded.

The key elements to consider when addressing environmental impacts are discussed **Section 2.4.2**.

2.3.5 Monitoring

Surveillance and monitoring of any changes in relation to the conservation objectives form an essential part of the management scheme. The relevant authorities are responsible for monitoring enforcement of those measures under the management scheme, which fall in to their functions.

The country conservation agencies will regularly monitor the site to determine the conservation status of the interest features and to determine whether the conservation objectives for particular sites are being met (**condition monitoring**). The other relevant authorities will generally undertake monitoring as part of their every day operations to observe whether the management measures agreed for the site are in place and operating (**compliance monitoring**).

2.3.6 Costs

The DETR/Welsh Office guidance on European marine sites in England and Wales states that full account should be taken of the cost implications in developing management schemes. Costs should be proportionate to likely benefits in terms of the conservation objectives. Relevant authorities will be responsible for their own costs arising from their participation in the process of developing the management scheme. They act within their existing powers and duties and will therefore also be responsible for bearing the costs of implementation and enforcement of those parts of the scheme which fall within their jurisdictions. However, additional costs of operating a European marine site will arise largely with respect to the co-ordination of effort between relevant authorities.

There will be costs associated with the administration process of developing, running and documenting the management scheme and the dissemination of information. Relevant authorities may agree locally to share these costs, which are expected to be small, with the possible exception of events such as the publication of the management scheme document. There will also be costs associated with setting up the consultative process, even if it is integrated with an existing consultative mechanism, such as an associated voluntary estuary plan or forum. These costs may peak shortly after the first consultation document is produced. In setting up the consultative process relevant authorities should be sensitive to the costs incurred by voluntary groups and other interests who will wish to contribute to the advisory group.

The costs of condition monitoring of the site to assess whether conservation objectives are being met normally falls to the country conservation agencies, although other authorities should, within their statutory functions, make a contribution to this and be prepared to share data. The costs of compliance monitoring will be borne by the relevant authorities and will generally require little additional work, forming part of their every day management activities. A co-ordinated and collaborative approach to monitoring and data sharing may yield considerable benefits in reducing effort and costs, avoiding duplication and ensuring a consistent approach.

Just as the costs involved in managing a site should be proportionate to likely benefits in terms of the conservation objectives, the same is true for any costs associated with the adoption of good practice in avoiding, minimising or addressing adverse impacts on the site. In practice, the adoption of the 'BATNEEC' and 'BPEO' approaches are synonymous where environmental action is concerned.

The actual total expenditure of relevant authorities on environmental matters can be difficult to determine because accounting systems assign costs and revenues to departments or operational functions and rarely provide a convenient means for aggregating environmental expenditures. Furthermore, expenditure for other reasons can have direct environmental benefits. For example, dust separation for health reasons or to reduce a potential nuisance may generate an environmental gain. In the event that an operation is causing the deterioration or disturbance to the marine features of the site, possible actions to remedy the matter may well be expensive. Remediation actions may, under certain circumstances, attract funding from grant sources, such as the Entrust mechanism for recycling landfill tax and the European LIFE programme.

2.4 Assessing and addressing impacts in the good practice guidelines

2.4.1 Assessing environmental effects

These guidelines seek to identify a range of activities where the potential for adverse effects on marine interest exists as a result of port and harbour operations. The process followed in the guidelines for assessing the potential environmental impacts from port and harbour operations and identifying possible beneficial, minimal and adverse effects is based on the following assumptions and considerations:

- The reasons for which individual European marine sites have been proposed for designation are varied and there is a range of different conservation interests at each site.
- The differing location, size, and function of UK ports and the wide range of different operations and activities that take place within them means that environmental issues arising from port and harbour operations in marine SACs also vary greatly from site to site.

The extent to which port and harbour operations might affect marine features within an SAC depends upon a number of variables, which might include one or more of the following:

- magnitude and frequency of operation or activity,
 - presence of sensitive habitats and species and their proximity to operation,
 - hydrodynamic conditions (tidal range, depth, tides, currents, rate of mixing),
 - sediment characteristics (size, density and quality),
 - background environmental quality (sediments, water, air),
 - existing habitat status (a habitat under stress is more likely to prove sensitive to an operation, than it would be if it were in good health at the time of the operation), and
 - seasonal variability and meteorological conditions.
- The large number of variables that need to be considered in determining whether an operation or activity is likely to have an adverse effect on marine SACs and the conservation features within them, means that this judgement will have to be made on a site by site basis, and will often be specific to individual habitats or areas within a site.
 - Therefore, specific guidance on what operations will effect marine SACs cannot be provided within the limitations of this report. Instead the report provides generic guidance on the range of potential impacts that may occur as a result of port and harbour operations, and a summary of the factors that should be considered when determining whether an impact (beneficial, minimal and/or adverse) is likely to occur.
 - It should be stressed that the impacts discussed in these guidelines cover the range that might occur in the UK marine environment. The guidelines **do not** suggest that any or all of the ‘worst case’ impacts will be realised at any individual site.
 - In assessing potential environmental impacts the guidelines attempt to do two main things:
 - relate any identified impacts back to the marine features or attributes for which the site is proposed for designation, and
 - identify how ports and harbours should approach issues where, without effective management, their operations will cause adverse impacts on marine features.
 - This task has been limited to some extent by a lack of information on the impacts of port and harbour operations on specific marine features. In comparison with terrestrial conservation, information and understanding of marine conservation is more limited and dispersed, and information gaps exist on the potential impacts of port and harbour operations in European marine sites. This lack of information is at least in part due to the highly complex, dynamic and largely unobserved nature of the marine environment. It is because of this that it is extremely difficult to predict the effects of man-made changes with certainty.

2.4.2 Addressing environmental effects

These guidelines reflect the guiding principles of sustainable development and continued human use, alongside the conservation of biodiversity set out in the Directive and the joint DETR/Welsh Office guidance on European marine sites in England and Wales. However, these three principles may not be mutually compatible all of the time. The guidelines build on existing good practice and also provide useful guidance to all ports and harbours in fulfilling their general duty to care for the environment. When using these good practice guidelines the following general principles should be considered:

- Joint DETR/Welsh Office guidance on the application of the precautionary approach should be followed (**Box 6**, DETR & WO 1998). Whether the precautionary approach should be invoked over specific issues will need to be agreed as part of each SAC management scheme.

Additional management measures will only be required under the SAC management regime if:

- an activity will cause the deterioration or significant disturbance to the habitats or species for which the site has been designated and the associated biological and physical processes which support them, either directly or indirectly,
- the scale of the impact is such that it will reduce the favourable condition of the habitat or species for which the site has been designated, and
- existing management measures are shown to be insufficient to prevent the impact and existing mechanisms cannot be adapted to deliver the conservation objectives.

Box 6. The Precautionary Principle

All forms of environmental risk should be tested against the precautionary principle that means that where there are real risks to the site, lack of full scientific certainty should not be used as a reason for postponing measures that are likely to be cost effective in preventing such damage. It does not however imply that the suggested cause of such damage must be eradicated unless proved to be harmless and it cannot be used as a licence to invent hypothetical consequences. Moreover, it is important, when considering whether the information available is sufficient, to take account of the associated balance of likely costs, including environmental costs, and benefits (DETR. 1998).

- A very important task of the SAC management scheme is to make a reasoned judgement about the impacts which are a genuine cause for concern, to identify the authority that has the power to address them and then to help that authority develop pragmatic solutions.
- Shipping and boating operations require consideration of a number of issues, including the potential effects of ship wash, noise pollution, emissions and other discharges. In many cases the potential problems identified are difficult to avoid, but sensitive design and operation can minimise any effects on the marine features for which an SAC is designated.
- It is often not within the power of a Port and Harbour Authority to take actions to control, in any meaningful manner, some of the potential impacts that may occur as a result of operations within ports and harbours, but is the responsibility of other regulatory bodies. These potential impacts may be minimised or addressed by compliance with existing relevant regulations and by providing support for programmes and initiatives led by other relevant authorities or organisations.
- Where action to minimise impacts requires ports and harbours to encourage good practice in vessel operators, consideration needs to be given as to how, and by whom, motivation and incentive can be given to achieve this. In the absence of external guidance or regulation, it can be asked, ‘what action is the ship captain or boat operator likely to take which may avoid or minimise the alleged effect?’ Factors such as professional pride, the potential damage of adverse publicity and pressure from insurers may lead the ships’ master to act in a way which will minimise potential impacts.
- It is always desirable to seek ways of addressing the environmental impacts of port and harbour operations that do not impact adversely on the commercial activities of existing ports, placing them at a disadvantage to other ports. There are benefits of seeking win-win outcomes that meet both the environmental and commercial goals simultaneously, rather than resorting to ‘compromise’ and ‘balance’, which means that both ports and the environment lose out.
- When considering how to address impacts on European Sites it is always desirable to consider voluntary measures and partnerships first. However, relevant authorities may need to use their statutory powers, including those to introduce and enforce byelaws. This course of action should only be used where it is clear that voluntary measures would be ineffective and insufficient to achieve the conservation objectives in European marine sites.
- A review of bye-law making powers for the coast has been made by DETR which has looked at the scope and purpose of the powers held by regulators, their general effectiveness and the relationship between regulation and voluntary initiatives (DETR 1998). The review stresses that authorities should pursue voluntary measures before using byelaws. Among the recommendations made in this review, it was suggested that there should be no wider enabling power for harbour authorities to make byelaws for environmental purposes or recreational management.

- Byelaws provide the main means of enabling detailed management of a port. Harbour authorities have the powers to make byelaws under various legislation, sometimes dating back to Harbours, Docks & Piers Clauses Act 1847 or by the more recent powers which have since replaced this Act. However, Harbour Authorities might need to apply for new powers to create byelaws by means of a Harbour Revision Order under the Harbours Act 1964. New byelaws require confirmation from DETR Ports Division. The present process of making byelaws is slow.
- Respect for the marine environment and the wildlife that lives there is an important aspect of maritime tradition and is based largely on the principle of self-management. For example, it is the Royal Yachting Association (RYA) policy that education and training are better than regulation. There is very strong motivation for them to support such initiatives through local clubs and watersport organisations, and voluntary estuary strategy mechanisms. In the spirit of self-management and education, numerous associations representing vessel owners and operators, boat users, maritime industry and ports and harbours have developed good practice guidelines for their members. These include good practice guidelines and codes of conduct produced by the International Chamber of Shipping (ICS), RYA, BMIF and ESPO. In addition many ports and harbours prepare their own environmental guidelines promoting good practice amongst users.

3. Commercial port and harbour operations

3.1 Background

The safe and sheltered anchorage provided by the numerous estuaries, inlets and bays located around the UK coastline make them ideal locations for ports and harbours. These same estuaries, inlets and bays contain a host of diverse habitats, including subtidal sandbanks, intertidal flats and wetlands which are rich in diverse marine life, reflecting the designation of a selection of such sites as SACs.

There are over seventy ports and harbours situated in and around marine SACs in the UK which range from large multi-faceted ports, to small, specialised cargo, fishing and recreational harbours. Out of the top ten cargo ports identified in the UK (HMSO Port Statistics 1992), two are located within or near marine SACs, namely Milford Haven and Southampton. Other major ports operating near marine SACs include, Ramsgate, which is among the top five UK passenger ports, Bristol, and Portland. The majority of ports and harbours located within or near marine SACs are smaller. Whilst, individually these small ports are of lesser economic importance, they are of great local importance and together form an important contribution to the UK's economy.

The marine sector in general contributes £27.8 billion to the UK's Gross Domestic Product (Rugh & Skinner 1996). Although ports directly contribute only 3% of that total, port and harbour infrastructure underpins many of the other marine sectors, including leisure (which contributes 21%), shipping (7%) and ship building (6%).

At its simplest, a port is simply a location where traffic changes between land and sea modes of transport. The breadth of this definition embodies the fact that ports are not all the same. They range from simple wharves to major complexes. A port may only be responsible for the conservancy of the waterway (that is controlling safety and navigation), such as the Port of London. Alternatively it may manage the entire operation, from ship arrival at the seaward limit, through to movement of the cargo on to the land based transport system. Within the UK the latter is rare and it is more common for the port owner to provide an infrastructure, which is then used and operated by a variety of independent concerns. In consequence it is not straightforward to define the functions of a port. SAC management schemes need to recognise this variety and complexity of interests if they are to be effective.

The high profile of tanker accidents and the resulting oil pollution has resulted in shipping being viewed by the public as of cause for concern. Whilst, these incidents are regrettable and highlight the need for vigilant operation and effective response plans, shipping remains the least environmentally damaging form of transport and is recognised as such in the Eighteenth Report by the Royal Commission on Environmental Pollution (1994). The main environmental benefits of shipping in comparison to other forms of transport include efficient and low consumption of energy, lower noise and most atmospheric pollutant levels, lower incidence of major accidents and pollution events, and relatively compact infrastructure and therefore reduced loss of natural habitat in environmentally sensitive sites.

Commercial shipping operations within ports and harbours can be divided into two broad categories, vessel movements and cargo operations, which are discussed in this section. Maintenance of commercial vessels is an important operation which takes place in the many commercial ship yards and dry docks located within or near candidate SACs. The issues arising from the maintenance of vessels and harbour structures are discussed in **Section 4**. Although similar issues are encountered when undertaking these maintenance activities in commercial shipyards or in recreational harbours, it is important to note that the scale and situation are somewhat different (MPearce, Shipbuilders and Shiprepairers Association personal communication 1998).

Recreational activities within the confines of ports and harbours are dealt with in **Section 4**. However, the overall management of vessel movements, commercial and recreational, in ports and harbour areas are discussed in this section.

3.2 Existing regulations

By definition, sea ports and harbours straddle the interface between land and sea. The law however, uses the coastline as a legal boundary. This situation means that both maritime law and the law of the land apply to ports. Establishing management schemes for SACs will enable collaboration with other relevant authorities to address potential problems identified within the existing regulatory framework.

The majority of port operations are administered by statutory harbour authorities, who are each governed by their own legislation tailored to the needs of each port. The Docks and Harbour Act 1972, places statutory responsibility on the harbour master to ensure navigation and safety within the harbour limits. In addition, ports have a duty to have regard to the environment under the Harbours Act 1964 as discussed in more detail in **Appendix F**. Under such legislation, the harbour master may issue general or specific directions to control movements of vessels within the estuary in order to fulfil their statutory responsibilities. Various Merchant Shipping Acts and Regulations apply to both the ports and commercial shipping.

Ports do not regulate ships and manning. This should be done by ‘flag state control’ operated by the country in which the ship is registered. As this has proved unsatisfactory ‘port state control’ has become common. Under this regime the government represented by the inspection division of the Maritime and Coastguard Agency (MCA) exercises the rights of the ‘port state’ to inspect and if appropriate detain sub-standard ships. The port authority is not involved in this process and, even if it is aware of the fact, it has no powers to exclude a sub-standard ship unless it can prove that the vessel or its cargo is dangerous as defined in legislation or regulation.

International protocols and conventions relating to safety, laws of the sea and pollution apply to shipping and ports. The UK government has a responsibility to ensure that measures are implemented in order to honour their commitments to these protocols. In some cases the commitments made at government level have yet to be translated into UK legislation. Examples of the legislative controls over commercial port operations are listed in **Box 7** and summarised in **Appendix F**.

Box 7. Examples of main legislation and regulations affecting commercial port operations

- Conservation (Natural Habitats & c.) Regulations 1994.
- Convention on the prevention of pollution from shipping 1973/1978 (MARPOL).
- Control of Pollution (Landed Ships’ Waste) (Amendment) Regulations 1989.
- Control of Substances Hazardous to Health Regulations 1994.
- Dangerous Substances in Harbour Areas Regulations 1987.
- Dangerous Vessels Act 1985.
- Docks and Harbour Act 1972.
- Environmental Protection Act 1990.
- Environmental Protection (Prescribed Processes and Substances) Regulations 1991.
- Harbours Act 1964.
- Hazardous Waste Regulations 1998.
- Health and Safety at Work Act 1974
- International Regulations for Preventing Collisions at Sea 1972.
- Merchant Shipping Acts and Regulations.
- Merchant Shipping (International Safety Management (ISM) Code) Regulations 1998.
- Merchant Shipping (Salvage and Pollution) Act 1994.
- Noise Act 1996.
- Noise at Work Regulations 1989.
- Transport and Works Act 1992.
- Wildlife and Countryside Act 1981.
- United Nations Convention on the Law of the Sea (UNCLOS).

3.3 Environmental impacts of port and harbour operations

Shipping operations

3.3.1 Ships Wash

The movement of ships through water may potentially affect the features of a marine SAC under certain circumstances, both through the generation of waves and propeller-induced turbidity in the water column. Ships generate waves, which get bigger and more energetic the faster the ship goes relative to its length. The magnitude of the waves generated by a vessel are related to the following variables:

- the speed of the vessel (as the speed of the vessel increases, the waves generally increase in size),
- the size and displacement of the vessel, and
- the distance between the vessel and the marine feature of interest (clearly the wave energy at the foreshore and hence the potential for erosion will be dependent upon the distance from the source of the wash, the form of the seabed and any other obstacles).

The energy in the waves is a function of speed and displacement. Therefore, the generation of ships' wash will be highly specific to the type and design of vessel, and it cannot be assumed that the larger or faster a vessel the greater the wash generated as this is not always the case (Box 8). The wave energy generated by moving vessels should be considered in relation to the background wave climate in an area.

Examples of how vessel type can affect wash include the following considerations:

- Small fast power cruisers proceeding just 'off the plane' will make more wash than if they were in a fully planing mode at maximum speeds.
- High speed hulls, such as planing hulls or narrow low-wash catamaran hulls may produce little wash.
- Hovercraft make a depression in the water under the cushion which can have poor wash characteristics.

Box 8. Ships' wash in Southampton Water

A study of ship generated wash in Southampton Water was undertaken in 1996 which distinguishes the wash generated between different types of vessels in defined areas with and without speed restrictions (ABP Research R495 1995).

Tugs, travelling at up to 12 knots in the unrestricted area, were observed to create the greatest wash (because of their high power and pull in relation to their length when free running). Jet and Ro-Ro ferries, cruise liners and container vessels were found to generate less wash despite some of them travelling at higher speeds.

To date little research has been undertaken to investigate the potential impacts of vessel movements and ships' wash on marine habitats, although this matter has recently received increasing attention. Review of the limited information available at present has identified the following more common effects:

- intertidal erosion of estuaries which may have a minor or adverse impact,
- resuspension of sediments which may have either adverse or beneficial effects, and
- aeration of the water column which would be considered beneficial.

Intertidal erosion

A connection between ships wash and potential impacts on the erosion of intertidal flats and saltmarsh is difficult to establish because of the natural variability of the marine system, although the wash itself may be obvious as it breaks on the intertidal. Other potential causes of erosion include reduction in sediment supply and natural storm events. However, there are cases in UK estuaries where ships' wash is considered to exacerbate rates of erosion of intertidal and shallow subtidal habitats. For example, there are concerns about the high speed ferry service operating between Harwich and the Hook of Holland which is known to create wave problems along the shores and shallow sandbanks of the Stour/Orwell Estuary. The ferry operator is reported to have taken appropriate action to address the ships' wash problem that only occurs at critical depths and speeds (HRWallingford & Posford Duvivier Environment 1998).

The distance of the designated marine feature to be protected from the main navigation channel is an important consideration in assessing the potential for erosion of a given shoreline, as wash energy dissipates relatively quickly. A boat that produces large waves some distance from the shoreline may have less impact than a vessel producing small waves closer to the shoreline (Zabawa & Ostrom 1980). This effect will rely to some extent on other variables such as the form of the seabed coming into play. The depth of water over which the vessel moves affects the size and energy of the vessel-induced waves. Within deep water the waves produced will be relatively smaller than in shallower waters where wave heights increase.

Rate of shoreline erosion is also critically dependent upon the composition of the shoreline. A shoreline that is soft and easily eroded will suffer more from increased wave action than a rocky shore. In coastal SACs the existence of intertidal foreshore will protect a feature behind it, such as Atlantic salt meadows or dune systems, by dissipating wave energy. Research has also shown that the following characteristics increase the susceptibility of a shoreline to erosion (Zabawa & Ostrom 1980):

- an exposed point of land in a narrow river,
- a steep near shore gradient,
- water level in proximity to vulnerable areas of the shoreline, and
- high levels of boating activity concentrated near to the shore.

Re-suspension of sediments

The re-suspension of sediments from the bottom and margins of navigation channels as a result of vessel movements may present an issue in certain estuary, shallow inlets and bays, intertidal flat and subtidal sandbank habitats. Suspended sediment decreases the amount of light that penetrates the water column and therefore has an impact on plants and algae. This reduction in plant productivity has knock on effects to the rest of the ecosystem. The re-suspension of sediments may cause disturbance to sensitive marine animals, particularly due to a smothering effect as the sediments settle. Depending on the quality of the sediments, organic matter, nutrients, and contaminants may be re-released affecting water quality, by the removal of oxygen for example, with possible detrimental effects on marine animals and plants in the area. The potential impacts of sediment re-suspension are discussed in more detail in the dredging section (Section 5). In comparison with natural events, such as storms, which often cause large amounts of sediments to be lifted into the water column over large areas, shipping and boating activity represents only a minor source of localised re-suspended sediments.

Boat and propeller induced turbidity appears to be influenced by a number of variables including depth of water, levels of activity and sediment characteristics (**Box 9**).

Box 9. Factors influencing boat and propeller induced increases in suspended sediments

- The shallower the water, the greater the suction created by the vessel moving through the water at the bed resulting in increased re-suspension of sediment. The depth of influence will vary on a site by site basis.
- Where a vessel passes through a narrow channel, occupying a large proportion of its cross sectional area, the wave generated and the 'under-keel clearance', can result in a greater mobilisation of sediment from the bottom and margins of navigation channels.
- The extent and duration of vessel activity is related to the resuspension of sediment within an area. Areas that are heavily used offer little time for the sediment to resettle and as a result receive more disturbance than an area that is not used frequently. It has been observed that one hour after vessel activity has stopped the sediment will begin to resettle, although this will depend upon the size distribution of the material stirred up and the hydrodynamic regime.
- Sediment characteristics have an important influence on turbidity. Finer materials such as silt will be more easily re-suspended than larger particles.
- The hydrodynamic conditions at the site determine where suspended sediments will be re-distributed

In areas with high levels of suspended sediments, such as the Severn Estuary, the re-suspension of sediments from vessel movements is likely to have little or no additional environmental effects on the benthic communities living in these turbid environments. Similarly, where the temporary suspension of sediments occurs on a regular basis within the proximity of the navigation channel it is unlikely to

cause any observable effects on the communities present which will be adapted to living with the disturbance in these locations. However, the impact of re-suspending sediments on communities in areas with low suspended sediment levels is potentially higher.

The potential for problems exist if ships' movements result in erosion at the margins of the channel, and depending on the depth and characteristics of the sediments, this can cause temporary suspension of sediment, which may be transported away from the site of erosion. The amount of sediment mobilised will depend on the speed size and position of the vessel causing the ship wash in relation to the erosion site. Generally, resuspended material is likely to be deposited on to the channel bed rather than back onto the mudflats. A special case where sediment resuspension may occur, is when a vessel passes through a narrow channel, occupying a large proportion of its cross sectional area. Where this occurs the waves generated and the proximity of the hull to the bottom, 'under-keel clearance', can result in greater mobilisation of sediment from the bottom and margins of navigation channels.

Turbulence and aeration

Turbulence caused by the action of the propeller results in aeration of the water column. The increase in the dissolved oxygen content of the water column would be beneficial to the surrounding flora and fauna. Unfortunately, there has been little research into this area to establish a link (UKCED 1993).

Concerns have recently been expressed over the potential impacts of large waterjet propelled vessels on marine life, in particular that plankton and marine micro-organisms would be destroyed by the rapid pressure changes as water passes through water jet propulsion units. However, concerns have been defused by a recent study into the effect of fast ferry operations carried out by the Danish Environmental Studies Institute which found that turbulence caused by waterjet propulsion units of fast ferries do not constitute a threat to marine micro-organisms (Hynds 1997). Even assuming the worse case that all micro-organisms that pass through the waterjets would die, the mortality rate would still only be a very small proportion of the total numbers of plankton in the vessel's track and considering the short life span of a generation of plankton (generally less than 14 days), fast ferry movements are unlikely to have any noticeable effects.

3.3.2 Collisions between vessels and marine animals

The movement of ships and boats to and from ports may potentially have some effect on marine life simply by virtue of their presence. This is particularly the case with high-speed leisure craft and in marine SACs designated for their marine mammals. There have been a number of studies on the effects of vessel movement on marine mammals. These include the Institute of Zoology's Marine Mammal Strandings Project (Jepson personal communication 1998), the Natural History Museum's stranded whale recording scheme (Muir personal communication 1998), the work of the Sea Mammal Research Unit and Durlston Country Park in Dorset (Browning personal communication 1998) and studies undertaken in Cardigan Bay (Evans personal communication 1998) and the Firth of Forth (Reid personal communication 1998). Research has shown that although a rare occurrence in UK waters, collisions do occur between marine mammals and ships/boats operating at speed, which may result in fatal injuries or wounding. However, quantified information on the occurrence of these incidents is very limited.

Over the past few years, there have been a limited number of incidents where dead and stranded marine mammals, often harbour porpoises, have shown evidence of propeller damage or massive trauma, indicative of ship collisions. In Scottish waters there have been recent reports of fatal collisions between vessels and basking sharks, which are a protected species under the Wildlife and Countryside Act. Further collision incidents are known to take place with seals, however, there is very little information available on the occurrence of these events (National Seal Sanctuary personal communication 1998). Generally, the risk of collisions with marine mammals is greater for recreational craft and dolphin-watching boats and guidelines have been developed for minimising the disturbance to dolphins and porpoises from these activities (Section 3.4.3).

As one would expect, wherever possible, animals will avoid contact with moving vessels. However this is not always the case, for example dolphins and porpoises often actively seek out moving vessels and swim close alongside in the bow wave which may make them vulnerable to injury from collision (A. Muir Natural History Museum personal communication 1998). Many mariners, including yachtsmen, regularly report the enthusiasm with which dolphins accompany their vessels, often for relatively long periods of time before diving away. For example, bottlenose dolphins in the Moray Firth readily approach vessels, to bow ride or to accompany them through the narrows (UKCEED 1993).

Research has been undertaken by the Sea Mammal Research Unit to establish the distribution of seals around UK waters. Observations show that seals co-exist with shipping in many areas around the coast. The presence of fishing vessels may even provide an additional food source as a result of the practice of discarding unwanted fish overboard. It is unlikely that other marine animals will be affected greatly by vessel movements in the UK.

3.3.3 Noise from ships and boats

Noise associated with shipping has the potential to cause disturbance to marine animals, including the marine mammals, fish and birds designated under the Habitats Directive. The main source of noise from vessels is generated by the engine, which may travel via the atmosphere or be transmitted through the structure of the craft. The volume of sound generated and transmitted into the air or water will depend on the size, design and location of the engine, and the craft's size and construction. There have been very few studies carried out to investigate the effects of noise pollution in UK coastal waters, particularly with regard to ship-generated noise on marine animals. The level of information that is available on underwater noise is generally inconclusive with regard to the effects on marine life.

Marine mammals are known to continue to use areas with very high levels of boat traffic and noise, such as Galveston Harbour in Texas (ICES 1991). However, there is concern over noise pollution in general which tends to centre on the possible behavioural effects and that in the worse cases marine mammals, fish or birds may be driven away from their home territories. In recognition that noise and erratic boat movements can distract feeding dolphin or drive them away, codes of conduct have been prepared for vessels operating in Cardigan Bay and the Firth of Forth **Section 3.4.3**.

Dolphins have a sensitive echo location system. Concerns have been expressed that underwater noise may disturb dolphins, however, there is little research available to support or disprove these concerns in relation to noise from commercial shipping and recreational craft in UK waters. The preliminary findings of a study undertaken as part of the Durlston Dolphin Research Programme indicates that it is unlikely that bottlenose dolphins are disturbed by the noise generated by high speed ferries operating out of Poole Harbour (**Box 10** - Browning, Williams & Haarland 1997).

Observations of seals made as part of the work of the Sea Mammal Research Unit show, not surprisingly, that seals are usually less tolerant to disturbance during the breeding season and when feeding their offspring. Further research is required to establish whether seals exhibit behavioural changes as a result of noise from shipping and port operations. Seals generally choose relatively undisturbed areas to come ashore and breed. Ironically, RAF bombing ranges, which despite being the source of a certain level of noise pollution have been observed to provide suitable areas for colonies of seals. This observation is likely to be a result of the restrictions to public access along these stretches of coast (Sea Mammal Research Unit personal communication 1998).

Box 10. Dolphins and high speed ferries operating from Poole Harbour

This study investigated whether bottlenose dolphins showed signs of disturbance from the noise generated by a newly introduced high-speed ferry service operating out of Poole Harbour. The preliminary results of this study suggest that although analysis of the acoustics of the ferry indicate that there is potential for disturbance, the local group of dolphins were unlikely to be affected.

There were no discernible changes in dolphin behaviour since the high-speed ferry service began operating in the area. Further research into this subject continues as part of the Durlston Dolphin Research Programme. It is important to stress that the preliminary findings of this study apply to only one site, one ferry service and one group of bottlenose dolphins.

The effect of underwater noise has been more extensively studied with regard to the impact of seismic surveys on marine animals, and the resultant disturbance to fish feeding behaviour, repulsion from fishing grounds, avoidance behaviour in sea mammals and disturbance of breeding colonies of birds. Effects of the high level, low frequency sounds from seismic surveys are thought to be temporary, with lasting harm to fish, sea birds and mammals unlikely (Turnpenny & Nedwell 1994).

3.3.4 Marine accidents

There is an inherent risk of marine accidents occurring where goods are transported by sea, just as there are risks associated with other forms of transport, although these risks are far less per tonne mile than occur with other forms. Such accidents may occur if a ship is unsuccessful in its attempt to avoid another vessel or obstruction. Harbour authorities make an important contribution to reducing the risk of such events by undertaking their responsibilities as conservancy authorities over various measures to provide for navigation safety. Furthermore, where response plans have been drawn up, an appropriate, co-ordinated approach to any incident will ensure that any potential damage to the environment is limited, particularly where hull ruptures and loss of cargo or fuel spillage occur. The potential impacts of such oil spills and discharges are discussed in the Waste Management Section (Section 6).

When a vessel runs aground it is inevitable that this event will disturb the seabed. The length of time a vessel stays aground may influence the extent of damage caused however, waiting for the tide to re-float the vessel may be less harmful than vigorous action by tugs. Grounding of a vessel may cause resuspension of sediment resulting in turbidity and mobilisation of any contaminants in the sediment. The disturbance to the benthic community will be short lived and dependent upon the type of benthic animals *in situ*. Hard bottom communities are generally less resistant to increases in turbidity than those adapted to a silty estuarine environment. Some loss may occur as a result of burial. In general, the impact of a grounding incident and the length of time required for habitat recovery is likely to be greatest for sensitive, slow growing species and communities in the intertidal and shallow subtidal that are unable to move away, such as maerl or seagrass beds. In hard bottom areas, physical damage to rocky communities, such as those of reef habitats, may be an issue, although the greater risk of hull damage will normally mean that navigators will allow greater safety margins to minimise risk.

3.3.5 Anchoring and mooring

Ports and harbours around the UK coast, and the estuary and bay habitats in which they lie provide shelter and safe anchorage for ships and boats. However, the anchoring of vessels may disturb or damage animals and plants on the seabed, either temporarily by increasing suspended sediments from the disturbance of the bottom or through direct contact with dragging anchors. The effects are of most concern in areas with sensitive or slow growing species, such as shellfish beds, soft corals, sea grasses and maerl. Disturbance from anchoring depends upon the frequency, magnitude and location of activity, type of sediments, and the sensitivity of benthic communities. Where the seabed sediments are soft and there are no sensitive communities or other underwater obstructions, damage caused by anchoring is likely to be minimal and any disturbance is generally temporary, although disturbance in low energy environments can be more than temporary. However, when anchoring over sensitive rocky communities the effects may be more damaging, for example on subtidal reef habitats. However, anchoring is often already restricted or discouraged in areas containing debris, wrecks and other obstructions, typical of uneven rocky bottom areas, which are referred to as foul ground on navigational charts (Section 3.4.8). The impacts from mooring vessels depend on the type of mooring involved.

There have been concerns expressed that the location of moored craft close to the shore may cause disturbance through noise and vessel movements, particularly where it is adjacent to intertidal feeding areas used by birds. However, there appears to be very little literature and evidence that supports this view. The existence of tall yacht masts does not seem to constitute a line of sight obstruction for those birds that are sensitive to such a constraint. In most leisure mooring areas, the number of times a vessel is moved per year is very low and such movements are concentrated into a few hours on Saturday mornings and Sunday evenings. Disturbance levels are therefore minimal. Where drying moorings exist, the moorings can only be used when the intertidal areas are covered, thus eliminating any disturbance to feeding birds.

The existence of a permanent mooring area close to a wildlife site has the effect of keeping vessels that are likely to cause a disturbance through noise or wash, such as high speed recreational craft, water skiers and personal water craft, further away from intertidal habitats. In such circumstances mooring areas can provide a positive protection to designated features. Mooring areas also represent an area where restrictions are in place for human safety reasons, including speed limits and fishing bans. Mooring areas therefore represent a haven where impacts that may normally exist in an area are at a reduced level. In one example, civil law (an injunction) was used to prevent clam fishermen from dredging in a mooring area and damaging the mooring gear after they had extensively fished the rest of the harbour. In this case the mooring area was effectively a nursery.

Cargo operations

3.3.6 Discharges and emissions from cargo handling

During cargo handling operations in ports and harbours discharges and emissions can and do occur, often accidentally. Handling of dry bulk cargo including grain, coal, iron ore, china clay may cause the production of dust. Handling of liquid bulks may require discharge through pipelines, which provides the potential for leaks, emissions and spillages. Sources of atmospheric pollution can stem from cargo vapour emissions. Release of cargoes into the marine environment may have direct environmental effects, as in the case of the loss of toxic substances, or indirect effects, such as the loss of non-toxic organic-rich substances which may result in oxygen depletion on their breakdown.

There are vast amounts of dry bulk cargoes shipped around Europe and the dust generation from the physical handling of these cargoes is generally harmless to the marine environment. Concern is often due to its highly visible nature. Some dry bulk cargoes have high concentrations of organic material and/or nutrients, such as fertilisers and animal feed, with high biological oxygen demands, large spillages of these may cause localised nutrient enrichment and oxygen depletion. This may result in the suffocation of marine life in the vicinity.

In several ports located in European marine sites cargoes may include harmful substances including oil, liquefied gas, pesticides, industrial chemicals and fertilisers, where accidents may result in their release which can adversely affect the marine environment. For the purpose of Annex II and III, the MARPOL Convention has classified the environmental effect of harmful substances carried by sea in bulk or in packages. The environmental hazards of harmful substances include damage to living resources (toxicity), bioaccumulation, hazard to human health (oral intake, inhalation and skin contact) and reduction of amenities. The severity of the pollution of the marine environment, air, soil or groundwater will depend upon the nature of the substance and the amount and concentration released into the port environment. Although discharges and emissions from dust and fumes may occur from everyday operational activities in ports and harbours, they are unlikely to be present in sufficient concentrations to cause ecological harm if HSE regulations are complied with and good operational practice adopted. The potential impacts of oil spills and discharges are discussed in the Waste Management Section (Section 6).

3.3.7 Noise from cargo operations

Noise associated with cargo handling has the potential to cause disturbance to animals and birds inhabiting European marine sites. However, it is unlikely that noise from cargo operations will have any impact on SAC designated features. There is very little information available on the effects of noise on waterfowl, and it is particularly sparse with regard to port and harbour operations. Much of the research into the effects of noise on waterfowl focuses on the impacts of coastal construction, including the building of roads, bridges and barrages. A British Trust for Ornithology (BTO) review reports that evidence of noise disturbance during construction operations has been found for certain wildfowl and wader species (BTO 1990). However, to some extent the literature is biased towards finding effects since studies are often undertaken where a problem is perceived. Although noise has little known impact on waterfowl and waders, there is considerable evidence to show that noise does have an impact on other bird species (D.Huggett RSPB personal communication 1998).

Evidence suggests that in general, wildlife, including birds, adjust to noise levels, even sudden noises, as indicated by the existence of SPAs near to 24 hour container terminals which have been there for years. Noise tolerance can be demonstrated by the developed tolerance of birds to the regular loud noises made by bird scarers used to protect crops. Habituation of birds to noise, light and traffic disturbance is reported to be considerable, as birds are rather adaptable and can accommodate regular disturbance events, becoming tolerant to the disturbance over a relatively short period. However, the ability of waterfowl species to habituate to less predictable and regular forms of disturbance and their ability to compensate for lost feeding time due to disturbance is poorly understood (BTO 1990). The noise generated by cargo operations in ports is very unlikely to affect European marine sites and there is anecdotal evidence that birds continue to use feeding grounds close to major container terminals. However, whether more birds would use the site if the noise was not there, or if birds would be able to feed more effectively, will remain unanswered questions at present.

3.4 Means of avoiding, minimising and addressing the potential impacts of port and harbour operations

It is evident from the literature review that a wide range of port and harbour operations may cause adverse environmental impacts. Where uncertainty exists, it is equally possible that they do not, or that the impact is insignificant in relation to the reasons for which the site was designated. Suitable actions that should be considered in ports and harbours to address the impacts identified above, some of which are already in operation, are as follows:

- environmental policy, reviews and management systems,
- information and codes of conduct,
- ensuring safety,
- emergency response procedures (Section 6.4.2),
- provision of information on European marine sites,
- zoning of activities,
- re-routing via alternative navigation channels,
- protection of intertidal features using breakwaters and other structures,
- compliance with regulations covering cargo operations and promotion of good practice, and
- managing anchoring.

3.4.1 Environmental policy, reviews and management systems

Ports need to improve the transparency of the actions that they take in the normal course of operations that also protect the environment. Each major function of the port and harbour requires consideration of the environment within its normal management operation. Yet, the absence of a written statement of environmental policy, environmental review or a formal environmental management system has made it difficult to explain to government, environmental groups and the public the sheer extent of environmental activity within the ports industry. Therefore, increased accountability of port and harbour operations may be achieved through informal or formal means with the common aim of recording and publishing them. A major benefit of undertaking environmental reviews and implementing environmental management systems is the ability to identify environmental issues for a port and to provide a means of ensuring that they are managed in a systematic and effective way.

Preparation of an environmental policy or review

There is no doubt that there will be an ever-increasing requirement for environmental reporting. Some major companies have produced comprehensive environmental reports covering:

- description of operations and environmental activity,
- clear environmental objectives, quantified where possible,
- quantified performance against objectives,
- external auditing of environmental performance, and
- certification to the International Standard ISO14001, the European Eco-Management and Audit Scheme (EMAS) and/or risk ratings such as Safety and Environmental Ratings Management (SERM).

Such companies tend to be in the manufacturing or utility sector, where there are clear inputs (electricity and water) and identifiable outputs (emissions and waste). Typically these reports cover five to seven main themes. The ports industry has a more complex problem when preparing an environmental review of its operations with up to 20 themes to be covered at the same level of aggregation. Energy and water consumption are minimal factors compared to the 'hands on' management of the real environment by ports. Also much of what ports do is in a regulated environment and requires the ports industry to work closely with a wide range of Government and local authorities.

In these circumstances it becomes difficult to define quantified environmental objectives at an early stage. A review of a port or harbours environmental policy is therefore a first step. The environmental policy review can be backed up by a management system that tracks achievement of the environmental objectives in terms of time, whilst trying to avoid intruding on existing well-established management practices. An example of a recently prepared environmental review is Associated British Ports (ABP) *better place in the environment*, the steps taken to develop of which is described in **Box 11**. The Port of Dover is in the process of developing its second 'Environmental Review'. Its first review, which was published in 1998, provided an overview of the port's environmental performance during 1997 and established specific targets to ensure that progress could be monitored effectively (Dover Harbour Board 1998).

Box 11. The ABP Environmental Review

The ABP environmental review explains the complex background within which ports must operate and sets out the wide range of environmental issues to all possible "stakeholders". This makes clear the fact that the ports have been involved in environmental management for a long time, and explains the constraints and motivation for their actions. It also sets out overall environmental goals, in terms of sustainability, and specific unquantified objectives for each theme in the review.

Themes covered include environmental management, marine safety, operations, coastal zone management, conservation schemes and biodiversity, dredging, pollution and ships' waste, and developmental projects. Following the wide distribution of the review, ABP are in the process of searching for quantified measures (benchmarks) for the environmental objectives which are genuinely within the control of port management. The review represents a baseline on which formal environment management and reporting can be built.

The review is widely recognised as the most comprehensive environment report from a UK port company yet, and has received acclaim from a number of sectors. At the recent ACCA national reporting awards ceremony Mr Michael Meacher, the Environment Minister, singled out three companies as being good examples of first time reporting, including ABP. In their submission to government relating to the review of Trust Ports, RSPB recommended that Trust Ports should be required to prepare and publish an environmental review. They stated that "A good example of the kind of thing required is the Environmental Review published by ABP".

As part of the ECO-information in European Port project, a self-diagnosis methodology has been designed to allow port managers to regularly review their environmental management practice and to identify their environmental priorities as the first step in an environmental review. This self-diagnosis methodology or SDM98 examines environmental management together with key aspects (compliance, port development, incident control, current actions) of the environmental issues targeted by this European project. The SDM98 is being completed by over 50 ports in Europe and the UK, including a number of ports belonging to the British Ports Association who are prime partners in the project. The analysis of these results will provide individual ports with an overview of their environmental strengths and weaknesses and provide review the environmental situation in the European port sector. The software version and analysis tool are under development (Tyler-Walters Cardiff University personal communication 1999).

Implementation of an environmental management system

A number of ports and harbours within or near marine SACs have developed an environmental policy and some are implementing some type of environmental management system. Environmental management systems are an internal system of procedures and reviews that seek to identify and minimise the impacts of port operations. In some cases these systems have been developed to meet the International Standards for environmental management systems (ISO14001 (BS EN ISO 14001)) and others have been prepared according to the guidelines of the European Eco-Management and Audit Scheme (EMAS).

At present EMAS registration is restricted to companies in the mining, manufacturing, utility or waste sectors, although it is due for revision for implementation in the year 2000. The specifications of EMAS are changing into a more user-friendly format and if a regulatory regime comes into force then EMAS will be central to it. In 1998, Michael Meacher stated that any voluntary systems must achieve or approach EMAS certification to be regarded as acceptable. The principal features of the revised EMAS will be:

- Environmental management systems based on 14001
- Covering all types of sites and organisation
- Compliance with legal standards
- Commitment to improvement
- Open dialogue with stakeholders
- A new type of environmental statement comprising
- Publicly available tier reporting
- Annual update
- Details of verification
- Summary of environmental objectives
- Data on performance against objectives
- Summary of impacts
- Description of organisation
- Environment policy can be used to report on national or sectoral indicators.

An environmental management system is likely to be only as effective as it is designed to be, but they can be designed so that real achievements can be made. These achievements may simply be increased awareness of the ports of any potentially damaging operations and the identification of solutions, to the implementation of good housekeeping practices to minimise pollution (Renniss 1995) (**Section 4**). Education of staff, sub-contractors, suppliers and the public play an important role in an environmental management system and increasing public awareness of the objectives that the port is trying to achieve helps in the success of implementation. The benefits of implementing an environmental management system in the Ports of Truro and Penryn are discussed in **Box 12**.

Box 12. Environmental Management System in the Ports of Truro and Penryn

The Ports of Truro and Penryn have been implementing an environmental management system in the Fal Estuary for several years. Their activities attracted the interest of English Nature who provided assistance to aid in the preparation of interpretative material and provided advice, where necessary, in achieving objectives and targets set by the port. The Ports describe many benefits from implementing the environmental management system. Perhaps the greatest benefits arise from simply keeping records of information and quantified data on the ports' activities, operations and developments. A more specific benefit came from a review of suppliers undertaken as part of the management system, which resulted in the purchase and use of pontoons made of recyclable plastic which has a much longer design life than wooden alternatives. The environmental management system is in the process of being registered for ISO 14001 accreditation (Brigden personal communication 1998).

Whether an environmental management system is being developed for the purpose of specific accreditation or simply to provide a more strategic approach to a port's existing management procedures and reviews, the key steps involved in setting up and implementing the system are the same. A brief summary of these steps is contained in **Appendix G**, which draws on the guidance for participants in EMAS published by the Institute of Environmental Assessment (1998) and the guide for integrating conservation into environmental management systems published by the Earthwatch (1998).

Further guidance is provided in the PIANC environmental management framework for ports and related industries, which provides generic guidelines for managing environmental issues based on the principle of sustainable development. This framework can be tailored to meet the needs of the full range of relevant individual organisations, covering all activities associated with waterborne transport and its infrastructure, as well as being able to conform to international standards for environmental management if required (PIANC in preparation).

3.4.2 Information and codes of conduct

Providing information to port users, operators and employees on the importance of European marine sites and the influence that their activities may have on their local site would raise awareness of any potential problems identified and may contribute to minimising them. In particular, the information provided should identify the features for which the SAC or SPA is designated and their sensitivity to port and harbour operations. Possible methods for raising awareness of marine sites are summarised in **Box 13**.

Where appropriate the literature produced should encourage good practice amongst those working within the confines of ports and harbours, which includes port users, terminal operators, ship's agents and all port employees. Practical information, possibly in the form of codes of conduct, should be provided on reducing any impacts and include recommendations for sensitive operation, which may include encouragement of the continued use of BPEO. This will enable the operators to gain a balanced view on how their operations can effect the neighbouring environment.

Box 13. Possible methods of providing information to port and harbour users on European marine sites

- The majority of ports and harbours already provide users with port booklets containing information on services, facilities and cargoes which could be updated to incorporate information on the Marine SAC where they operate.
- Simple leaflets can be prepared to provide specific information on the SAC site.
- Ports often prepare diagrammatic information leaflets containing annotated maps (not for navigational use) on which the location of marine features in relation to the port could be illustrated. Symbols can be used to draw attention to any special care required when operating in marine SACs. Examples of symbols which might be used are shown in **Appendix I** (Lankester, 1996). Where appropriate, existing port maps may be modified to incorporate such material.
- Illustrated information and maps can be displayed on notice boards in port and harbour areas, such has been done in Chichester Harbour to raise the awareness of users of the wildlife importance of the harbour.
- Regular workshops can be run to serve as a forum to air views on what is possible from an operator's point of view to encourage sensitive operation. Voluntary estuary management plans form a suitable arena for such discussion.

Guidelines are being developed for minimising disturbance to dolphins and porpoises from recreation at sea and dolphin-watching boats. Local variants of these guidelines have been adopted as codes of conduct for the protection of resident populations of dolphins in the Firth of Forth and Cardigan Bay. **Appendix H** contains an example of the information and codes of conduct provided to commercial passenger boats operating out of the small ports of New Quay and Aberaeron in the Cardigan Bay SAC which was produced by Ceridigion County Council in conjunction with the owners and operators of commercial boats. The information includes a brief outline of the nature conservation importance of the site, general guidance on speed limits and manoeuvring (including a map showing the areas where byelaws apply), and special practices that should be observed to protect dolphins, seals and birds.

3.4.3 Ensuring safety in navigation

Much is made in the literature about the consequences of collision, grounding and the increased risks resulting from higher traffic levels. The truth is that major incidents involving environmental side effects are rare, although where they do occur they receive major publicity. Any skipper risks his job if he acts in an unsafe manner, and shipowners expect safe operation if only to minimise maintenance and insurance costs. These are powerful motivators.

Ports are investing in more sophisticated traffic management measures accommodating ever-higher traffic densities. Some of the techniques used are summarised in **Box 14**. Even where these provisions are in place, problems can arise where different types of user share the same water. Yachts, fishing vessels, water skiers and other leisure users can cause problems. Regulation through byelaw should be used as a last resort, if only because it is costly to enforce and does not motivate users to comply.

Box 14. Vessel management techniques to provide safe navigation

- Use of pilots, or qualified masters holding pilotage exemption certificates.
- Creation of 'sole occupancy' channels for large or unmanoeuvrable vessels, especially those carrying hazardous or polluting cargoes.
- Development of passage planning procedures, including pre-agreed 'abort' actions to be used in the event of difficulties developing.
- Introduction of effective VHF communications.
- For very large tankers, the use of escort tugs where it can be demonstrated these are effective (although refineries or their customers usually insist on such provision before the harbour deems it to be required).
- For harbours with dense traffic, including vessels carrying hazardous cargoes, modern VTS facilities with digital signal processing and display are generally employed.

Other examples exist where alternative, shallower channels have been marked so that small craft can choose to stay clear of large vessels, and will usually do so for their own peace of mind. At the narrow entrance to Portsmouth Harbour, where tides can be strong, small craft are recommended to use engines, if fitted, and to stay to one side of the channel, clear of ferries that cannot risk losing steerageway in the entrance. This approach works, however it may not be effective on every occasion, and the likely required approach to management will be a combination of the voluntary approach with a degree of supporting regulation.

3.4.4 Zoning of activities

Zoning within a European marine site is a mechanism that can be used to define the location of conservation features and particularly sensitive or vulnerable areas, prioritising the ecological assets of the site. This allows specific conservation objectives and management measures to apply to these areas and more permissive, generalised management measures to apply to the rest of the site. Management schemes based on this zoning approach have been developed and implemented at various locations in the UK, including the Skomer Marine Nature Reserve where the ‘protection zones’ are based on the sensitivity of the marine communities to damage from human activities (Appendix J).

Zoning is also often used to manage human activities, keeping different types of users apart or outside particularly sensitive areas. This approach has been adopted in Australia’s Great Barrier Reef Marine Park where the range of legislation controlling activities in the park are colour coded to form multiple-use zones which are summarised on charts. There are seven zones which range from a general use zone where virtually all activities can take place, through increasing levels of restriction, to a preservation zone which is most highly protected.

A similar approach has been adopted for the Lundy Marine Nature Reserve (Appendix J) and on a trial basis at two voluntary Marine Nature Reserves between Portland Bill and Selsey Bill. The multiple-use zoning scheme approach has also been applied to explore more effective ways of presenting information about marine management in Flamborough Head, Falmouth Bay and Estuaries, and the Severn Estuary (Gubbay 1996).

Zoning can play a part in ensuring both marine safety and environmental protection by keeping activities, such as those involving high speed craft (water skiing or power boating) or anchoring vessels, within suitable areas where the impact on wildlife will be least damaging, away from shipping lanes and shallow water. The Poole Harbour Aquatic Management Plan adopts this type of zoning for recreational activities (Appendix J), giving all recreational users their own areas of activity within a relatively safe environment (Poole Harbour Steering Group 1998). These zones are enforceable by harbour byelaw. The plan also identifies six ‘quiet areas’ where activities resulting in excessive noise should be avoided at particular times of the year, including principal bird nesting and roosting sites within the harbour. Within quiet areas there are advisory six knot speed limits, as a means of reducing engine noise.

Zoning in European marine sites

Essentially there are two types of zoning that may be used in the management of marine sites:

- Permissive zoning which seeks to allow an operation or activity to take place within a prescribed zone. This is non-exclusive and seeks to establish a ‘presumption in favour’ of an operation or activity without necessarily offering any view on the operation outside the permitted zone.
- Restrictive zoning which seeks to prevent or regulate an operation or activity within a prescribed zone.

Greater consideration is being given to drawing up management schemes with permissive zones for particular types of activity. Permissive zoning may be the only way in which social and economic factors can be taken into account in developing the management scheme. The status of a zone is, however, difficult to determine. Intuitively there should be a ‘presumption in favour of’ the operation which is zoned and which does not damage the site. However, zones are not exclusive and cannot be

made permanent within the existing law. The process of permissive zoning therefore would appear to have value only in the context described in **Box 15**.

Box 15. Zoning of activities in European marine sites

Zoning in marine sites would appear to be of most value in the following management context:

- A permissive zone is proposed by an entity carrying out an activity and/or a relevant authority.
- Proposed permissive zone is examined by the country conservation agency to determine its likely to influence on the designated features of the site. If they conclude that there will be little or no effect on these features then the proposed zone will be endorsed. A permissive zone is only likely to be agreed where the impact of the operation or activity on the designated features are well understood, or possibly for a trial period associated with special monitoring.
- The country conservation agency may seek to compensate for the possible impact of the zoning proposal by suggesting other restrictive zones in which the features concerned will be particularly well protected, although all areas of the site should be protected where possible.
- Zoning schemes, like all management measures, need to be agreed by all relevant authorities before they can form part of a management scheme and consult with affected users.
- Simplicity and clarity in the zoning scheme are likely to produce the best overall result.
- There are benefits of seeking zones that meet both the environmental and commercial goals simultaneously. For example, speed limits in harbours set for navigational safety reasons will also have the effect of reducing disturbance and erosional effects. Additional speed restrictions should only be introduced where there is a clear demonstration that vessel speed significantly affects the marine features and their communities adversely, although temporary measures may be considered. It may be necessary for a port or harbour to apply for a Harbour Revision Order for the powers to create byelaws for this purpose.
- Zoning schemes, particularly those based on voluntary agreement, are not necessarily cast in stone and may be adapted to changing circumstances.

Restrictive zones are usually imposed for reasons of human safety, such as areas where water-skiing, motor-boating or windsurfing are banned in order to protect swimmers. Restrictive zones are also used to protect habitats, such as speed limits within a harbour to reduce disturbance to areas of adjacent intertidal flats which provide important feeding areas for birds, and especially to protect species during breeding seasons. Such zones will usually command widespread public support if the positive reasons for the zone are clear and well understood. The impossibility of total enforcement in the marine environment means that zoning is unlikely to succeed if such widespread support does not exist. Restrictive zoning limits peoples freedom and will always be resented by some sectors. It must therefore be used only where they are needed to protect the designated marine features.

3.4.5 Re-routing traffic via alternative navigation channels

Re-routing of traffic via alternative navigation channels should only be considered if it is accepted that there is a very real problem with the current patterns in vessel movement and there is an alternative route available. This consideration is particularly important given the navigation and safety implications of re-routing. The practicality of re-routing traffic via alternative navigation channels will depend upon the location of a particular port or harbour and the geography of the surrounding area. In some cases additional dredging, at some cost and with potential environmental impacts, may be required to allow alternative routes to be used safely.

Examples where re-routing has been employed include Stena Line's operation to Gothenburg Harbour (Hynds 1997). In response to growing concerns about ship wash and in an attempt to reduce any potential impact of its fast 'water jet' ferry operation on the Gothenburg archipelago, ferries were re-routed through the northern Torshamn Channel during the peak season when there is a considerable concentration of shipping within the channel to the north of Vinga. This response may have been appropriate in this situation, but consideration of such a step would need to be done (as in this case) in conjunction with operators and with a careful evaluation for any navigational and safety implications.

3.4.6 Protection of intertidal features from ships' wash

Where there is evidence that ship or boat wash is causing erosion of designated intertidal flats or saltmarsh habitat, and where other appropriate measures have been considered and applied, a further management option that may be considered is to protect the intertidal features by creating structures, such as breakwaters, bunds or mounds of sediments on the intertidal. Harwich Harbour Authority has applied this approach in Trimley Marshes on the StourOrwell Estuary (**Box 16**). Such an approach to protecting marine features may also provide a beneficial use for dredged materials, however the potential impacts on local hydrodynamics and ecology, should be considered (**Section 5.3.9**). This should not be considered where the costs of undertaking such a scheme would greatly outweigh the potential environmental gain. Furthermore, the potential application of this approach may be limited by the need for a grant aid to fund this work and by land ownership issues.

Box 16. Harwich Harbour scheme to protect intertidal habitats from ships' wash

In response to concern over the erosion of Trimley Marshes an intertidal recharge scheme was undertaken by Harwich Harbour Authority. 63,000 m³ of dredged sands were placed in soft groynes perpendicular to the eroding shoreline.

The benefits of the scheme were reported to be twofold. Whilst protecting the shoreline from ships' wash, a beneficial use for dredged material was provided (Dixon 1996).

A further method of minimising ships' wash in the proximity of vulnerable shores might be to place moorings in the area to reduce speeds. This is a particularly useful approach where small speedboats and personal watercraft are a potential problem. Other variables which influence ships' wash, such as propeller wake, ship design and hull form, are outside the scope and powers of any port authority and therefore cannot be changed by an SAC management plan.

3.4.7 Compliance with regulations covering cargo operations and promotion of good practice

With regard to cargo handling, ships have a duty to report any hazardous cargoes to ports and special arrangements can then be made. In general, these are compliant with HSE regulations, or are based on the IMO IMDG code. Most of the implementation in detail is carried out by private stevedores, not by the port authority (unless the port directly employs stevedores). Spills and emissions from cargo handling do occur.

In order to minimise accidental incidents operators and stevedores need to ensure that the standard of training given is adequate and that in the event of an accident, adequate procedures are in place. Regular maintenance checks should be undertaken by these parties to ensure that the risk of accidents occurring is minimised. Safety systems are in place in most ports and risk assessments are carried out for more hazardous activities. Furthermore, many ports dealing with dry bulk cargo already make use of the BATNEEC in handling operations, such as dust suppressing systems. Impacts from dust and fumes are unlikely to be in sufficient concentration to cause ecological harm if HSE regulations are complied with. Cargo accidents involving spills will trigger the appropriate level of the port emergency plan (see Waste Management **Section 6**).

There is a clear incentive for ports and harbours to reduce such pollution incidents, as they represent not only a hazard to workers and the environment but also a financial loss. Loss of cargo will result in reduced profits and clean up operations may be expensive and time consuming. In severe cases fines may also be imposed where an activity is regulated under the Environmental Protection Act or other relevant legislation.

Ports and harbours can encourage good cargo handling practice amongst those working within the confines of ports and harbours, including, stevedores, terminal operators, ship's agents and all port employees. This should focus on efforts to minimise nuisance and environmental impacts caused by their operations, with particular reference to dust, atmospheric pollution, water and soil contamination and noise.

3.4.8 Managing anchoring

It is recognised that care should be taken by vessel operators when anchoring in marine SACs to ensure that anchors do not drag and damage sensitive animals and plants of designated subtidal habitats. Port and harbour authorities manage anchoring within harbour areas. Where anchoring is a matter of safety, anchoring restrictions do not usually apply. Many good anchoring sites are traditional, and are used because they provide shelter from wind and sea, and adequate holding ground. Locations used for anchoring by commercial vessels are usually dictated by the vessel traffic management requirements of the port, although this does not necessarily mean that they cannot be managed in a way that is less damaging to the European marine site. However, the following comments apply principally to anchoring by leisure craft and other small vessels.

Anchoring is often restricted within ports and harbours for the purposes of safety. Most navigational charts show areas where anchoring is not permitted, such as areas where there are power or telephone cables, and pipelines for oil or gas. Such restrictions are so evidently sensible, and in the interests of the vessel operator that they are accepted by the marine community at large. Anchoring is also inadvisable in areas of 'foul ground', which are marked 'foul' on the chart, and generally consist of areas containing wreckage or debris. Other areas can be designated for commercial shellfish and where users also understand that anchoring may result in damage.

Where the risk of damage to designated sensitive communities is high from anchoring boats outside areas where anchoring is already restricted, additional restrictions may be applied to limit the effects. Ports and harbours should apply additional restrictions on anchoring activities with caution and only where they are needed to protect vulnerable communities of designated marine features. Where the bottom is soft and there are no commercial shellfish, underwater obstructions, or particularly vulnerable plant and animal communities, damage caused by anchoring is likely to be minimal, therefore anchoring restriction is generally not necessary. In soft sediment areas which are ideal for both anchoring and supporting eelgrass beds, with no other obstructions, provision of targeted information to encourage users not to anchor can be used, although it is difficult to reach and influence all users.

There are obvious benefits of seeking outcomes that meet both the environmental and safety goals simultaneously. For example, the rocky subtidal habitats that may constitute foul ground may also contain vulnerable communities, such as corals and reef communities. It may be simpler to refer to these areas as foul ground than to apply a further restriction on anchoring in the area on environmental grounds. If such a restriction fails to provide adequate regulation of anchoring damage a more stringent ban on environmental grounds will be necessary. In this event, the best way forward is to clearly explain to port and harbour users the reasons why the regulation is required and to mark these areas clearly on the charts. Where regulation is considered necessary, a port authority might have to apply for a harbour revision order to make a general direction to shipping for this purpose.

Box 17. Useful operational and environmental guidance for port and harbour operations

- A better place in the environment, ABP Environmental Review (Associated British Ports 1998).
- Byelaw powers for the coast, A discussion paper (DETR 1998).
- Code of practice for noise levels on ships (MSA 1983).
- Environmental Code of Practice (ESPO 1993).
- Environmental Code of Practice (British Ports Federation 1993).
- Poole Harbour Aquatic Management Plan (Poole Harbour Steering Group 1998).
- Shipping and the Environment, a code of practice (International Chamber of Shipping 1997).
- Validity of Scientific Criteria for Environmental Auditing of Port and Harbour Operations (Wooldridge & Couper 1995).
- Work boat code of practice: An operator's guide (MCA 1998).

3.5 Summary

Table 3. Summary of the possible effects of port and harbour operations in European marine sites and suggestions for means of avoiding, minimising and addressing them (Ben = Beneficial, Min = Minimal, Adv = Adverse)

| Port and Harbour Operations Potential issues, key processes & potential impacts | Considerations and comments | Potential impacts on marine sites Beneficial Minimal Adverse | Possible means of avoiding, minimising and addressing impacts |
|---|--------------------------------|--|---|
| | | | |

*Good practice guidelines for ports and harbours
operating within or near UK European marine sites*

| Port and Harbour Operations Potential issues, key processes & potential impacts | Considerations and comments | Potential impacts on marine sites Beneficial Minimal Adverse | Possible means of avoiding, minimising and addressing impacts |
|--|--|--|---|
| SHIPPING OPERATIONS | | | |
| Potential impacts from ship and boat movements | | | |
| <p>Issue: Collisions with marine mammals</p> <p>Key process: Physical damage (collision)</p> <p>Potential impact: Collisions with high-speed vessels may cause the injury or death of marine mammals.</p> <p>Issue: Ship and boat wash</p> <p>Key process: Changes in physical regime (waves & sediment transport)</p> <p>Issue: Vessel noise</p> <p>Key process: Non-toxic contamination (sediment suspension)</p> <p>Potential impact: Disturbance to marine mammals and fish may occur from engine noise.</p> | <p>Collisions are rare in UK waters, but do occur. This problem is more commonly associated with high-speed recreational vessels. Limited research on marine mammal strandings is ongoing. The effects are difficult to distinguish from natural events but very little information is available relating to ship/boat collisions.</p> <p>Impacts depend upon vessel size, type and speed; level of disturbance to cetaceans activity, proximity to sensitive intertidal and shallow subtidal habitats. There is some evidence of noise disturbance to cetaceans from vessels. Research is ongoing, but little information is available relating specifically to noise from ships/boats.</p> | <p>Min/Adv</p> <p>Min/Adv</p> <p>Min</p> | <p>Education and codes of conduct for port and harbour users.</p> <p>Education and codes of conduct for port and harbour users.</p> <p>Voluntary or byelaw enforced speed restrictions.</p> <p>Voluntary or byelaw enforced speed restrictions.</p> <p>Zoning of activities likely to produce excessive wash in relation to particularly sensitive designated habitats.</p> <p>Zoning of seasonal quiet areas in close proximity to identified sensitive areas, such as mammal breeding grounds and bird feeding areas.</p> <p>Creation of sediment bunds or wave breaks along the foreshore to protect important intertidal habitats for which the site has been proposed for designation.</p> |
| <p>Issue: Seabed disturbance by vessel movements & propellers</p> <p>Key process: Non-toxic contamination (sediment suspension)</p> <p>Potential impact: Boat and propeller induced temporary increases in suspended solids and turbidity may cause localised disturbance of benthic animals and plants (Section 5).</p> | <p>Effects depend on the types of vessel, level of activity, sediment type and quality, water depth and background suspended solid levels.</p> | <p>Min</p> | |

| Port and Harbour Operations Potential issues, key processes & potential impacts | Considerations and comments | Potential impacts on marine sites Beneficial Minimal Adverse | Possible means of avoiding, minimising and addressing impacts |
|---|---|--|---|
| <p>Issue: Vessel groundings Key process: Physical damage (abrasion, siltation & smothering) Potential impact: Grounding, due to navigation error or accident, may result in localised damage and disturbance to benthic communities, re-suspension of sediments and smothering.</p> <p>Issue: Marine accidents or groundings with loss of cargo or fuel Key process: Physical damage (abrasion, siltation & smothering) Toxic contamination Non-toxic contamination Potential impact: Marine accidents or groundings resulting in releases of cargo or fuel may cause a wide range of impacts on habitats and species, including a deterioration in water quality, contamination of sediments, and smothering (see cargo handling below and Section 6)</p> | <p>Levels of disturbance will depend upon location of incident, size of vessel, length of time vessel is aground, and sensitivity of habitat and communities affected.</p> <p>The effects are highly specific depending upon the type and quantities of cargoes/fuels entering the marine environment, location of incident, sensitivity of habitats and communities, and, where appropriate, the effect of emergency response.</p> | <p>Min/Adv</p> <p>Min/Adv</p> | <p>Ensure safe navigation.</p> <p>Emergency response planning (Section 6).</p> <p>Use of pilots and effective VHF communications.</p> <p>Zoning of activities – such as the creation of ‘sole occupancy’ channels for large/ unmanoeuvrable vessels, especially those carrying hazardous or polluting cargoes.</p> <p>Development of passage planning procedures.</p> <p>The use of escort tugs for very large tankers where it can be demonstrated as effective.</p> <p>The introduction of modern VTS facilities with digital signal processing and display for busy harbours with dense traffic including vessels carrying hazardous cargoes.</p> <p>Re-routing of navigation channels where practical.</p> |
| <p>Issue: Mooring and Anchoring Key process: Physical damage (abrasion) Non-physical disturbance (noise & visual presence) Potential impact: Anchoring vessels may disturb or damage sensitive benthic communities, in both rocky and soft substrates. The use of permanent moorings may cause direct loss of intertidal habitat and bird feeding areas, some disturbance through noise and vessel movements, particularly adjacent to areas used by birds.</p> | <p>Disturbance from anchoring depends upon the frequency, magnitude and location of activity, type of sediments, and the sensitivity of benthic communities.</p> <p>Where the bottom sediments are soft and there are no sensitive communities, less impact is likely to be caused. The impacts arising from mooring vessels depend on the type of mooring used.</p> | <p>Min/Adv</p> <p>Min</p> | <p>Education, information and codes of conduct for port and harbour users, indicating areas where anchorage will cause no harm and discouraging anchoring in areas where there are important subtidal animals and plants.</p> <p>Voluntary or byelaw enforced anchorage restrictions.</p> <p>Zoning of seasonal ‘quiet areas’ in close proximity to identified sensitive areas, such as mammal breeding grounds and bird feeding areas.</p> |

| Port and Harbour Operations Potential issues, key processes & potential impacts | Considerations and comments | Potential impacts on marine sites Beneficial Minimal Adverse | Possible means of avoiding, minimising and addressing impacts |
|--|--|--|--|
| CARGO OPERATIONS | | | |
| <p>Discharges and emissions from cargo handling</p> <p>Issue: Non-toxic discharges and emissions to water</p> <p>Key process: Non-toxic contamination (turbidity & organic enrichment)</p> <p>Potential impact: Operational and accidental spills and releases of dusts during the handling of dry bulk cargo (for example china clay, grain, coal) may cause a temporary local deterioration in water quality. Discharges and dust emissions into the marine environment may temporarily increase turbidity and organic cargoes (such as animal feed) may cause the localised removal of oxygen from the water, possibly disturbing marine animals.</p> | <p>The impacts depend on the types and quantities of dusts entering the marine environment. Generally, the levels of most dry-bulk cargo dusts generated will have little or no effect, with the possible exception of high levels of organic dusts, which may cause the localised removal of oxygen from the water.</p> | Min/Adv | <p>Port health and safety, and waste management procedures.</p> <p>Use of BATNEEC to minimise quantities of material released.</p> <p>Routine maintenance and adequate contingency planning.</p> |
| <p>Issue: Hazardous discharges and emissions to water</p> <p>Key process: Toxic contamination Non-toxic contamination (turbidity & organic enrichment)</p> <p>Potential impact: Accidental release of hazardous substances during the handling of cargoes, such as oil, liquefied gas, pesticides or industrial chemicals, may cause the pollution or contamination of marine habitats and disturbance or damage to communities.</p> | <p>The effects are highly specific depending upon the type and quantities of cargoes entering the marine environment, location of incident in relation to marine features, sensitivity of habitats and communities, and, where appropriate, the effect of emergency response. The impacts of oil pollution are discussed further below (Section 6).</p> | Min/Adv | |
| <p>Issue: Noise from cargo handling</p> <p>Key process: Non-physical disturbance (noise)</p> <p>Potential impact: Waterfowl and marine mammals, such as seals when on land, may be disturbed by noise generated from port and harbour operational activities, such as cargo handling and traffic.</p> | <p>Little information is currently available. Although there may be some disturbance, birds are thought to adjust to long-term continuous noise levels. The effects will depend on level and type of noise and proximity of birds to the source. Sensitivity may increase during particular periods, such as breeding periods.</p> | Min | <p>Use of BATNEEC/BPEO to minimise noise pollution. Working to relevant British Standards.</p> <p>Zoning of 'quiet areas' in close proximity to sensitive sites.</p> |

3.6 Good practice

In order to avoid, minimise and address potential environmental impacts arising from their operations, ports and harbours operating in or near European marine sites should:

- Improve the transparency of actions taken in the normal course of port operations that protect the environment, such as the preparation of an environmental review, implementation of an environmental management system and the development of codes of practice.
- Consider producing own environmental guidelines or codes of conduct to provide guidance and educate port users and employees, promoting sensitive operation in relation to designated marine features.
- Inform port users, operators and employees of the site's designation as an SAC/SPA, the reasons why it has been designated and the sensitivity of these marine features to commercial port and harbour operations. This can be achieved through the production of leaflets or booklets, annotated charts, notice boards and running regular workshops. Where appropriate information should encourage good practice and sensitive operation among those working within or visiting the port.
- Consider how motivation and incentive can best be given to vessel operators to avoid and minimise the potential environmental effects from vessel movements.
- Continue to review vessel traffic management techniques to ensure safe navigation to avoid and minimise the environmental consequences of marine accidents, including groundings, collisions and the increased risks resulting from higher traffic levels and congested waters.
- Investigate voluntary approaches to find management solutions to navigation problems resulting from conflicts between commercial shipping and other port and harbour users, using regulation as a last resort. However, in some cases regulation may be necessary for the harbour authority to fulfil its duty to ensure that their activities do not have an adverse impact on the SAC features.
- Consider the zoning of activities, in space or time, for environmental protection and marine safety purposes, keeping activities within suitable areas where the impact on designated features will be avoided or minimised. Zones can be enforced by byelaws to address adverse impacts, such as the possible effects of disturbance, wash or noise. Zoning schemes should only be developed and used where they are needed to protect the designated marine features and like all management measures, need to be agreed by all Relevant authorities before they can form part of a management scheme.
- Comply with relevant environmental and safety legislation to avoid and minimise potential environmental effects from vessel movements, operational emissions, and cargo handling operations.
- Consider re-routing traffic through alternative channels, if they exist, where there are adverse environmental impacts associated with current patterns in vessel movements and where other appropriate measures have been considered and applied.
- Investigate the feasibility of protecting intertidal features from ship wash by creating breakwaters where there is evidence that ships wash is causing the erosion of designated intertidal flats or saltmarsh habitat, where all other appropriate measures have been undertaken or as a precautionary approach. This approach may also provide a beneficial use for dredged materials, although impacts need to be considered. This should not be considered where the costs of undertaking such a scheme would greatly outweigh the potential environmental gain or where there are long-term adverse impacts to the site.
- Make data routinely collected by the port available to country conservation agencies who have the statutory duty to monitor the condition of the SAC. Consider facilitating the monitoring programmes set up by country conservation agencies, by for example, allowing survey instrumentation to be mounted on harbour craft and port structures. A collaborative approach to monitoring and data sharing among all relevant authorities will facilitate the development and ongoing implementation of management schemes, and may foster greater understanding of the working practices and objectives of different bodies.
- Liaise closely with country conservation agencies, 'in confidence' if necessary, to facilitate early identification of potential impacts, and to ensure mutual appreciation and understanding.

4. Recreational harbour operations and maintenance activities

4.1 Background

4.1.1 Recreational activities in marine SACs

Some of the UK's most important recreational harbours are located within marine SACs. The Solent and the south/south west coast of England in particular hold major commercially important recreational harbours. Other popular recreational areas for boating activities include Milford Haven, the south Essex estuaries, Solway Firth, Strangford Lough and the Wash and North Norfolk coast. In addition, there are smaller recreational harbours and marinas scattered along the length of the UK coastline, taking advantage of the many natural safe anchorages and sheltered harbours and contributing to the local economy. Although perhaps not well known for its recreational activities, Scotland's west coast attracts cruising yachtsmen to its numerous natural anchorages, its attractive scenery, and its few harbours and moorings, including yacht harbours in marine SACs, such as Arisaig which is relatively popular for this coastal area. Other marine sites support little or no recreational boating activities, such as Papa Stour which is one of the UK Marine SAC Project sites.

In many cases, recreational harbours are not in a class of their own, with recreational use merging with other harbour activities. For instance, Cowes Harbour accommodates marinas, ferries, commercial shipping, ship manufacturing and gravel quays. The Hamble, although predominantly recreational, also includes fishing boats and yards that maintain all sorts of crafts. In Portsmouth Harbour, recreation sits together with naval installations and commercial shipping and fishing activity (Quin BMIF personal communication 1998).

Different types of recreational activity occurring in a selection of marine SACs and an indication of the types of facilities and capacity of recreational harbours within them are shown in **Table 4**.

Table 4. Examples of type and level of recreational activities occurring within ports and harbours in selected marine SACs

| Marine SAC | Recreational activities | Recreational boating |
|--|---|--|
| Solway Firth ¹ | Sailing, windsurfing, scuba diving, recreational fishing. | 9 RYA affiliated sailing clubs Sailing membership 800 + 500 visiting members 300 resident boats. |
| Plymouth Sound and Estuaries ² | Sailing, canoeing, rowing, windsurfing, water skiing, jet skiing, recreational fishing, power boating and scuba diving. | 19 sailing clubs and 8 marinas, Around 4,500 moorings. |
| The Solent (including the Solent Maritime SAC) ³ | Sailing, power boating and cruising, water skiing, jet skiing, rowing, windsurfing, diving, fishing. | Around 90 sailing clubs and 24 marinas, Over 11,000 moorings and 8,000 resident berths, Total boats over 27,000. |

Information from: ¹ UKCEED 1999 in preparation, ² Captain Gooder Queens Harbour Masters personal communication 1998 and ³ Dunbar *et al* 1997.

A survey carried out by Research Solutions Ltd., on behalf of the BMIF, estimated that as many as 4 million people take part in boating activities in the UK each year (1994). In the height of the leisure boom in the late 1980's a detailed national survey suggested that by the year 2000, participants in water based recreation would increase from 4.88 million to 6.4 million (Leisure Consultants 1989). As a result it was thought that pressure on the marine environment may increase as demand for moorings and marinas grew. However, generally this rate of growth is not at present being realised in the UK where boating participation has been constant for a number of years (UKCEED 1999 in preparation).

4.1.2 Recreational user interactions

The effects of recreational activities on marine SACs are being addressed in another of the UK Marine SACs Project reports *Guidelines for managing recreational user interactions within UK European marine sites* (UKCEED 1999 in preparation). The study group will work along side governing bodies and recreational users to draw together best practice and research information on recreation in and around SACs. The Recreational user interactions report investigates the potential effects that may arise from the movement of recreational craft to and from harbours and marinas within and near European marine sites. The issues associated with water-based recreation that are covered in the report include the following:

- engine emissions,
- noise disturbance,
- vessel wash from recreational craft,
- antifouling paints,
- sewage and other waste discharges,
- disturbance to wildlife,
- boat generated waves and erosion, and
- the potential impacts associated with the provision of recreational infrastructure.

These guidelines do not seek to duplicate the work undertaken in the recreational task to identify and address the impacts of recreational activities in marine sites. While some of the issues listed above are specific to recreational activities, those covered in these guidelines are relevant to the management and operation of commercial and recreational ports/harbours alike, particularly where port and harbour authorities are faced with managing a range of commercial and recreational activities together. These issues are therefore covered together in the following sections of the guidelines:

- Section 3 Commercial port and harbour operations - vessel movements, vessel wash, noise pollution, safe navigation and user conflict, vessel management options and zoning, mooring and anchoring,
- Section 5 Dredging - dredging of recreational harbours, and
- Section 6 Waste Management - management of waste generated from recreational craft, including oil, sewage and garbage.

As the issues relating to the potential impacts of recreational harbour operations are covered elsewhere in these guidelines, the remainder of this section of the report focuses on the **process** of managing harbour activities in marine sacs and maintenance activities in port and harbours.

4.2 Harbour operations and plans and projects

There has been much concern about the impact of SAC designation on current activities and operations in harbours and marinas, particularly on essential maintenance activities. Many maintenance activities are essential to preserve human safety. As such they have priority over all other considerations. However, ports should observe a general duty to have regard to the environment and seek to minimise impacts. In the Solent, meetings have been held between English Nature and the Solent Harbour Masters and BMIF representatives to address these concerns and find a way forward. The agreements reached in those meetings form the basis of the following discussion on the process for looking at harbour activities in marine SACs.

In marine SACs there is a general presumption that present use will continue, unless there is evidence that it is causing deterioration or disturbance to designated marine features. This will be achieved by agreement through the management scheme process. However, changes (projects and plans) in marine SACs and SPAs are subject to ordinary planning and consent processes, including a requirement to assess significance for all projects and plans proposed in or near European marine sites and the need to carry out an appropriate assessment, where necessary. There is a requirement to determine whether proposed changes will have significant effects on the European marine site.

Typical operations and activities undertaken in recreational harbours are listed in **Box 18**. As the navigation authorities, harbours have a statutory duty to undertake a number of these activities in the interests of safety, these include the first group of activities. Others activities are essential to the commercial operation of recreational harbours who must evolve with the ever changing needs of their customers, who are increasing in number. In the spirit of sustainable development a pragmatic and balanced approach is needed from all involved in the SAC management scheme.

The range of harbour activities listed in **Box 18** can be divided into four main categories:

- maintenance of a structure in its present state,
- replacement of like for like,
- improvement of a structure, and
- new plans and projects.

The suggested management approach for dealing with these activities is discussed below.

Box 18. Selection of maintenance operations/activities and plans/projects in recreational harbours

- Maintenance, replacement and installation of :
 - navigation marks,
 - piles,
 - lights, and
 - vessel traffic schemes.
- Maintenance, replacement and installation of moorings using chains, piles and pontoons.
- Maintenance, improvement/extension and construction of :
 - slipways and
 - jetties.
- Maintenance of seawalls, flood defences and wave screens.
- Removal of wrecks.

4.2.1 Maintenance of structures and replacement of like for like

Activities that are required to maintain harbour and marina structures or to replace structures like for like, such as the renewal of piles or replacement of moorings, will continue as always. Only in the unlikely case that there is evidence to show that these activities are causing deterioration or disturbance of designated marine features will the problem need special measures to be taken. Above all, where genuine safety issues are involved, environmental considerations must not be allowed to delay action.

Within SSSIs, country conservation agencies normally issue a notice of consent, upon application, under Section 28 of the Wildlife and Countryside Act to cover ongoing operations. Such an approach can be used to cover maintenance activities in harbours and marinas whereby current activities can then go ahead without further approval. Agreement between harbours and country conservation agencies can be managed through the framework of a site management statement.

Where activities go beyond normal maintenance, such as a very large scale replacement programme that may require a pile driver or such to be brought on site, discussion should take place with the country conservation agency over matters such as the timing of operations to find mutually acceptable ‘windows of opportunity’ and appropriate working practices.

It is the small-scale maintenance activities that form the focus of these guidelines. Discussion of possible environmental effects that may result from these activities and suggestions for good working practice for minimising and coping with these effects is provided in the following section (**Section 4.3**). In many cases, these actions are already practised widely in UK harbours and marinas as part of every day management.

4.2.2 Improvement, enlargement or extension of structures

The improvement, enlargement or extension of existing harbour and marina structures are plans and projects under the Habitats Directive. Examples of these activities may include the extension of pilings and enlargement of slipways. In many cases works of this kind will be small in nature and result in small and acceptable changes. Due to their small-scale nature and the uncertainty which may exist on the extent of planning control below the low water mark, but within local authority boundaries, such works are often thought to fall into a grey area between operations/activities and plans/projects. However, under the Habitats Directive there is a requirement to determine whether all plans/projects

proposed within or near European marine sites are likely to have a significant effect on the site and to address the combined affects of many small developments occurring in or near a site.

The issue of combined effects has been the cause of much confusion, concern and debate, even at Government and EU level. Clear direction on how to consider combined effects is needed. Although further guidance on this subject is not available at this time, combined effects are under consideration by an Intergovernmental Habitats Steering Group. The process for addressing combined effects of such small works on existing harbour structures should be developed and described in the SAC management scheme. A strategic approach to addressing this issue will probably provide the best solution. Until the issues involved are resolved, agreement between relevant authorities and a common sense approach offer the only practical way forward. The process of considering major plans and projects to enlarge or extend existing harbour structures is described below.

4.2.3 New plans and projects

Harbour authorities have the power to undertake works or change to the use of land within their jurisdiction without need for planning consent, under General Development Order (GDO). However, under the Transport and Works Act 1992 it was made a statutory duty to balance nature conservation with their other duties, such as dredging and development. New harbour and marina developments, such as the construction of jetties or slipways, already require a multiplicity of consent from competent authorities under various legislation, including Habitats Directive, that also requires that each development is considered on a case by case basis and in combination with other projects. Under the Habitat Regulations there is a requirement to review permitted development rights within European marine sites.

PPG 9 suggests that a developer, taking advice from the country conservation agencies should consider whether the effect of the development is likely to be significant in terms of the conservation objectives for which the site was designated, either individually or in combination with other proposals. A flow diagram outlining the process that must be followed for all plans and projects considered to have a likely significant effect on a site is shown in PPG 9. This process includes the completion of an appropriate assessment to determine whether the proposed development will adversely affect the integrity of the site. Problems have arisen in the past over the interpretation of the concept of "significance" and "adverse affects on site integrity" when a developer has sought to promote a plan/project in or near a European marine site. For coastal developers there is a need for clear guidance and criteria for the application of these concepts and some basis for evaluating the likelihood of success if investment and hence growth is not to be inhibited. This process can be facilitated by early, pre-application discussions between the developer and the local country conservation agency, and any consultations will be dealt within the existing country conservation agency charter standards.

4.3 Maintenance activities

This section of the report examines the impacts that may result from the maintenance of harbour structures and vessels including:

- harbour and marina run off from the maintenance of harbour structures and boat cleaning areas,
- the use of biocides and detergents to clean harbour structures and fixtures and protect them from algal growth, and
- the maintenance of vessels in the harbour and the use of antifouling paints to protect against fouling of boats.

Many of the products that are used in the care and maintenance of infrastructure and vessels in port/harbour areas can be harmful to the environment, particularly if used in carelessly or in excess. Ports can only control maintenance activities on the port estate. Pollution arising from privately owned facilities is a matter for the Environment Agency which is the relevant authority responsible for the protection of 'controlled waters' from pollution under the Water Resources Act 1991. In general,

existing pollution control powers will be sufficient for the purpose of protecting marine SACs. However, in the context of SAC/SPA management their powers may only be used where the impacts relate to the features for which the site has been designated.

The main legislative controls over the activities involved in the maintenance of harbour operations are listed in **Box 19** and summarised in **Appendix F**. These are largely concerned with the use, storage and disposal of harmful substances and duty of care for the environment. Under the Water Resources Act 1991 it is an offence to cause pollution in controlled waters, either deliberately or accidentally.

Box 19. List of legislation and regulations concerned with the maintenance of harbour structures

- Control of Substances Hazardous to Health (COSHH) legislation.
- Environment Protection Act 1990.
- EC Directive on Biocides 1998.
- Food and Environment Protection Act, 1985.
- Health and Safety Executive (HSE) Regulations.
- Health and Safety at Work Act 1974.
- Town & Country Planning (Assessment of Environmental Effects) Regulations 1995.
- Town & Country Planning (Environmental Assessment and Permitted Development) Regulations 1988.
- Town & Country Planning (General Permitted Development) Order 1995.
- Water Resources Act, 1991.

The most wide ranging regulations covering maintenance activities is the Europe wide ban on the use of TBT (tributyl tin) based paints in 1987 for craft under 25m. The IMO have recently recommended a ban on the use of TBT in antifouling paints from January 2003 and the presence of TBT on ships hulls will be prohibited by 2008.

All of the biocides used in the marine industry in the UK have received provisional approval from the HSE and following a review process, copper may become the first biocide to obtain full approval. The recent EC Directive on biocides requires the evaluation of all biocides by the year 2008 with regard to their efficacy and safety to humans and the environment. Only substances having passed this evaluation, as 'low risk' or 'basic' substances, will be listed in Annex I of the Directive and can be placed on the market.

4.4 Environmental effects of maintenance operations

4.4.1 Maintenance wastes and marina/harbour runoff

Maintenance wastes can enter a harbour as a result of a number of activities including scraping old paint from vessels, cleaning pontoons, cleaning jetties and wharves or cleaning vessels. Within marinas and boatyards there are often commercial maintenance areas that are usually housed in large hangers, and there are also general boat areas where boat owners can carry out their own maintenance of craft, whether in dry berthing areas, against walls or on scrubbing grids. Within these areas pressure washing, scraping and painting operations take place (UKCEED 1993). As a result of spillages, debris and wastes produced during these activities, the waters used to wash down maintenance areas may contain a mixture of contaminants including oils, oil emulsifiers, paints, solvents, detergents, bleach, antifouling paint scrapings or sandblasting wastes.

Contaminated cleaning waters can be washed down into the harbour or marina basin directly or via the drainage system. Even when no chemicals are used in the cleaning of harbour structures and just water and elbow grease is applied, the runoff that enters the harbour may be contaminated with oil, debris, heavy metals or sediments from the surfaces of the jetties, pontoons and wharves. On occasion dirt, debris and spillages have been known to be swept directly over the side and into the water.

On entering the marine environment these pollutants can have harmful or toxic effects on the animals and plants. In many cases the effects may be temporary and minimal, however risks of possible adverse effects increase where cleaning agents and other chemicals are used incorrectly or in large quantities far in excess of needs. The dilution of wastes in the harbour waters means that in most cases any possible adverse effects will be only localised and temporary. However, there may be a problem where wastes are washed into enclosed waters, such as docks, or areas with low tidal flushing. The use of biocides, bleach and detergent in the maintenance of harbour structures and vessels are discussed further below.

Biocides and bleach

Fouling of harbour structures, such as slipways, steps, jetties, pontoons, can result in surfaces becoming covered in layers of bacterial and algal slime that must be removed. Obviously ensuring that walkways are safe for staff and the public is an important consideration in harbour management. A number of methods have been used to overcome the effects of fouling of both harbour structures and boats with variable success. These range from manual washing and scraping to the application of chemicals to kill and remove the fouling organisms (biocides). Unfortunately for the environment, in most cases the use of biocides is the simplest and most effective means of maintaining safe harbours.

Bleach is a popular solution used by a number of small ports and harbours to remove algae from slipways, ladders and steps. However severe damage can occur to the local marine environment where chlorine-containing agents, such as bleach, are used in large quantities at any one time. The impact of chlorine on the marine environment has been monitored for many years and has been shown to be toxic to shellfish and fish as well as causing the localised lowering of species diversity. The relatively widespread use of bleach is encouraged by the fact that it works very well as an inexpensive, easily applied biocidal agent, and there are few non-polluting alternatives which easily remove algae and prevent its occurrence for sometime. Practices such as pressure hosing or scraping are very labour intensive and often do not achieve a level of removal that is safe for the public (Rennis 1995). Where biocides and bleach must be used, dilution is the key to minimising the potential affects. One must also have regard to the possibility of the storage of contaminants in sediments and their accumulation in marine animals.

Detergents

Soaps and detergents are often used within harbours for general cleaning operations, particularly for cleaning vessels. When detergents enter harbour waters they can cause the formation of 'grey water' which contains phosphate nutrients that encourage algal growth. Under certain conditions, which depend on a number of variables (including background water quality and season), when present in low concentrations this can have the effect of enhancing plant productivity. When detergents are present in high concentrations the formation of algal blooms may occur. The breakdown of these blooms causes the removal of oxygen from the surrounding waters, which can disturb or suffocate sensitive marine animals within the area. The tendency for algal bloom formation is highest during the warmer spring and summer months.

4.4.2 Antifouling paints

Boat and ship hulls spend a large proportion of the time submerged in water and as a result they become prone to colonisation by marine micro-organisms, weed, barnacles and so forth. Fouling of craft increases the drag on the hull, which can lead to increased fuel consumption. The most effective means of protecting boats from the fouling is to apply a coating of antifouling paint which contains a biocide that is designed to leach into the almost static layer of water next to the hull preventing organisms adhering to the paint by poisoning the settling organisms. World-wide the use of these paints has made a significant contribution to the reduction of costs to maritime industry, through savings in fuel consumption, dry docking and maintenance costs (ICS 1997). However, their release into the marine environment has also been found to have harmful effects on non-target organisms, such as shellfish.

Much of the pollution problem associated with the use of antifouling paints derives from the traditional widespread use of the old types of paint. When these were first applied the leaching rate was high and more biocide was released into the environment than was necessary to control fouling, and when the paint aged, the rate of leaching was much lower, releasing too little biocide to be effective. Modern antifouling paints are carefully formulated to release biocide at a constant rate and in concentrations just above that needed to kill the juvenile organisms that cause the problems (BMIF 1997).

There are numerous types of antifouling paints, containing a range of different active ingredients, and varying in their longevity (and therefore their application rates), compatibility with certain substrates and leaching behaviour (Boxall, Conrad & Reed 1998). Antifouling biocides enter the environment during application of antifouling paint, leaching from paint into the surrounding water and during the removal of paint and discard of contaminated remnants.

Over the past two decades the most commonly used biocides in antifouling paints for recreational vessels and larger commercial vessels have been tributyl tin (TBT) and copper compounds, which are discussed below. There are non-toxic alternatives to the use of biocides in antifouling paints available, such as silicon-based paints which make the surface of the ship slippery so that fouling organisms have difficulty attaching themselves to the hull and are washed off as the ship moves through the water. At present these alternatives are less effective, but are undergoing further development.

TBT-based antifouling paints

For over thirty years TBT was the active agent in antifouling paints used extensively in the maritime sector. It has been described as one of the most harmful substances knowingly introduced onto the marine environment. In the 1980s it became apparent that the use of TBT was causing severe damage to non-target species in the wider marine environment, such as deformities in shellfish and mollusc communities, reduced growth of algae and toxic effects in young fish. The effects of TBT were particularly noticeable on dog whelk populations near harbours and marinas where female dog whelks developed into males (Loretto and Proud 1993).

Recognition of the widespread environmental affects caused by TBT resulted in the Europe-wide ban of its use in 1987 on boats under 25 metres. At present in the UK the use of TBT-based paints continues on larger vessels and it remains at present the most-effective means of controlling fouling. However, in November 1998 the IMO made the decision to introduce a world-wide ban in the use of TBT in antifouling paints for most ships from January 2003, a ban which has been in place for several years in some countries, such as Japan.

Pressure for a complete ban of the use of TBT in antifouling paints has been increasing with evidence that it is bio-accumulating in food chains, with particularly high levels being found in marine mammals (Iwata *et al* 1995). The reported effects of TBT in marine mammals include suppression of the immune system. Marine mammals (porpoise and grey seals) stranded along the coasts of England and Wales have been shown to be contaminated with low levels of butyl tin compounds. Whilst the levels of these tin compounds are lower than some of those reported for small cetaceans from other areas, such as Japan, the USA and the Adriatic Sea, further study is required of possible toxic effects of these compounds and the risk their accumulation poses to marine mammals in the UK (Law *et al* 1998).

It is recognised the IMO ban will need to be gradually introduced and its success depends upon the development of effective substitute paints. Paint manufacturers have been researching and developing alternative paints for some years, with varying degrees of success. At present copper antifouling paints present the best practical environmental option for a TBT alternative available to the marine industry. Phasing out TBT would be undermined if other paints were found to be more detrimental to the environment. The International Chamber of Shipping has stated that the antifouling coatings industry “seems to be seeing a way through the problem” (ENDS Report 1998), although they have warned that a full-scale switch would be at significant cost to the maritime industry. The IMO urges member states to encourage the use of alternative antifouling paint systems, pending the mandatory ban, and to set a timetable for the phasing out of TBT.

Copper-based antifouling paints

The ban of the use of TBT on smaller vessels has resulted in the shift back to the use of copper as the main biocide in the UK. Although copper is a naturally occurring element which is essential for metabolic processes in living organisms, it is also a widespread pollutant in industrial waters which can be one of the most poisonous heavy metals when present in excess. The main sources of copper contamination in the marine environment are from industrial discharges and atmospheric deposition, particularly from foundries and metal processing operations. Fungicides, wood preservatives and boat antifouling paints can also contribute to high levels of copper in the aquatic environment.

In general 95% of the UK recreational market is using some form of copper-based paint (UKCEED 1993). In a study commissioned by the Environment Agency, WRC estimated the amount of copper used on coastal leisure craft in the UK in one year was between 75,173 and 311,769 kg (Boxall, Conrad & Reed 1998). This study found the majority of copper in antifouling enters the marine environment through leaching, and that only a small proportion enters during the removal of antifouling paint, which occurs mostly by water blasting. However, the concentrated nature of the biocide in scrapings and cleaning residues may cause more of a localised environmental problem.

In addition to the widespread use of copper-based paints on leisure boats, they have also been tested on ocean going ships over 25m, particularly in the USA and Japan. There are potential drawbacks of the use copper-based paints, including an incompatibility with aluminium-hulled craft and the production of offensive odours. A new form of copper antifouling developed is the copper based gel coat, or epoxy, that is used widely in the United States. It is claimed that it lasts up to 15 years, but the cost is higher than the previous types of paint and it does not work as well. Certain fouling organisms are resistant to copper-based paints and they have now been supplemented by additional biocides known as booster biocides. Trials of alternative copper-based coatings with rapidly degradable boosting biocides on ships in Japan have claimed recent breakthroughs with equivalent performance of TBT products (ENDS Report 1998).

Although at present copper antifouling paints present the BPEO available to the marine industry, there are a number of potential environmental impacts that may occur from using copper antifouling paints. Copper present in the water and sediments can be accumulated by benthic animals causing, for example, reduced respiration rates and impaired growth in mussels, clams and other shellfishes (Conrad & Widdows 1997). The toxicity and accumulation of copper varies greatly depending on concentration levels, exposure, temperature and salinity, the presence of other metals and the type, size and age of the marine organism. It is therefore difficult to generalise about the toxicity of copper to marine organisms there is evidence that certain species of fish are sensitive to quite low levels of copper even though other species are tolerant of much higher levels. Benthic marine organisms are thought to be slightly more sensitive to copper than fish, although some species demonstrate a capacity to adapt to elevated levels.

There is limited information available on the environmental impacts on non-target species, particularly algae, associated with the use of the newer booster biocides, such as the herbicides irgarol and diuron. These studies are discussed in the Recreational User Interaction report (KCEED 1999 in preparation). Using a model to predict concentrations of antifouling in the environment, WRC have estimated that the six most common biocides used in antifouling paint for recreational craft, including copper (I) oxide, diuron, copper thiocyanate and 'Irgarol 1051', were present in marina waters in concentrations generally more than an order of magnitude higher than levels required for toxic effects on marine algae and fish (Boxall, Conrad & Reed 1998). However, it should be noted that these estimated concentrations were generally higher than levels actually measured in the marine environment and are likely to be an overestimate. An improved model is currently being developed for the HSE and the Environment Agency, which should provide information that will help to determine whether further control options are necessary.

4.5 Means of avoiding, minimising and addressing the potential impacts of maintenance operations

It can be seen from the literature review that it is possible for animals and plants found within marine SACs to be harmed as a result of maintenance activities undertaken in port and harbour areas. However any long-term adverse effects are highly unlikely to occur. Ports and harbours have no powers to regulate maintenance activities and marine runoff which is a matter for the marina or vessel operators to observe regulations which will be enforced by the environment agencies who are the relevant authority responsible for protecting controlled waters against pollution. Ports can, and should, support campaigns initiated by the environment agencies, such as encouraging the observance of their Pollution Prevention Guidelines for marinas and craft (PPG14) which contain guidelines for boat maintenance activities (**Appendix K**).

Maintenance activities undertaken to keep harbours working must comply with health and safety regulations and harbour authorities, managers and operators have a duty of care to prevent and minimise possible impacts on the environment. In most cases, these practices are considered sufficient to ensure that the effects of maintenance activities are insignificant in relation to the reasons for which the site was designated and any possible remaining impacts are likely to be only temporary and minimal in nature.

More serious environmental effects are generally only likely to occur as a result of poor working practices and accidents which may cause unnecessary or increased inputs of toxic maintenance substances and wastes into harbour waters. Encouraging staff to follow simple good working practice may reduce these possible impacts. Many UK harbours already do this. Where good working practices are considered insufficient to prevent an identified pollution problem, harbour infrastructure in outside maintenance areas can be modified to minimise the amounts of contaminants entering the marine environment. In such cases the cost of doing this needs to be weighed up against the possible environmental benefits. Public awareness of the steps taken in harbours to protect the environment needs to be increased. Suitable actions to reduce the possible impacts of maintenance activities in harbours, many of which are already in operation, are outlined below.

4.5.1 Educate and encourage

The education of staff and the public plays an important role in environmental management. The emphasis for environmental management in recreational harbours is placed on the use of voluntary approaches to educate and raise awareness of possible issues and to encourage sensitive operation among staff and harbour users alike. A wealth of environmental guidance and codes of conduct have been produced in recent years as a result educational campaigns aimed at boat owners and other harbour users (**Box 21**). However, similar guidance for harbour authorities and their staff remains largely unpublished.

Port and Harbour Authorities should provide information to all employees of harbours, marinas, and boat yards to raise awareness of:

- the importance of the area in which they work for its marine conservation features and the reasons why it has been designated as a marine SAC or SPA,
- the potential environmental impacts that may occur as a result of maintenance activities undertaken in the harbour area,
- more environmentally sensitive ways of undertaking maintenance activities, illustrating practical and economic benefits where they exist, and
- any future developments in finding effective alternatives to anti-fouling paints.

4.5.2 Good housekeeping

The majority of the potential pollution problems that *may* arise from maintenance activities within port and harbour areas can be avoided or minimised by ensuring that all employees follow simple good housekeeping practices and by the use of environmentally sensitive alternatives to damaging cleaning agents wherever practical. However, there will be cases when harbours are faced with no suitable effective alternative to the chemical already used and limited procedures available to reduce pollution. In such instances steps can be taken to reduce the amounts of substances being used in the first place. This type of environmental management is already widely practised in ports and harbours and examples of good working practices include the following:

- Staff should be required to sweep up all solid waste such as paintchippings and sandblasting wastes and place these in skips for land disposal.
- The occurrence of accidental spills of polluting substances may be reduced by keeping cans, bottles and tins securely closed when not in use, and ensuring that they are given safe storage according to health and safety requirements.
- Any spillage's of cleaning agents, paints and other maintenance products should be mopped up and never swilled over the side of jetties and wharves into the harbour waters.

- After cleaning operations, excess liquids and algal wastes should be contained and mopped up as much as possible.
- Where it is difficult to prevent direct discharge when cleaning jetties and pontoons, ports, harbours and marinas might discourage or where necessary prohibit the use of cleaning agents (detergents, bleaches or oil emulsifiers) and require that only pressure washing with harbour water is used for cleaning. However, this should only be carried out in areas where pressure washing is considered sufficiently effective not to compromise safety.
- To reduce the amounts of cleaning agents, such as bleach, being used in harbour areas they could only be applied to surfaces where there is a safety risk to the public or staff.
- High priority should be given to finding effective alternative means of cleaning harbour structures and vessels with the aim to discontinue the use of products that contain phosphates and chlorine. An example of this is the possible use of non-slip paint products as an alternative to other coverings on the surfaces of walkways to improve safety and possibly reduce the frequency of cleaning operations. Such paints are already used on boat decks and quaysides, however the paints are resins and therefore may pose a risk of pollution themselves in sensitive situations.

Where additional work is generated, such as sweeping up debris before washing down surfaces or more time consuming activities are adopted as an alternative to the use of cleaning agents, such as power washing, staff costs can be increased. However, equally the potential benefits and savings to be made by reducing or stopping the use of, often expensive, cleaning chemicals should also be considered and promoted. Boat owners and RYA club members are finding high pressure washing with water to be an effective way of removing natural growth and dirt from a variety of surfaces without the use of chemicals (Eardley RYA personal communication 1999)

The Environment Agency's guidance note on pollution prevention for marinas and craft provides specific guidance for those undertaking boat hull cleaning, painting and antifouling activities (**Appendix K**). This guidance suggests that all maintenance activities involved in removing and applying antifouling coatings should be carried out in dry docks or 'scrub off areas' wherever possible and that when maintenance activities occur near the waters edge, the use of suitable screening or barriers will prevent solids entering the water. Authorisation is required from the Environment Agency for the use of TBT antifouling paints on vessels over 25 meters.

4.5.3 Provision of reception facilities and other infrastructure for the collection of maintenance wastes

The provision of reception facilities for ship generated wastes is a statutory requirement for all 'ports and terminals', including marinas, boatyards, yacht clubs, private wharves, and public slipways (Section 6.4.1). Ports, harbours and marinas provide general-use skips and bins that can be used by employees and boat users for the disposal of non-hazardous maintenance wastes from the harbour area. In addition, special points for chemical waste disposal are often provided at major mooring points and dedicated boat maintenance areas for the collection of toxic substances, such as oils, antifouling paints and contaminated scrapings. Where these facilities are not currently provided, harbour authorities, managers and operators should give consideration to their introduction, bearing mind the scale of maintenance activities occurring the harbour, the potential for pollution entering the marine environment and not least of all the costs involved. The safe disposal of maintenance wastes in reception facilities can be encouraged by taking the steps summarised in **Box 20**.

Where pollution from port and harbour maintenance operations or ship or boat cleaning operations is identified as a more serious problem, the installation of infrastructure to collect maintenance wastes should be considered. This may include the provision of permanent 'scrub-off' facilities in boat maintenance areas, which collects residues from scraping and sandblasting. In order to prevent the direct discharge of contaminated cleaning wastes from harbour surfaces, infrastructure can be constructed that allows wash down wastes to be collected in a sump and certain contaminants to be removed before the water runs into the harbour or sewage drain system. This might involve building

| Port and Harbour Operations Potential issues, key processes & potential impacts | Considerations and comments | Potential impacts on marine sites Beneficial Minimal Adverse | Possible means of avoiding, minimising and addressing impacts |
|---|--|--|---|
| <p>Issue: Anti-fouling paints Key process: Toxic contamination Potential impact: Most anti-fouling paints are toxic. When allowed to accumulate in high concentrations in sediments they can be toxic to non-target marine organisms. The adverse effects of TBT on marine life are well known, particularly with regard to shellfish and molluscs. Copper-based anti-fouling paints are less toxic to non-target species, but may still have toxic effects in high concentrations.</p> | <p>The use of TBT anti-fouling paints on commercial vessels is at present the most effective option available. However, the IMO have recently decided to ban the use of TBT in antifouling paints. Research and development is ongoing to find and test alternative coatings. Copper anti-fouling paints have been relatively widely used on vessels and are the BPEO available to the marine industry at present. Toxic effects from copper to non-target species are only likely as a result of high amounts in sediments due to continued spills or careless maintenance operations. Non-toxic alternatives are also available, but are less effective.</p> | <p>Min/Adv</p> | <p>Develop guidance to encourage the careful use, handling, storage and disposal of antifouling paints in the harbour.</p> <p>Provide separate reception facilities for vessel maintenance wastes.</p> <p>Provide 'scrub-off' facilities to collect maintenance residues from boat cleaning operations.</p> <p>Consider the use of alternative anti-fouling agents, bearing in mind their effectiveness and operational efficiency.</p> |

Box 21. Useful operational and environmental guidance for recreational harbour operations

- Good Practice to Boating and the Environment (British Marine Industries Federation 1997).
- Guidelines for managing recreational user Interactions within UK European marine sites, CCW, UK Marine SACs Project (UK CEED 1999 in preparation).
- Navigate with Nature - Are you on Course? (UK CEED 1998).
- Pollution Prevention Guidance Note 14: Marinas and craft (PPG 14) (Environment Agency, 1996).
- PPG9 – Planning Policy Guidance on Nature Conservation (DoE 1994).
- The Code of Practice for the Construction and Operation of Marinas and Yacht Harbours (The Yacht Harbour Association 1992).
- Tide Lines- Environmental Guidance for Boat Users (Royal Yachting Association 1997).
- Managing Personal Watercraft: A guide for local and harbour authorities (BMIF *et al* 1999).

4.7 Good practice

In order to avoid, minimise and address potential environmental impacts arising from their operations, ports and harbours operating in or near European marine sites should:

- Educate, encourage and train staff to avoid and minimise pollution from maintenance activities, as far as is practical. This can be achieved by providing information to all staff to raise awareness of:
 - the importance of the area in which they work for its marine conservation features and the reasons why it has been designated as a marine SAC or SPA,

- the potential environmental impacts that may occur as a result of maintenance activities undertaken in the harbour area, and
- more environmentally sensitive ways of undertaking maintenance activities, illustrating practical and economic benefits where they exist.
- Ensure that all employees follow simple good housekeeping practices to minimise the amounts of harmful substances entering the marine environment as a result of maintenance operations. Staff should be required to:
 - sweep up all solid waste such as paint chippings and sandblasting wastes and place these in skips for land disposal,
 - mop up any spills of harmful substances and excess chemicals after cleaning operations and never swill them over the side of jetties and wharves into the harbour waters,
 - place ground sheets under boats during cleaning operations, where practical, and
 - use, handle and store harmful substances in a responsible manner in compliance with health and safety regulations.
- Use environmentally sensitive alternatives to harmful chemical agents when cleaning harbour surfaces, such as pressure washing with harbour water (where this method is effective enough to ensure public safety). Where there is no suitable effective alternative to the cleaning agent already used, consider only using cleaning agents such as bleach on harbour walkways where there is a safety risk to the public or staff from algal growth.
- Give high priority to finding effective alternative means of cleaning harbour structures and vessels with the aim to discontinue the use of products that contain phosphates and chlorine. Consider, where appropriate, introducing newsurfaces which require less cleaning.
- Provide adequate reception facilities for the safe disposal of maintenance wastes, including bins and skips for non-hazardous sweepings and debris and special points for the disposal of hazardous substances, such as concentrated cleaning chemicals, oils, antifouling paints and contaminated scrapings.
- Where good working practices are considered insufficient to prevent an identified pollution problem, harbour infrastructure in outside maintenance areas can be modified to minimise the amounts of contaminants entering the marine environment. This may include the following steps which will require a cost to the harbour that should be considered against the potential for environmental improvement:
 - installing permanent ‘scrub-off’ facilities to collect maintenance residues from boat cleaning operations,
 - constructing a bund around maintenance areas and collecting wastes in a sump to allow debris to settle out before the water runs into the harbour or sewage drain system, and
 - investing in a separator for oil to be removed from wash down wastes.
- Increase public awareness of the steps taken in harbours to protect the environment from the possible effects of maintenance activities.

5. Dredging and disposal

5.1 Background

5.1.1 Why dredge?

Dredging is a fundamental activity for most, but not all, ports and harbours. The Central Dredging Association states that “in its simplest form dredging consists of the excavation of material from the sea, river or lakebed, and the relocation of the excavated material elsewhere for disposal” (IADC/CEDA 1997). In ports and harbours dredging can be undertaken to meet a number of different objectives, which include the following:

- **Navigation:** to maintain or improve/extend navigable depths in ports, harbours, marinas and shipping channels which is usually a statutory requirement for port and harbour authorities.
- **Flood control:** to improve drainage or sea defence.
- **Construction and reclamation:** in support of coastal development or for the provision of foundations for civil engineering works, for example barrages, bridge piers and pipelines.
- **Mining/Aggregate:** to win minerals and aggregate materials from underwater locations (Aggregate extraction is the subject of a further report of the UK Marine SACs Project).
- **Beach nourishment:** to supply material to reinstate or improve the performance of a beach as a sea defence or an amenity.
- **Environmental:** to improve and clean up the environment, generally for the removal of contaminated sediments which is commonly called **demedial dredging**.

Box 22. Maintenance dredging

Maintenance dredging is the routine periodic removal of material in approach channels to port and harbour basins to maintain widths and depths in previously dredged areas to ensure the safe access for vessels. Maintenance dredgings are generally composed of sands and silts that have been recently deposited by siltation and must be removed in order to keep a channel or berth open for navigation at the defined design profile.

Maintenance dredging may vary from an almost continuous activity throughout the year to an infrequent activity occurring only once every few years. For the purpose of disposal licensing a general rule of thumb is applied, that if a period of over five years has lapsed between a new and previous dredge, the material will be treated as capital dredgings for disposal purposes due to its characteristics. However, this will be considered on a case-by-case basis.

In ports and harbours dredging may be required to deal with unforeseen circumstances, such as the movement of a sandbank across an entrance channel to a port which must be removed as a matter of emergency. From a disposal viewpoint this is considered as maintenance dredging.

Dredging for navigation purposes encompasses two main types, **maintenance** and **capital dredging**. These categories of dredging are defined in **Boxes 22** and **23** based on definitions provided by the following dredging specialists and organisations:

- Bray, Bates & Land 1997.
- Institute of Civil Engineers 1995.
- ABP Research, R462 1994.
- IADC & CEDA 1996.
- Bowles, MAFF personal communication 1999.

The main difference associated with these definitions relates to the renewal of existing consents and the application for new consents for the disposal of dredged material. The main reason a distinction is applied by the consenting authorities concerns the physical characteristics of the dredged material and how, or if, it will disperse during its disposal or beneficial placement and subsequently move away from the disposal site. Generally for capital dredging, there is unlikely to be as much information available about the characteristics of the material and an additional assessment is made to determine the potential environmental impacts and the predicted pattern of dispersal away from the disposal site.

In their guidance on European marine sites in England and Wales, DETR/Welsh Office describe dredging and disposal as an example of an activity which might occur in European sites (DETR & WO 1998). However disposal of dredged material is subject to consent and licensing, and therefore also falls into the definition of a project and plan which is “in general, any operation which requires an application to be made for specific statutory consent, authorisation, licence or other permission”.

This section of the guidelines focuses on routine maintenance dredging in ports and harbours that will be managed under the marine SAC management scheme. Ports generally have a statutory responsibility to maintain navigation for port users. This remit includes dredging to keep the navigational channels open and may include commercial agreements to maintain the channel at a certain depth for a specific customer. It is therefore imperative for ports, harbours and marinas to carry out dredging when necessary.

Capital dredging for new port, harbour and marina developments, includes the construction, extension or deepening of berths and navigation channels for access by larger vessels. These operations will, in general, require consent under the Harbours Act 1964 (or equivalent local Act) and will therefore be subject to the Assessment of Environmental Effects Regulations. Capital dredging will generally not be considered within the SAC management plan and is therefore not considered in these guidelines. However, the impacts of different types of navigation dredging can be generic to some extent, and case studies of capital dredging will be discussed where considered relevant to the development of SAC management plans.

Box 23. Capital dredging

Capital dredging for navigation purposes is the excavation of sediments to increase depths in an area, usually but not always for the first time, to accommodate the draft of vessels (to a depth that also allows for a siltation buffer zone). The name of this type of dredging derives from the implications that the work requires the payment of a single capital sum. Excavation generally takes place into ‘virgin’ material that is relatively stable and has become consolidated under the existing hydraulic regime. However capital dredging also includes the removal of material from previously dredged areas where sedimentation has since occurred and has not been disturbed by further dredging over a period of time. In such cases consolidation of the deposited material occurs and the physical properties of the bed will revert to similar characteristics to the virgin material and is therefore treated as capital dredged material.

As identified above, MAFF generally consider the time period required for this process to occur to be at least five years. With capital dredging the full range of materials may be encountered and soft materials, such as clays, sands and silts, can be mixed with stiffer clays, boulders and rocks. The additional assessment made by the consenting authorities on capital material may demonstrate that despite a period of consolidation, the material continues to exhibit the characteristics of maintenance dredgings and accordingly will be regarded as such.

5.1.2 Dredging and disposal in European marine sites

Between 20 and 40 million tonnes of material is dredged from English and Welsh ports, harbours and their approach channels every year, and in 1994 the amounts dredged were estimated at some 40 million tonnes (Lee *et al* 1995). However, the levels of dredging that take place varies greatly from port to port and from year to year. For example, whilst Milford Haven may only have a minimum requirement to undertake maintenance dredging in some years, in others the oil companies in the Haven have dredged substantial amounts. The variation in dredging effort in ports and harbours across the UK is indicated in Table 6, which provides estimates of the amounts of material dredged per year in selected SACs.

For example, the ports of the Severn Estuary were reported to dredge around 4.5 million tonnes of sediments in a typical year (Severn Estuary Strategy 1997), whereas in Strangford Lough only 2,000 tonnes were dredged a year (Portaferry Harbour personal communication 1998). In contrast, no dredging is undertaken at Millbay Docks and Sutton Harbour in Plymouth Sound, although small amounts of maintenance dredging activity is undertaken within the Dockyard Port of Plymouth.

In addition to undertaking maintenance dredging to improve or extend navigable depths in ports, harbours, marinas and shipping channels, it is also an important activity in the vicinity of lock and dock gates to ensure there is efficient operation and continued access to dry docks and basins.

Table 6. Indication of the variation in dredging effort in or near selected UK marine SACs

| Marine SAC | Port | Total estimated amounts of material dredged |
|--|---|---|
| Fal and Helford (England) | Falmouth Penryn Truro | 3,000-4,000 m ³ per year |
| Morecambe Bay (England) | Barrow Fleetwood Heysham Lancaster | 1,270,000 – 2,670,000 m ³ per year ¹ |
| Pembrokeshire Islands (England) | Milford Haven Pembroke Dock | 50,000 m ³ per year |
| Plymouth Sound and Estuaries (England) | Cattewater Harbour Millbay Docks Sutton Harbour Dockyard Port of Plymouth | None Very small amounts of maintenance dredging per year |
| Severn Estuary (England/Wales) | Avonmouth Bristol Cardiff Barry Newport Sharpness Gloucester Watchet | 3,460,000 m ³ per year ¹ |
| Strangford Lough (Northern Ireland) | Strangford Portaferry | 1,500 m ³ per year ¹ |

¹ converted from tonnes assuming that the material has a density of 1,300kg/m³

In the UK, the majority of material from maintenance dredging is disposed of at sea at about 150 licensed disposal sites (MAFF 1996; IMO 1997). Quantities of maintenance dredgings disposed to sea in England and Wales varied from 17.6 – 34.1 million wet tonnes between 1985 and 1993 (Murray 1994a). Gradual reductions in the amounts of material disposed of at sea have resulted from changes in port operations and dredging practices and the increased use of beneficial options for the disposal of sediments. Less than a quarter of UK marine SACs have disposal sites located in or near the site. These include four UK Marine SAC Project sites, namely Morecambe Bay, Fal and Helford, Solway Firth and The Wash, and a further seven sites, Moray Firth, Flamborough Head, Essex Estuaries, Thanet Coast, Solent Maritime, Severn Estuary, and the Pembrokeshire Islands. The amount of maintenance dredgings disposed within or near these sites varies greatly, as does the nature of the various disposal sites.

In recent years, all applicants for sea disposal licences for dredged material in the UK have been required to consider whether the material can be managed in such a way to derive environmental or other benefits or the potential for beneficial use of the material. Dredged material from ports and harbours have been put to a range of beneficial uses, including construction, agricultural and environmental uses. A number of ports and harbours within or near marine SACs are considering the feasibility of using dredged material for intertidal recharge schemes and saltmarsh restoration schemes. Small-scale schemes of this kind have been undertaken on an experimental basis at over 15 locations along the south east coast of England, including a number within the Essex Estuaries SAC. The Port of Truro has also been investigating the feasibility of mixing dredge spoil with china clay waste to produce a soil substitute for use in land reclamation on contaminated sites.

Whilst intertidal recharge schemes can provide long-term benefits of environmental enhancement and protection, the act of placing material over existing intertidal habitats has the potential to cause the same short-term impacts of any disposal operation, generally associated with smothering and increased suspended solids. In recognition of the dual nature of intertidal recharge schemes they are discussed both as an impact of the disposal of maintenance dredgings and as a means of addressing potential impacts arising from dredging operations.

5.2 Existing regulations for dredging and disposal

Internationally, more attention is being given to the importance of maintaining and protecting the marine and coastal environment. Regulation of activities involving dredging and disposal is a key element in achieving these goals. In the UK, such legislation has arisen largely from European and International Conventions. The majority of port undertakings, including maintenance dredging, are administered by statutory harbour authorities who are each governed by their own legislation tailored to the needs of each port (DoE 1995). The regulatory framework listed in **Box 24** provides for proper assessment of the potential effects of marine dredging and disposal on navigation and the environment are made and that measures are taken to minimise any adverse environmental effects where the impact is likely to be significant.

The regulator of the disposal of dredgings in England and Wales is MAFF, in Scotland it is the SOAEFD and in Northern Ireland it is the Department of the Environment for Northern Ireland (DOE(NI)). In order to dispose of dredged material in the sea a FEPA disposal licence is normally required from these regulatory bodies. The environment agencies regulate applications for waste disposal licenses for contaminated dredged material to landfill. Consent is also required from DETR Ports Division for certain marine works, including maintenance dredging and disposal, with implications on the provision of safety of navigation, under the Coast Protection Act 1949. However dredging activities in enclosed areas which exclude the tide, dredging under local Acts or dredging to remove anything causing obstruction or danger to navigation are exempt from obtaining this consent from DETR under Regulation 35.

As scientific knowledge advances and in response to new and revised legislation there will be some changes in the work required in order to obtain a licence for disposal. The consent procedure is often facilitated if detailed assessments of the effect of the disposal of dredged material including potential beneficial uses have already been carried out. Most of these issues need to be addressed irrespective of whether the dredging operation is within a European marine site.

Within marine SACs the renewal of licences for the disposal of maintenance dredgings, should be relatively straightforward provided that adequate information is provided in line with government guidance. In general, maintenance dredging has been carried out within ports, harbours and estuaries over several years if not decades and is in essence an intimate part of the sediment regime and dynamics of an area. It is widely acknowledged that there are gaps in the scientific understanding of hydrodynamics and sediment transport and therefore in some cases a monitoring programme may be required to establish that disposal has not caused unforeseen problems.

It is generally viewed that the existing regulations and controls (**Box 24** and **Appendix F**) provide the most suitable route to account for maintenance dredging within SAC management schemes. Certain methods of dredging operate by throwing material into suspension in the water column. As these methods do not involve disposal, they therefore fall outside the MAFF licensing process, and are regulated by the harbour authority.

Box 24. List of legislation affecting dredging and disposal activities

- Coast Protection Act 1949.
- Conservation (Natural Habitats & c) Regulations 1994.
- Deposits in the Sea (Exemptions) Order 1985.
- Environment Act 1995.
- Environmental Protection Act 1990.
- Food & Environment Protection Act 1985 (FEPA).
- Harbours Act 1964.
- Harbour Works (Assessment of Environmental Effects) Regulations 1998.
- Harbour Works (Assessment of Environmental Effects) (Amendment) Regulations 1996.
- Landfill Tax Regulations 1996.
- Waste Management Licensing Regulations 1994.
- Various local harbour powers.

FEPA 1985 meets the requirements of the London Convention 1972 and the OSPAR Convention 1992 in so far as they relate to disposal of waste at sea.

5.3 Environmental impacts of maintenance dredging and disposal

5.3.1 Range of potential environmental effects

The potential environmental effects of maintenance dredging are generally two-fold, firstly as a result of the dredging process itself and secondly as a result of the disposal of the dredged material. During the dredging process effects may arise due to the excavation of sediments at the bed, loss material during transport to the surface, overflow from the dredger whilst loading and loss of material from the dredger and/or pipelines during transport. Depending on where these activities take place, a European marine site may be affected by either dredging or disposal alone, by both activities or by neither.

In considering the environmental effects of maintenance dredging and disposal, the potential benefits of these operations should not be overlooked. These include the removal of contaminated sediments and their relocation to safe, contained areas, and the possible improvement of water quality made by the restoration of water depth and flow. There can be significant beneficial improvements from the use of clean maintenance dredgings to enhance mudflat and saltmarsh habitats, and to mitigate losses of intertidal land through sea level rise and capital dredging operations (Bowles, MAFF personal communication 1999).

The extent to which maintenance dredging and/or disposal might effect features in a SAC or SPA is highly varied and site specific, depending upon a number of variables including those shown in Box 25. Prediction of the potential effects that might be caused by maintenance dredging and/or disposal in a marine SAC cannot be made with any degree of confidence if these parameters are not known on a site-by-site basis. Generally, the potential impacts of dredging and disposal can be summarised as follows (IADC/CEDA 1998, ICE 1995, PIANC 1996):

- Removal of subtidal benthic species and communities.
- Short-term increases in the level of suspended sediment can give rise to changes in water quality which can effect marine flora and fauna, both favourably and unfavourably, such as increased turbidity and the possible release of organic matter, nutrients and or contaminants depending upon the nature of the material in the dredging area.
- Settlement of these suspended sediments can result in the smothering or blanketing of subtidal communities and/or adjacent intertidal communities, although this can also be used beneficially to raise the level of selected areas to offset sea level rise or erosion (short-term impact v long-term gain).

Box 25. Factors influencing the potential effects of maintenance dredging and disposal

- Magnitude and frequency of dredging activity.
- Method of dredging and disposal.
- Channel size and depth.
- The size, density and quality of the material.
- Intertidal area.
- Background levels of water and sediment quality, suspended sediment and turbidity.
- Tidal range.
- Current direction and speed.
- Rate of mixing.
- Seasonal variability and meteorological conditions, affecting wave conditions and freshwater discharges.
- Proximity of the marine feature to the dredging or disposal activity.
- Presence and sensitivity of animal and plant communities (including birds, sensitive benthic communities, fish and shellfish).

The impact of dredged material disposal largely depends on the nature of the material (inorganic, organically enriched, contaminated) and the characteristics of the disposal area (accumulative or dispersive areas) (SOAEFD 1996). The potential impacts of the disposal of maintenance dredgings on the marine environment, such as restricting the disposal of heavily contaminated sediments, is to some extent minimised through the FEPA licensing process by conditions imposed by the licensing authority.

The evaluation of the environmental effects of dredging and disposal must take account of both the short-term and long-term effects that may occur both at the site of dredging or disposal (near field) and the surrounding area (far field). The IADC and CEDA (1998) guide provides a useful table that illustrates the temporal and spatial scales in which various environmental effects of dredging might be

realised (**Table 7**). Near field effects are simply defined as ‘phenomena occurring within the geographic bounds of the activity, or less than approximately 1 km from the activity’, and far field effects as ‘occurring more than approximately 1 km from the activity’. However, other sources suggest that caution should be used when adopting an arbitrary distance to distinguish between near and far field effects, due to the site-specific nature of the potential effects that arise from dredging.

Table 7. Time–space matrix of potential effects associated with dredging and dredged material placement (IADC/CEDA 1998)

| | Near-field Environmental Effects (<1km) | Far-field Environmental Effects (>1km) |
|--|--|--|
| Short-term Environmental Effects (<1 week) | Dredging Turbidity Smothering/removal of organisms Reduced water quality | Dredging None generally expected |
| | Disposal Smothering of organisms Turbidity Reduced water quality Acute chemical toxicity | Disposal Offsite movements of chemicals by physical transport |
| Long-term Environmental Effects (>1 week) | Dredging Disturbance by shipping traffic Removal of contaminated sediment | Dredging None generally expected |
| | Disposal Altered substrate type Altered community structure Chronic chemical toxicity Bioaccumulation | Disposal Offsite movements of chemicals by physical transport and/or biota migration |

In addition to the environmental effects that may occur as **direct** result of dredging and disposal activities, we must also consider the environmental effects that may occur as a result of the physical changes to bathymetry and hydrodynamic processes that dredging makes. Although such changes may occur as a result of maintenance dredging, they are more commonly associated with capital dredging activities. These changes can be summarised as follows (IADC/CEDA 1998):

- alterations to coastal or estuary morphology, for example alteration of sediment pathways and changes to siltation patterns, which may affect coastal habitats and species in addition to marine ones,
- alterations to water currents and wave climates, which might effect navigation and conservation interests, and
- reduction or improvement of water quality.

Each of the potential effects from dredging and disposal are discussed in the following sections. It should be stressed that there will be few maintenance dredging and disposal operations in marine SACs where all of these potential effects will be realised.

5.3.2 Dredging: Removal of benthic animals

During all dredging operations, the removal of material from the seabed also removes the animals living on and in the sediments (benthic animals). With the exception of some deep burrowing animals or mobile surface animals that may survive a dredging event through avoidance, dredging may initially result in the complete removal of animals from the excavation site.

Where the channel or berth has been subjected to continual maintenance dredging over many years, it is unlikely that well-developed benthic communities will occur in or around the area. It is therefore unlikely that their loss as a result of regular maintenance dredging will significantly effect the marine ecology of SACs. However, certain marine species and communities are more sensitive to disturbance from dredging than others. For example, dredging where maerl beds (calcified seaweed) *Sabellaria* reefs (reef forming marine worms) are present may result in the irreversible damage of these sensitive, slow growing species. These are important habitats, generally associated with the Annex I habitat subtidal sandbanks, found in only a few UK marine SACs (Birkett *et al* 1998). It is, however, unlikely that such sensitive marine communities would develop in close proximity to the disturbed habitat of a regularly maintained navigation channel.

The recovery of disturbed habitats following dredging ultimately depends upon the nature of the new sediment at the dredge site, sources and types of re-colonising animals, and the extent of the disturbance (ICES 1992). In soft sediment environments recovery of animal communities generally occurs relatively quickly and a more rapid recovery of communities has been observed in areas exposed to periodic disturbances, such as maintained channels (Box 26).

Box 26. Recovery of benthic communities following dredging activities

A review of dredging works in coastal areas world-wide showed that the rates of recovery of benthic communities following dredging in various habitats varied greatly (Nedwell & Elliot 1998; Newell, Seiderer & Hitchcock 1998), which is indicated as follows:

| Location | Habitat type | Recovery time |
|-----------------------------|----------------|---------------|
| Coos Bay, Oregon | Disturbed Muds | 4 weeks |
| Gulf of Cagaliari, Sardinia | Channel muds | 6 months |
| Mobile Bay, Alabama | Channel muds | 6 months |
| Goose Creek, Long Island | Lagoon muds | >11 months |
| Klaver Bank, North Sea | Sands-gravels | 1-2 years |
| Chesapeake Bay | Muds-sands | 18 months |
| Lowestoft, Norfolk | Gravels | >2 years |
| Dutch coastal waters | Sands | 3 years |
| Boca Ciega Bay, Florida | Shells-sands | 10 years |

Recovery rates were most rapid in highly disturbed sediments in estuaries that are dominated by opportunistic species. In general, recovery times increase in stable gravel and sand habitats dominated by long-lived components with complex biological interactions controlling community structure.

These findings are supported by studies of the Georgia Estuary system, USA, which suggest that maintenance dredging has only a short term effect on the animal communities of the silt and clay sediments. Although almost complete removal of organisms occurs during dredging, recovery begins within 1 month and within 2 months the communities were reported to be similar to pre-dredge conditions (Stickney & Perlmutter 1975).

Other studies suggest that dredging impacts are relatively short term in areas of high sediment mobility (Hall, Basford & Robertson 1991). For example, the complete recovery of benthic animals in a channel in the estuarine Dutch Wadden Sea occurred within 1 year of the removal of sediments from this highly mobile sand environment (Van der Veer *et al* 1985).

5.3.3 Dredging and disposal: Suspended sediments and turbidity

When dredging and disposing of non-contaminated fine materials in estuaries and coastal waters, the main environmental effects are associated with suspended sediments and increases in turbidity. All methods of dredging release suspended sediments into the water column, during the excavation itself and during the flow of sediments from hoppers and barges. In many cases, the locally increased suspended sediments and turbidity associated with dredging and disposal is obvious from the turbidity 'plumes' which may be seen trailing behind dredgers or disposal sites.

Increases in suspended sediments and turbidity levels from dredging and disposal operations may under certain conditions have adverse effects on marine animals and plants by reducing light penetration into the water column and by physical disturbance (Box 27). For maintenance dredging, the extent of these environmental affects is near-field and temporary generally only lasting as long as dredging operations are taking place (ABP Research R707 1997; IADC/CEDA 1998).

Background suspended solid and turbidity levels in marine SACs are highly variable. In many estuaries and bays background turbidity levels are high, such as the Wash, the Severn, the Dee and the Mersey (Parr *et al* 1998). Organisms in these environments are able to tolerate continuous exposure to high suspended sediment concentrations, for much longer than would occur in most dredging operations (ADC/CEDA 1998; Peddicord & McFarland 1978; Stern & Stickle 1978). Marine plants and animals living in areas where the waters are normally clear may be especially vulnerable to the effects of increased suspended sediments. For example, fjordic sea lochs in Scotland tend to have very low turbidity levels as do the rocky coasts and rias along the west coast of England.

The degree of resuspension of sediments and turbidity from maintenance dredging and disposal depends on four main variables (Pennekamp & Quak 1990):

- the sediments being dredged (size, density and quality of the material),
- method of dredging (and disposal),
- hydrodynamic regime in the dredging and disposal area (current direction and speed, mixing rate, tidal state), and
- the existing water quality and characteristics (background suspended sediment and turbidity levels).

Dredging activities often generate no more increased suspended sediments than commercial shipping operations, bottom fishing or generated during severe storms (Parr *et al* 1998). Furthermore, natural events such as storms, floods and large tides can increase suspended sediments over much larger areas, for longer periods than dredging operations (Environment Canada 1994). It is therefore often very difficult to distinguish the environmental effects of dredging from those resulting from natural processes or normal navigation activities (Pennekamp *et al* 1996).

In most cases, sediment resuspension is only likely to present a potential problem if it is moved out of the immediate dredging location by tidal processes (Bray, Bates & Land 1997). Therefore when dredging in enclosed areas, such as within locks or dock basins, there is little likelihood that material will be transported to the wider environment and effect the marine features of the SAC. In general, the effects of suspended sediments and turbidity are generally short term (<1 week after activity) and near-field (<1km from activity). There generally only needs to be concern if sensitive species are located in the vicinity of the maintained channel.

5.3.4 Dredging and disposal: Organic matter and nutrients

The release of organic rich sediments during dredging or disposal can result in the localised removal of oxygen from the surrounding water. Depending on the location and timing of the dredge this may lead to the suffocation of marine animals and plants within the localised area or may deter migratory fish or mammals from passing through. However it is important to stress that the removal of oxygen from the water is only temporary, as tidal exchange would quickly replenish the oxygen supply. Therefore, in most cases where dredging and disposal is taking place in open coastal waters, estuaries, bays and inlets this localised removal of oxygen has little, if any, effect on marine life (Bray, Bates & Land 1997).

Box 27. General effects of increased suspended solids and turbidity levels

Increased suspended sediments can effect filter feeding organisms, such as shellfish, through clogging and damaging feeding and breathing equipment (Brehmer 1965; Parr *et al* 1998). Similarly, young fish can be damaged if suspended sediments become trapped in their gills and increased fatalities of young fish have been observed in heavily turbid water (Wilbur 1971). Adult fish are likely to move away from or avoid areas of high suspended solids, such as dredging sites, unless food supplies are increased as a result of increases in organic material (ABP Research R701 1997).

Increases in turbidity results in a decrease in the depth that light is able to penetrate the water column which may affect submerged seaweeds and plants, such as eelgrass *Zostera* species, by temporarily reducing productivity and growth rates (Parr *et al* 1998). The tolerance of eelgrass to high turbidity is indicated by the survival of a very sparse bed near the turbidity maximum of the Severn Estuary, which is one of the most turbid estuaries in the UK (Dee Davison Associates 1998). Although this demonstrates that eelgrass can survive in estuaries with high levels of suspended sediments, this bed declined greatly during the construction of the Second Severn Crossing which was associated with the adverse effects of smothering by the same sediments.

However, despite the temporary nature of the effect, if oxygen depletion were to occur during important life stages of sensitive species, such as the peak spring migration of salmon and sea trout smolt (young) through estuary and bay habitats, the effects could be adverse. The Environment Agency has the general duty to maintain and protect freshwater fisheries, including salmon and sea trout, with jurisdiction out to 6 miles from freshwater baselines.

The resuspension of sediments during dredging and disposal may also result in an increase in the levels of organic matter and nutrients available to marine organisms. This can result in two main effects:

- In certain cases, such as environments adapted to low nutrient conditions or sensitive to the effects of eutrophication which can simply be described as nutrient enrichment leading to the formation of algal blooms. These blooms can reduce the surrounding water quality by causing the removal of oxygen as the blooms break down or occasionally by the release of toxins which may disturb marine wildlife. The potential formation of algal blooms in coastal and estuarine areas is generally limited by high turbidity levels and tidal flushing (ABP Research R701 1997), however blooms are known to occur in certain marine SACs, particularly during spring and summer months.
- In other cases, increased organic material, nutrients and algal growth may provide more food for zooplankton and higher organisms, with possible knock-on effects on the productivity of the marine ecosystem. For example, there is evidence of increased productivity of benthic communities surrounding a disposal site in Liverpool Bay that receives considerable amounts of dredged silts. The beneficial effects are reported to be a result of organic enrichment from the dredged material and due to the stabilisation of sediments through the incorporation of fine organic matter (Murray 1994b). Increased suspended sediments as a result of dredging operations in the Walney Channel, Morecambe Bay may have resulted in increased numbers of filter-feeding brittlestar and an worm (George *et al* 1996). However, if the communities that are present in the vicinity of disposal sites rely on low nutrient levels then any nutrient enrichment is unlikely to be beneficial.

5.3.5 Dredging and disposal: Contaminated sediments

Although generally not heavily contaminated, much dredged material is subject to some contamination (Murray 1994b). A variety of harmful substances, including heavy metals, oil, TBT, PCBs and pesticides, can be effectively 'locked into' the seabed sediments in ports and harbours. These contaminants can often be of historic origin and from distant sources. The dredging and disposal processes can release these contaminants into the water column, making them available to be taken up by animals and plants, with the potential to cause contamination and/or poisoning. The likelihood of this occurring depends upon the type and degree of sediment contamination however, some remobilisation of very low levels of pollutants would be expected during many dredging campaigns.

Box 28. General effects of contaminants on marine life

- When found in sufficient quantities in the food chain, contaminants may cause morphological or reproductive disorders in shellfish, fish and mammals (ABP Research R512 1995).
- Generally young shellfish and crustaceans (oysters, shrimp, crab and lobsters) are much more susceptible to the toxicity of contaminants than adults (Connor 1972).
- Concentrations of heavy metals in most estuaries are too low to cause adverse effects on eelgrass *Zostera* (Dee Davison Associates 1998). Investigations into the effects of contaminants on eelgrass and the levels that cause sublethal affects is ongoing at the Plymouth Marine Laboratory (R. Covey English Nature personal communication 1998).

The highest levels of contaminants generally occur in silts dredged from industrialised estuaries. If low level contaminants are released into the water column during disposal, they may accumulate in marine animals and plants and transfer up the food chain to fish and sea mammals. The general effects of contaminants on marine life are summarised in **Box 28**. Monitoring has revealed no evidence of any toxic effects on nearby benthic communities at a disposal site in Liverpool Bay, which receives substantial quantities of moderately contaminated silts (Murray 1994b).

Although almost all dredged silts will contain some contaminants arising largely from the past industrial activities typical of many port and harbour locations, fortunately, the occurrence of very contaminated sediments is rare in the UK. The FEPA pre-licensing assessment process prevents the disposal of highly contaminated sediments in the marine environment, generally avoiding the occurrence of direct toxic effects on marine animals and plants.

In the UK levels of contamination in sediments that are to be deposited at sea are monitored by MAFF, SOAEFD and (DOE(NI)). No absolute thresholds of acceptable contamination levels are set, with no guideline or legislative standards. Instead levels of contamination in the sediments are compared with existing background levels in the local area. This pragmatic case by case approach allows natural variation between regions resulting from the local geology to be taken into account. In the absence of absolute values for UK sediment quality standards for marine disposal, it is sometimes useful to compare concentrations of heavy metals with standards adopted in other countries which are given in the IADC/CEDA guidelines, *The environmental aspects of dredging - 2b* (IADC/CEDA 1997).

Where elevated concentrations of contaminants are identified in the assessment process, CEFAS/SOAEFD/DOENI investigate the potential for direct biological effects on marine communities near disposal sites and may impose conditions on the dredging licence to minimise or avoid such impacts. When very contaminated sediments are found the means of managing the situation is agreed with the licensing authority and the national environment agencies. Occasionally, where the contaminants in the dredged sediments appear relatively recent, effort may be made to trace the pollution source in the waterways that lead to the port (ABP 1998). Similarly, beneficial use schemes that involve the placement of material below MHS (Mean High Water Springs) will also require assessment and licensing under FEPA legislation (IADC/CEDA 1997).

5.3.6 Dredging and disposal: Settlement of suspended sediments

Sediments dispersed during maintenance dredging and disposal may resettle over the seabed and the animals and plants that live on and within it. This blanketing or smothering of benthic animals and plants, may cause stress, reduced rates of growth or reproduction and in the worse cases the effects may be fatal (Bray, Bates & Land 1997). Generally sediments settle within the vicinity of the dredged area, where they are likely to have little effect on the recently disturbed communities, particularly in areas where dredging is a well-established activity. However, in some cases sediments are distributed more widely within the estuary or coastal area and may settle over adjacent subtidal or intertidal habitats possibly some distance from the dredged area.

The sensitivity of marine animals and plants to siltation varies greatly and discussed briefly in **Box 29**. In areas with high natural loads of suspended sediments, the relatively small increases in siltation away from the immediate dredging area are generally considered unlikely to have adverse effects on benthic populations. Assessment of the effects of siltation from capital dredging in Morecambe Bay concluded that some smothering of benthic animals was inevitable. It was suggested that given that the area is subjected to regular maintenance dredging of navigation channels and berths and that the adjacent subtidal and intertidal areas appear to be productive, it is unlikely that effects from the proposed dredging programme will have anything more than temporary and fairly localised impacts (ABP Research R707 1997). Post-dredge surveys of the deepened navigation channel to the Port of Londonderry, Lough Foyle, which is in close proximity to important commercial shell fisheries, indicated that with appropriate care, substantial dredging works can be undertaken with no adverse effects on shell or other fisheries (Bates 1996).

Box 29. Examples of the varying sensitivity of marine animals and plants to siltation

- Animals with delicate feeding or breathing apparatus, such as shellfish can be intolerant to increased siltation, resulting in reduced growth or fatality (ABP Research R707 1997).
- Maerl beds (calcified seaweed) are reported to be sensitive to smothering due to channel dredging (Birkett *et al* 1998).
- In important spawning or nursery areas for fish and other marine animals, dredging can result in smothering eggs and larvae. Shellfish are particularly susceptible during spring when spatfall occurs.
- When smothering of intertidal areas occurs, there may be subsequent effects on the availability of animals and plants in bird/fish feeding areas.

5.3.7 Dredging and disposal: Changes to hydrodynamic regime and geomorphology

General statements about the impact of maintenance dredging on the hydrodynamics and geomorphology of a site cannot be made as the effects are site specific, very difficult to isolate from other 'forcing effects', such as sea level rise or reclamation, and are often little understood. Although all dredging activities can cause some change to the hydrodynamic flow, the magnitude and type of effect will be related to the overall size of the excavation compared to the overall size of the system. Most reported adverse effects of dredging on hydrodynamics and geomorphology of coastal and estuarine areas are associated with capital dredging operations. Examples of knowledge of possible effects of dredging on the hydrodynamics and geomorphology on selected marine SACs and other estuarine sites are summarised in **Box 30**.

Box 30. Reported possible effects of dredging on the geomorphology in selected European marine sites

The current pattern of dredging in the Solent is reported to have altered the sediment regime and environment, however there is no evidence of long-term damage (Solent Forum 1997).

The Falmouth Bay and Estuaries Initiative (Cornwall County Council 1995) states that the impact of dredging on the sediment budget of the area is unknown and there is a need for more information.

Major channel deepening works in the approach to Harwich Harbour has altered the sediment transport regime (HR Wallingford & Posford Duviver Environment 1998). The capital dredge increased siltation in the harbour, which subsequently reduced the amounts of sediment input into the Stour/Orwell Estuaries and increased the requirement for maintenance dredging. The net effect is to increase mudflat and saltmarsh erosion in the estuaries, with adverse effects on intertidal morphology. In this case the capital dredge has created the conditions for increased erosion, which is sustained by the regular removal of sediment from the harbour for disposal at sea. A mitigation package has now been devised to offset this effect.

Capital dredging operations in an estuary may permit a saltwedge intrusion to travel further upstream than previously, increase shoreline wave action, change tidal range, tidal currents, suspended sediment load and suspended sedimentation in areas away from the deepened part of the river (PIANC in preparation). The hydrodynamic changes and their effect on sediment erosion, deposition and transport may cause secondary geomorphological changes away from the dredge location, including the potential erosion of intertidal areas. These processes are affected by the sea bed sediment characteristics, underlying geology and, particularly on mudflats, the flora and fauna.

Since in many cases maintenance dredging is routine small changes in depth (relative to capital schemes) which for the majority of ports has taken place over a long period of time, the operation itself will have become part of the 'equilibrium' of the system. In such cases, a cessation of maintenance dredging could cause greater environmental change than continuing to dredge. However, this can not be used as justification for the continuation of dredging activities that are damaging designated features.

The overall effect of maintenance dredging on the hydrodynamics and geomorphology of a site has all the complexity of a capital scheme but the impacts are much smaller. In many cases the magnitude of dredging related alterations may fall well within the range of naturally occurring phenomena and probably impose little or no additional stress to marine features (ADC/CEDA 1998).

The siting of the disposal site could, however, cause a regular removal of sediment from the transport system which could affect the erosion and sedimentation processes and ultimately the form of the estuary, possibly depriving downstream coastal areas of sediment required to maintain coastal stability (Bray, Bates & Land 1997). Equally if the sediment is placed back within the same system, although the net change is insignificant the locations of maximum sediment concentration may change promoting additional siltation in specific areas. Increased erosion of mud and sand flats may have numerous implications on the ecology of marine habitats and species. For example a reduction in the lower intertidal area may lead to reduced intertidal communities and a subsequent loss of bird feeding grounds, to the possible benefit, however, of a better fish breeding grounds (Wedwell & Elliott 1998). By contrast, careful design of disposal can result in intertidal areas being increased.

5.3.8 Disposal: Discharge of dredged material at the disposal site

When the maintenance dredgings are disposed of at sea they will have a blanketing and smothering effect on benthic organisms in the immediate disposal site. The continual disposal of maintenance dredging at disposal sites may prevent the development of stable benthic communities, and the partial or complete loss of benthic production is an adverse effect which has to be accepted within regularly used disposal sites (Murray 1994b).

With the exception of the initial smothering of benthic communities at the disposal site which is inevitable, the potential for other effects to possibly occur as a result from disposal operations will be site specific, depending on the characteristics of the dredged material and the hydrodynamic conditions at the disposal site. These potential effects at the disposal site are minimised under the FEPA licensing process, irrespective of whether it is in or adjacent to a marine SAC, which is regulated by MAFF, SOAEFD and DOE(NI).

The finer the material and the greater the energy at the disposal site, the greater the possibility of increased suspended sediments and of far-field effects. However, as mentioned previously, these far-field effects of turbidity and smothering are generally only of high concern in areas of low background levels of suspended solids. Adverse effects may occur if these dredged materials settle out over communities adapted to and dependant upon clear conditions, such as clean swept gravels supporting rich sponge communities.

Disposal sites located in shallow and low energy areas may accept small amounts of fine dredged material occasionally, which is dispersed by tides and waves, ensuring that material does not build up at the site with no effects on adjacent communities. However, if the disposal site is overloaded with large quantities of maintenance dredgings over a short period, shallowing of the disposal site can occur and smothering can adversely effect areas of adjacent subtidal habitat. In contrast, disposal of dredged material may have beneficial effects through the creation of new subtidal or intertidal habitat, depending on the location of the disposal site. Examples of these effects are given in **Box 31**.

Box 31. Selected examples of the effects of the disposal of dredged material

- A disposal site near Ramsgate (Thanet Coast SAC) is regularly used for the disposal of small amounts maintenance dredgings without apparent adverse effects on marine ecology. However, disposal of larger quantities of material at the site resulted in the blanketing of adjacent areas and disturbance to local lobster fisheries (Murray 1994b).
- The disposal of capital dredgings offshore of Harwich is reported to have incidentally created a lobster habitat (Murray 1994a).

Just as dredging within highly turbid environments has little effect on the tolerant benthic communities, disposal of maintenance sediments in suitable locations within such estuary systems can also have minimal effects. For example, the disposal of between 5-10 million tonnes each year of fine dredged sediments in the highly turbid environment of the Humber Estuary is reported to have little physical or biological effect as the sediments are redeposited within the estuary (Whitehead ABP Research personal communication 1998; Murray 1994b).

5.3.9 Disposal: Intertidal recharge

As mentioned previously, although intertidal recharge schemes can provide long-term benefits of environmental enhancement and protection, the act of placing material over existing intertidal habitats can cause all of the short-term impacts of disposal at sea (suspended sediments and smothering), bringing them into the often more environmentally sensitive environments of estuaries, inlets and bays. However, despite the short-term problems, intertidal recharge is often the only practical means of attempting to combat erosion of intertidal habitats caused by coastal squeeze and rising sea levels.

Recharge of intertidal habitats with dredged materials that are coarser than the present intertidal sediments, such as a mixture of sand, gravel and rock can be used to protect saltmarshes from wave attack and erosion (Carpenter & Brampton 1996). Although this technique has many benefits for flood

defence purposes, the use of coarse sediments to recharge intertidal mudflats changes their nature considerably in terms of sediment processes and animal and plant communities. A reduction in typical mud dwelling animals may result in reduced food supplies for feeding birds and foraging fish, but conversely the new material may provide alternative habitats for breeding and nesting birds. A major benefit of using coarser sands is that most of the sediment stays in place, with little or no sediment resuspension, and therefore no siltation of adjacent areas. This was an important consideration in the Blackwater Estuary schemes, where the local fishermen were concerned about potential effects on important shellfish populations in the vicinity of the recharge site.

A small number of experimental recharge schemes have been undertaken in UK estuaries using fine maintenance dredgings with varied levels of success (Carpenter & Brampton 1996; Kirby 1995a & b; Pethick & Burd 1996). The potential beneficial and adverse effects associated with disposing of fine materials over intertidal habitats are summarised in **Box 32**.

Box 32. Examples of short-term impacts and long-term benefits of intertidal recharge schemes using fine sediments

Short-term impacts

- Smothering of benthic animals and plants at the recharge site, particularly if sediment is placed on the intertidal at too high a rate. Smothering can occur during the initial placement of material or due to more gradual accumulation.
- Risk of material being lost from the recharge site. Redistribution of sediments may potentially cause increased suspended sediments and smothering of nearby sensitive communities, such as shellfish beds. However, these effects may be no worse than may occur during severe storms.

Long-term benefits

- The sediments can be retained within the estuary system and recycled into the intertidal habitats, replacing lost intertidal area.
- Clean fine dredged materials are able to support productive benthic communities, similar to natural intertidal flats and can be re-colonised by fauna at the recharge site and from adjacent areas.
- With appropriate planning and time the recharged intertidal habitat can closely resemble natural intertidal flats, both in appearance and function.

The US Army Corps of Engineers warns that providing short-term, long-term or permanent structures to protect a newly recharged site from wind and waves in moderate to high energy areas may be the only way sediments can be stabilised and used as a habitat (Landin *et al* 1995). Experience from trial schemes indicates that gravel bunds or other protective mechanisms can be used to retain fine sediments at the recharge site, which has been achieved in several schemes undertaken by Harwich Harbour (Carpenter & Brampton 1996). Recharges using coarse bunds are most suitable in situations where mudflats important for their bird or saltmarsh habitats are being rapidly eroded, with no realistic prospect of replacement by shoreline re-alignment, or where a relatively soft defence is required to protect a terrestrial asset which cannot be relocated. The material used to create the bund should be carefully selected so as to retain some limited mobility where placed. This allows it to be a flexible structure, capable of responding gradually to change, rather than what is effectively small-scale rock armour.

Other protective structures that may be used to retain material in place and to reduce the redistribution of sediments to adjacent habitats, include sand bags, straw bales, brushwood fences and water or sediment filled geotextile tubes. The initial findings of an experimental scheme in the Medway indicates that intertidal recharge at a slow rate, 'trickle feeding', can be achieved using fine materials without the need for bunds (Pethick & Burd 1996). However, this will not be the case in all locations.

Each proposed intertidal recharge scheme needs to be considered on a site by site basis weighing up the potential for short-term adverse impacts against long-term environmental gain. A long-term view will be taken in assessing such proposals and localised short-term damage will be accepted where there are long-term benefits, in terms of sustainable management of broader areas of intertidal habitats. This assessment may involve the country conservation agencies, licensing authorities and the environment agencies.

5.4 Means of avoiding, minimising and addressing the potential impacts of maintenance dredging and promoting benefits

Although historically the primary objective was to optimise dredging operations and economic benefits with little regard to the environment, today in most cases dredging projects are evaluated and managed to minimise adverse environmental effects, whilst still maximising economic and environmental benefits. There are existing procedures and regulations in place which are generally considered to effectively avoid and minimise the potential for maintenance dredging and disposal operations to cause environmental harm, particularly the requirements of the FEPA licensing process. In addition, in recent years dredging has become a more scientific process with greater emphasis being placed on continuous survey of the channels to minimise dredged volumes. Changes in dredging practice and port operations have greatly reduced the amounts of material dredged over the past decade. Improved dredging technology and position fixing equipment allows more precision which has resulted in real reductions in the amounts of materials dredged and deposited (Murray 1994a).

In most cases, existing regulations and careful dredging practice are sufficient to avoid the potential effects discussed above and there is no need for further steps to be taken. Where adverse effects are identified or a precautionary approach is considered necessary the following actions may be taken to avoid or minimise impacts, many of which are already in operation as part of careful dredging practice:

- managing and informing contractors,
- timing of dredging and disposal operations,
- selection of BATNEEC dredging methods,
- reducing amounts of maintenance dredging,
- promotion of beneficial use,
- selection of BPEO disposal sites, and
- monitoring and record keeping.

5.4.1 Managing and informing contractors

It is important that contractors are fully briefed by port and harbour management prior to the commencement of dredging and disposal works. Contracting procedures may include the requirement for method statements and risk assessments for operations to be provided by the contractors. These should be agreed by the port or harbour before the works are allowed to proceed (ABP Research R707 1997). When renewing contractors, CIRIA (1997) suggest that tenders should be considered from companies who can demonstrate through good performance on similar work and that they are competent to carry out the work required. When briefing contractors consideration should be given to the factors indicated in **Box 33**.

Dredger operators should follow proper safety procedures to avoid accidents and spills, and ports and harbours need to ensure that other vessel users are provided with adequate information and instruction to avoid conflict with the dredgers. In order to reduce the potential for contractor error resulting in adverse environmental effects, ports and harbours should endeavour to regularly monitor the operations of the contractor during dredging and disposal activities. Bearing in mind a port's duty as a relevant authority, with the possibility of judicial review of its actions, the written instructions given to dredging contractors, and documented monitoring of their performance take on a new significance.

Box 33. Issues to consider when briefing contractors about dredging works in European marine sites

When briefing a contractor consideration should be given to:

- providing information on the marine SAC/SPA and the features for which the site was designated, and if appropriate outlining areas which are particularly sensitive to the effects of dredging at specific times of year which were identified in the consent process as a constraints to dredging operations,
- timing of operations,
- hydrodynamic conditions at the excavation and disposal location,
- use of BATNEEC dredging methodology, and
- particular areas of the dredging and disposal operations where contractor error can cause adverse effects on marine features.

Within the last ten years education and training on environmental issues has risen up on the agenda. With regard to dredging, knowledge of the most effective techniques can only be gained through experience. Therefore it has been suggested that the relevant labour force should be educated on marine environmental matters to minimise the detrimental effects on marine species as a result of the dredging process (ICE 1995).

5.4.2 Timing

Where problems resulting from increases in suspended sediments have been identified in a marine SAC, the timing of dredging and disposal operations may be planned, where practical, in order to avoid and reduce any adverse impacts on sensitive marine features. Timing can be considered both in terms of the local hydrodynamics, with the aim of minimising sediment dispersion and the extent of the area affected, and the ecology of the system to avoid sensitive periods. Recognising that timing restrictions can add considerably to dredging costs, a view needs to be taken of the social and economic consequences of timing restrictions.

When planning the timing of dredging operations common sense needs to be applied. In addition to ecological considerations, operational factors also need to be addressed such as peak recreational and commercial periods in ports and seasonal weather conditions. Therefore, a balance between nature conservation and operational interests needs to be found on a site by site basis when planning dredging.

In order to reduce the movement of suspended sediment from the dredge area, dredging should be undertaken at the most favourable points in the tidal cycle. This will vary from site to site, with local hydrodynamic characteristics and the various methods of dredging undertaken. To limit the dispersal of suspended sediments, dredging activities may be able to be undertaken during high or low water. Dredging operations may also be timed to divert the movement of any suspended sediments generated from sensitive areas. For example, in order to reduce impacts to sensitive communities upstream of the dredging activities, such as shellfish beds, dredging operations can be limited to ebb tide (Murray 1994a). Conversely, where appropriate, by dredging on flood tides timing can be used to ensure that suspended sediment is retained within the system, instead of being washed out to sea. The disposal of dredged material may be timed to either maximise or minimise the removal of sediments from the disposal site depending on the nature of the site and the sensitivity of the surrounding habitats.

In order to limit levels of suspended sediments released during sensitive periods for animals and plants near the dredge and disposal areas, the dredge programme can be planned to avoid important breeding, migrating and spawning times, egg, larval and juvenile stages or periods of greatest growth. These sensitive periods vary with different animals and to some extent from site to site. Examples of some general sensitive periods are summarised in **Table 8**.

Table 8. Simplified examples of general sensitive times for selected marine animals and plants

| Type of organism | Sensitive stage in life cycle | Period |
|----------------------------|--|---------------------------|
| Benthic animals | Spawning | Spring |
| | Highest growth rates (shellfish) | Early summer (May-July) |
| | Highest numbers of eggs and larval stages (shellfish) | Early summer (March-July) |
| Fish | Migration of salmon and sea trout young (smolt) from rivers to the sea | Spring and early summer |
| | Highest numbers of eggs and larval stages | Early summer |
| Microalgae (phytoplankton) | Highest growth rates (highest potential for algal bloom formation) | April through July |
| Seals | Breeding | Summer |

It is important to be aware that the sensitive periods for different marine animal and plant species vary and in some cases, such as when also considering sensitive periods for overwintering waterfowl, this could restrict dredging periods to impossibly small windows of opportunity. In such cases a view will be required on what is the most important period throughout the year to avoid and measures may be recommended to mitigate the residual effect. Local country conservation agencies and other environmental organisations, such as RSPB, EA and country wildlife trusts, can advise ports and harbours on critical breeding, rearing and migration periods that should be avoided in order to minimise potential adverse effects on marine organisms in each European marine site. In most cases, such advice should be co-ordinated by the country conservation agency so that competing factors can be evaluated and a rational judgement reached which can be fully explained to the port.

5.4.3 Selection of dredging methods

Dredging practice and equipment has evolved considerably in recent years to increase dredging efficiency and to minimise the potential adverse effects on the environment (Bray, Bates & Land 1997; Bates 1998). To some extent the environmental effects due to the resuspension and settlement of sediments during the excavation process can be minimised by selecting the most appropriate method of dredging. A summary of the main dredging methods used in the UK, their potential to cause the resuspension of sediments and how dredging equipment can be modified to improve environmental performance is shown in **Appendix L**. The characteristics of the dredging sites have a significant bearing on the type of dredger which can be used and on the extent that precautions to minimise sediment resuspension are needed (Bray, Bates & Land 1997). Subject to appropriate modification, most types of dredger can be operated in a manner that does not cause excessive loss of sediment to the surrounding environment.

The type of dredger used may not be an important consideration for all dredging operations. For example when dredging in enclosed areas, such as docks or within locks, where there is little potential for any adverse effects on the wider marine environment or in highly turbid environments where any adverse effects due to sediment resuspension are unlikely. Consideration should be given to the type of dredger used where adverse effects on marine animals and plants due to suspended solids have been predicted which cannot be avoided by careful programming of the timing of the works. Assessments on the most suitable dredger to use must be made on a case by case basis, giving consideration to both practical and economic considerations. The type of dredger employed is often determined by the depth of water, scale of the maintenance operations, the type of material to be dredged, and can be a question of meeting supply and demand.

Protective silt curtains or screens can be used with certain dredging equipment (grab and backhoe dredgers) in order to decrease the amount suspended sediment being transported outside the dredging area or can be placed around sensitive marine features. The use of silt curtains is reported to considerably reduce the loss of suspended sediments from the dredge area, by up to 75% where current velocities are very low. However they are generally ineffective in areas with high wave action and current velocities which exceed 0.5 m/s.

Over recent years, certain dredging methods have been used in ports and harbours that are not presently regulated under the FEPA licensing process, such as water injection dredging or sea bed levelling (**Appendix L**). These methods operate by moving material from one place to another along the seabed and as sediments are not raised from the surface of the water, then strictly speaking no disposal takes place. Although the aim of these methods is to keep sediments in the vicinity of the seabed, there is potential for increased suspended sediments to occur possibly causing disturbance to marine animals and plants, especially where sediments are contaminated. Agitation dredging, which encompasses a number of different techniques, is an example of a type of operation that is outside the remit of FEPA. Unlike other types of dredging, as its name implies, agitation dredging aims to disturb sediments and raise them into suspension in order to move material through the water column. It is therefore inevitable that there will be greater increases in suspended solids and siltation levels, and subsequently the magnitude and extent of impacts on the nature conservation interests of the site may possibly be greater, although they may remain within the range of natural variation, depending on the local conditions at the site.

As with other types of dredging, where these dredging methods occur in systems with high background levels of suspended sediments there is likely to be little problem, however in other areas more caution may need to be applied particularly with regard to agitation dredging. Although, it should be noted that the amounts of material redistributed during agitation dredging may be no more than occurs during natural phenomena, such as storm events.

When these dredging methods are proposed within the harbour area, either by the port themselves or a third party, consideration by the port authority should be given to the potential effects of such an activity on safe navigation and the potential for effects on designated marine features. This should be based on information provided by those proposing to undertake the dredging, including answers to questions such as, where, when, over what area, how much material, and how often? When considering whether there are likely to be any effects on the communities of the designated features of the site, ports and harbours may consult with the country conservation agencies for advice. Any identified effects of the proposed activities on designated features should be addressed and minimised by careful operation and by planning the dredge to avoid particularly sensitive times, as described in these guidelines.

5.4.4 Reducing the amount of dredged material

The amounts of material dredged in UK ports and harbours has steadily reduced over recent decades as a result of changes in dredging practice and port operations, such as technological advances, greater dredging accuracy, and increased surveying of dredged channels. However from both an economic and environmental viewpoint, it is worth ports and harbours asking the question ‘Can maintenance dredging be reduced further?’ This question is being addressed by many ports and harbours in the UK and world-wide.

There are a number of options for reducing maintenance dredging in ports and harbours (Burt & Paipai 1996), including the following examples:

- A review of dredging practice by Tees and Hartlepool Port Authority Ltd. revealed two main improvements that would reduce the amounts of material dredged. Firstly, allowing over spill of the hopper caused materials to be deposited upstream which then needed to be dredged again later. Secondly, the estuary was being gradually deepened more than was necessary for safe navigation.
- The Port of Rotterdam re-defined the seabed in terms of a density measurement that acknowledged the existence of fluid mud through which vessels can safely navigate, thus eliminating the need to dredge such materials.
- In certain cases engineering solutions have been found to reduce siltation within maintained channels. For example, groynes have been constructed on the Diver’s shoal in the Thames Estuary which concentrate the flow in the navigation channel, encouraging self-scouring.
- Work has been undertaken in the Netherlands to find engineering solutions to reducing dredging requirements in small harbours and marinas through specialised design and construction (Stichting Antislib 1997). The feasibility of such schemes are being considered in the UK (Quinn, BMIF personal communication 1998).

5.4.5 Beneficial use

What is possible?

Between 1989 and 1994 the amounts of maintenance dredged materials disposed of at sea under license in England and Wales almost halved due to improved port operations and dredging practices and the increased use of beneficial options for the disposal of sediments (Murray 1994a). The gradual reduction in the amounts of material being deposited at sea provides a means of minimising the overall potential effects from the disposal of sediments on the marine environment. In addition there are powerful economic arguments for ports and harbours to minimise amounts of material dredged and disposed at sea.

There has been over a decade of beneficial use schemes undertaken and planned by UK ports and harbours, mostly providing uses for coarse dredged materials such as gravels and sands for construction or coastal defence purposes, such as beach replenishment schemes. Beneficial use schemes using fine dredged silts are becoming more common. The use of maintenance dredged materials for environmental enhancement, such as habitat creation and restoration, has increased considerably in recent years, particularly intertidal sediment recharge (foreshore nourishment) schemes which provide a means of combating the erosion of intertidal flats and saltmarsh (ICES 1992).

Intertidal recharge schemes have been applied on a largely small-scale experimental basis in over 20 locations in Essex and Suffolk using dredged material from the Blackwater Estuary and Harwich Harbour (Carpenter & Brampton 1996). These schemes have the potential to be applied to address erosion problems in a number of European marine sites. A selection of beneficial use projects using dredged material from UK ports and harbours are summarised in Table 9 (Murray 1994a).

Table 9. Selection of beneficial use projects using dredged material from UK ports and harbours

| Beneficial use | Dredged Area | Deposit Area | Amount of material | Year |
|---|-----------------------------------|--|---|----------------|
| Beach nourishment: Coast protection/amenity | Swash Channel, Poole Harbour | Bournemouth Beach | 1,240,000 m ³ sand | 1989 |
| Coast protection and habitat creation | Harwich Harbour | Peewit Island, Blackwater Estuary | 3000 m ³ sand/shingle | 1992 |
| Saltmarsh restoration/feeding | Harwich Harbour | Horsey Island, Hamford Water | <1000 m ³ silt | 1992 |
| Beach nourishment: coast protection/amenity | Midship Channel, Poole Harbour | Sandbanks | 35,000 m ³ sand | 1992 |
| Intertidal recharge: coast protection/habitat creation | Harwich Harbour | Numerous sites in Stour/Orwell and Blackwater Estuary, including Trimley & Parkeston Marshes | 1,160,000m ³ sand/ gravel, clay/silt & rock | 1994 |
| Saltmarsh restoration and stabilisation | Maldon, Blackwater Estuary | Maldon, Blackwater Estuary | - | 1995 |
| Intertidal recharge | Medway Port | Medway Estuary | 4,000 m ³ silt | 1996 |
| Restoration of derelict contaminated land | Port of Truro Channel | Truro | 3,000 m ³ silt | 1996 onward |
| Intertidal recharge: coast protection/habitat creation | Harwich Harbour | North Shotley, lower Orwell Estuary | 22,000m ³ silts | 1998 |
| Intertidal recharge: coast protection/saltmarsh restoration | Harwich Harbour | Horsey North and Horsey Beach, Hamford Water | 20,000m ³ silt | 1998 |

(Based on information in Legget & Dixon 1994, Murray 1994a, Dearnaley *et al* 1995; Carpenter & Brampton 1996; HR Wallingford & Posford Duvivier Environment 1998)

Although habitat creation and restoration using dredged material is still relatively rare in the UK, during the past decade over 40,000 hectares of wetland, both coastal and inland, have been restored, created or protected using dredged material in the USA (Landin 1998). Thousands of schemes have been undertaken, primarily by the US Army Corps of Engineers, and to a lesser extent by other public agencies, such as the US Fish and Wildlife Service, conservation groups and by developers for federal and state permit applications under the Clean Water Act. An overview of the range of types of restoration and creation schemes undertaken through the USA has been described in numerous US Army Corps of Engineers guides and reviews (Landin *et al* 1995; Landin 1998; US Army Corps of Engineers 1987).

What is practical?

Considering the sheer volumes of material dredged in the UK every year, about 40 million tonnes, it is impossible to conceive sufficient beneficial use schemes to use such large amounts. However, this highlights the potential for the use of dredgings for beneficial uses and the creation and restoration of habitats. Possible constraints to the use of maintenance dredging in beneficial use schemes are summarised in **Box 34**.

These possible constraints to the promotion of beneficial use of dredged material need to be considered by the management scheme, however many of them can be addressed. If beneficial uses are adopted in the UK more often and a greater understanding of the issues involved is developed, the significance of these constraints is likely to be reduced. In many cases, the economic benefits of reducing the amounts of materials disposed of at sea, in terms of savings in steaming time to offshore dump sites, provides incentive and motivation enough to encourage beneficial use schemes in ports and harbours.

Box 34. Possible constraints to the use of maintenance dredgings in beneficial use schemes

- The perception that dredged material is a 'dirty' waste that must be disposed of at sea. This perception is gradually being changed and dredged material accepted as a useful material.
- The options for beneficial uses of fine materials are limited and silts are generally unsuitable for engineering or aggregate purposes. Cohesive muds require time to de-water and consolidate before becoming stable enough to support engineering structures or mature plant and animal communities. The time required for stabilisation in many cases may be outside the timescale for reclamation schemes and needs to be considered in planning habitat creation and restoration schemes using dredged material. However, fine material is vital for habitat creation purposes.
- Finding suitable locations within an estuary for such schemes may not be easy. Appropriate disposal sites may be highly restricted by coastal development, the location of intake and outfall pipes, navigation channels, land ownership, and fisheries, in addition to the presence of sensitive animal and plant communities.
- The high rate of production of dredging plant compared to the rate of use needed for most beneficial uses.
- Beneficial use schemes generally take longer to plan, find resources, obtain permits and undertake, than disposal at sea. Once dredging is underway the material needs immediate disposal (Burt & Paipai 1996). This highlights the need for strategic planning.
- Difficulties have been encountered in some beneficial use schemes on land, which often involve dealing with many different regulatory bodies, including the EA under the Waste Management Licensing Regulations 1994. If such beneficial use schemes are to be encouraged in the future there is a need for all relevant regulatory bodies to work together and reach consensus over ways that current regulatory disincentives may be removed, wherever possible.

It is important to note that although the methods and techniques used to recharge and restore intertidal habitats in the UK are novel here, the methodologies used in these schemes have, in the vast majority of cases, been tried and tested elsewhere, particularly in the USA. Over the past 25 years the US Army Corps of Engineers have developed and improved techniques to place dredged material, whilst meeting environmental standards which has resulted in the completion of several thousand wetland restoration schemes. There are useful lessons to be learned from these schemes, the consideration, planning, design and construction of which are described in the US Army Corps of Engineers *Engineering and design manual for beneficial uses of dredged material* (1987).

There is increasing guidance available on the beneficial use of dredged material and procedures for developing economic and effective ways to use dredged material, including construction, agricultural and environmental uses. The practical guides prepared by HRWallingford and PIANC provide a useful basis for assessing what beneficial use options are realistic for different types of sediments, including maintenance dredging material (PIANC 1992; Burt 1996).

Case studies

The following case studies of beneficial use schemes are discussed further in **Appendix M** as an illustration of what is currently being achieved in the UK:

- Port of Truro, beneficial use of silts as capping material for the restoration of contaminated derelict land,
- Harwich Harbour, intertidal recharge using dredged sands and silts for coastal defence and habitat creation, and
- Medway Port, intertidal recharge (trickle charge) using silts to retain sediments in the estuary system.

Contaminated dredge material

In the USA the use of contaminated dredged material for habitat creation has been studied and undertaken for the past ten years and is considered to be the major innovation in beneficial uses (Brandon, Lee & Simmers 1992). In several other European countries including Denmark and Holland contaminated dredged material is treated so that it can be used beneficially. It may be possible to find out more information on the practicalities of the treatment of contaminated dredged material. However, the costs associated with these civil engineering treatment schemes are up to £80 per m³ whereas normal costs of disposal are of the order of £3 per m³. Therefore, with contaminated dredged material beneficial use to the port operator is not a practicable option. However, this may depend on what the material is used for. There is a need to find low cost practical ways of using material beneficially.

5.4.6 Selection of disposal options

Under guidance from MAFF, CEFAS, SOAEFD and DOE(NI), ports and harbours throughout the UK select the Best Practical Environmental Option for a sea disposal site which is considered carefully so as to avoid adverse effects on marine organisms from occurring. If the sediment is going to be disposed of on land, an equal amount of consideration should be given to the sediment type and the location and status of the site under guidance of the environment agencies.

The benefits of returning dredged sediments back to the estuary system are becoming increasingly recognised. Disposal of fine sediments at suitable locations within the estuary allows the dynamics of the system to be maintained and the morphological and ecological development of the estuary to be conserved. Examples of the application of this disposal option are given in **Box 35**. Disposal of dredged sediments within the estuary or coastal cell system has the additional benefit of reducing the costs incurred transporting materials to deep-sea disposal sites.

Box 35. Examples of the disposal of dredged sediments within the estuary system

In the Humber the dredged channel is maintained in such a way, feeding the whole estuary as dredged material is disposed and redistributed within the estuary. As much as 8 million tonnes of fine sediments are disposed in this way each year with little physical or biological effect as the sediments are redistributed within the estuary (Murray 1994b).

A similar approach is being proposed in the Stour/Orwell Estuaries by Harwich Harbour Authority to address the problems of intertidal erosion caused by capital dredge operations, which are being sustained by current disposal practices (HR Wallingford & Posford Duvivier Environment 1998).

Fine dredged sediments have been disposed and retained within the Medway Estuary system in a manner that is not harmful to the environment (Pethick & Burd 1996).

5.4.6 Monitoring and record keeping

In the licensing process for the disposal of maintenance dredged material, great emphasis is being placed on verification of the effect of dredging and disposal on marine ecology and sediment regimes, with increasing demands for pre and post dredge monitoring of disposal sites. The licensing authorities identify the potentially sensitive features to be monitored, if considered necessary.

It is suggested that monitoring programmes for dredging and disposal operations should be considered an essential part of the dredging project, particularly when contaminated dredged material is involved (Burt & Paipai 1996). CIRIA's good practice guidelines for dredging, support the undertaking of post-dredging monitoring of the nature and the rate of change of sediments within the navigation channels, to provide information which can be taken into consideration before the next maintenance dredge is carried out (CIRIA 1997).

In setting up a monitoring plan, it is essential to have site-specific, measurable, attainable and realistic objectives. PIANC stress that post-dredging monitoring plans need to be flexible to allow any unforeseen operational problems to be accommodated (PIANC 1996). There are five main steps for the development of a physical and biological monitoring plan for the dredge and disposal of material (Fredette *et al* 1990, cited in Burt & Paipai 1996) which are:

- defining site-specific monitoring objectives,
- identifying components of the monitoring plan,
- predicting responses and developing testable hypothesis,
- designing survey and sampling methods, and
- identifying management options and design of remedial works.

Further advice and guidance on setting up and undertaking monitoring programmes, before and after, dredging and disposal operations is provided in *Volume 3 of the Environmental Aspects of Dredging, Investigation, interpretation and impact* (IADC/CEDA 1998) and *Management of aquatic disposal of dredged material* (PIANC 1997).

It is generally considered good practice in ports and harbours, to keep organised, up-to-date records of dredging operations. These records should incorporate data from hydrographic surveys of ports and harbours which are undertaken on a regular basis for navigation purposes and indicate changes in sedimentation patterns within the dredged channels. Maintaining thorough records has a number of benefits, including:

- the need to dredge, or otherwise, can be clearly demonstrated,
- areas within ports and harbours where dredging can be reduced, or not undertaken at all, may be identified, and
- the collation of this information eases the path to the renewal of dredging licences.

5.5 Summary

Table 10. Summary of possible effects of maintenance dredging and disposal in European marine sites and suggestions for means of avoiding, minimising and addressing them (Ben = Beneficial, Min = Minimal, Adv = Adverse)

| Port and Harbour Operations Potential issues, key processes & potential impacts | Considerations and comments | Potential impacts on marine sites Beneficial Minimal Adverse | Possible means of avoiding, minimising and addressing impacts |
|--|---|--|---|
| <p>Issue: Removal of marine species at dredge site</p> <p>Key process: Physical damage (extraction)</p> <p>Potential impact: Dredging causes the removal of benthic animals at the dredge site.</p> | <p>The removal of benthic animals is unavoidable, however the communities within regularly dredged channels are likely to be degraded and there is relatively rapid recovery.</p> | Min | <p>Consider timing of dredge to avoid sensitive periods for benthic communities in the maintained channels.</p> |

| Port and Harbour Operations Potential issues, key processes & potential impacts | Considerations and comments | Potential impacts on marine sites | Possible means of avoiding, minimising and addressing impacts |
|---|---|---|---|
| | | Beneficial Minimal Adverse | |
| <p>Issue: Impacts of reduced water quality at the dredge site</p> <p>Key process: Physical damage (siltation) Non-toxic contamination (suspended sediments, turbidity & organic/nutrient enrichment) Toxic contamination</p> <p>Potential impact: Dredging and disposal causes temporary increases in the level of suspended sediments in the water column which can give rise to increased turbidity, and the possible release of oxygen depleting substances (organic or anaerobic sediments), nutrients and contaminants.</p> <p>The potential effects of these changes on marine life are:</p> <ul style="list-style-type: none"> • Temporary reduction of algal/plant growth due to increased turbidity. • Disturbance to sensitive benthic animals and fish due suspended sediments, which may cause temporary disruption of migration of fish. • Temporary disturbance of marine animals from the depletion of oxygen due to release of organic-rich material. • Nutrient enrichment possibly causing increased food supplies/algal blooms. • Uptake of contaminants by marine life possibly causing direct toxic effects or effects further up the food chain. • Smothering of benthic animals and plants due to resettlement of suspended sediments. | <p>The suspension of sediments is inevitable, the extent depends on magnitude and frequency of dredging, background water quality, type of material, methods used, channel size and depth, hydrodynamics and the proximity of marine features and sensitive communities. The effects tend to be short term (<1 week after dredge activity) and near-field (<1km from activity). Dredging often generates no greater suspended sediments than natural events or other human activities.</p> <p>Depends on background water quality, and proximity of algae/plants.</p> <p>Depends on background water quality, proximity of sensitive species, sediment type and timing.</p> <p>Only when dredging sediments with high organic content or very anaerobic sediments.</p> <p>Depends on sediment and water quality.</p> <p>Depends on sediment quality (most dredged material not polluted, generally low level contaminants).</p> <p>Some smothering inevitable, depends on hydrodynamic conditions and proximity of sensitive species.</p> | <p>Min</p> <p>Min/Adv</p> <p>Min</p> <p>Min</p> <p>Min/Adv</p> <p>Min/Adv</p> | <p>Select appropriate dredger to minimise resuspension of sediments.</p> <p>Consider timing to dredge and disposal at most favourable points in the tidal cycle to limit extent of effects.</p> <p>Use silt curtains where practicable.</p> <p>Consider timing of dredging to avoid sensitive periods for marine animals.</p> |
| <p>Issue: Impacts at the disposal site</p> <p>Key process: : Physical damage (siltation & smothering) Toxic contamination Non-toxic contamination (suspended sediments, turbidity & organic/nutrient enrichment)</p> <p>Potential impact: Disposal of dredged material at sea causes smothering of benthic communities at the disposal site and may cause disturbance and damage to adjacent subtidal and intertidal communities from increased suspended sediments (possibly containing contaminants, organic matter and nutrients) and smothering (see above). Disposal of dredged material may lead to the creation of new subtidal or intertidal habitat, either inadvertently (see below) or through planned sediment recharge schemes.</p> | <p>Smothering is inevitable at disposal site. The communities within regularly used sites are often degraded. Extent of impacts depends on the magnitude and frequency of disposal, background water quality, type and quality of material, size and depth of receiving area, hydrodynamics and the proximity of marine features and sensitive communities. The finer the material and greater the energy at the disposal site, the higher possibility of increased suspended sediments and far-field effects. Potential impacts are minimised under the FEPA licensing process.</p> | <p>Ben/Min/ Adv</p> | <p>Consider alternative beneficial use options to reduce amounts of material disposed at sea.</p> <p>Select BPEO disposal sites.</p> <p>The potential effects at the disposal site are minimised under the FEPA licensing process.</p> |

| Port and Harbour Operations Potential issues, key processes & potential impacts | Considerations and comments | Potential impacts on marine sites Beneficial Minimal Adverse | Possible means of avoiding, minimising and addressing impacts |
|--|--|---|--|
| <p>Issue: Changes in hydrodynamics and geomorphology at dredge and disposal sites</p> <p>Issue: Changes in hydrodynamics and geomorphology at dredge & disposal sites.</p> <p>Key process: Changes to physical regime (bathymetry, tidal flows, currents, waves & sediment transport) Erosion & accretion</p> <p>Potential impact: Alteration of bathymetry, tidal currents and sediment-transport processes in the dredge and disposal areas, may cause the alteration of erosion and sedimentation patterns in adjacent areas, which may result in erosion, or creation of intertidal and subtidal habitat.</p> | <p>Impacts are site specific and very difficult to isolate from other natural or man-induced causes (for example sea level rise or reclamation). Effects depend on the scale and frequency of dredge and disposal, and the local conditions at the dredge and disposal site (overall system size, hydrodynamics and sediment-transport processes). Adverse effects are more commonly associated with capital dredging. Generally impacts on geomorphology are little understood and need studying.</p> | <p>Min</p> <p>Min/Adv</p> | <p>Consider site capacity for sediment containment or dispersal when selecting a disposal site.</p> <p>Consider the disposal of sediments within the system where it is the best practical environmental option.</p> <p>Consider and undertake where possible beneficial use schemes for habitat creation/restoration.</p> |

Box 36. Useful technical and environmental guidance for maintenance dredging and disposal

- Beneficial Uses of Dredged Material - A practical guide (PIANC 1992).
- Dredged material management guide (PIANC 1997).
- Dredging a handbook for engineers (Bray, Bates & Land 1997).
- Environmental aspects of dredging (IADC/CEDA 1997/1998)
Consists of a series of seven reports of which four are currently available:
 - No. 1 Players, Processes and Perspectives.
 - No. 2a Conventions, Codes and Conditions: Marine Disposal.
 - No. 2b Conventions, Codes and Conditions: Land Disposal.
 - No. 3 Investigation, Interpretation and Impact.
 - No. 4 Machines, Methods and Mitigation.
- Guidance on disposal of dredged material to land (CIRIA 1996).
- Guidelines for the beneficial use of dredged material (Burt 1996).
- Handling and treatment of contaminated dredged material from ports and inland waterways (PIANC 1996).
- ICE design and practice guides (Institute of Civil Engineers 1995).
- Inland Dredging - Guidance on Good Practice (CIRIA 1997).
- Management of Aquatic disposal of dredged material (PIANC 1998).

5.6 Good practice

In order to avoid, minimise and address potential environmental impacts arising from their operations, ports and harbours operating in or near European marine sites should:

- Prepare contracts which meet the requirements of all licenses, consents and agreements applicable.
- Fully brief contractors prior to the commencement of dredging and disposal works. Contractor method statements for operations should be agreed by the port or harbour before the works are allowed to proceed. Consideration should be given to:
 - hydrodynamic conditions at the excavation and disposal location,
 - marine features for which the site was designated, if appropriate areas which are particularly sensitive to the effects of dredging at specific times of year, and
 - particular areas of the dredging and disposal operations where contractor error can cause adverse effects on marine features.
- Endeavour to regularly monitor the operations of the contractor during dredging and disposal activities.
- Ensure that dredging is undertaken in a manner that limits, as far as practically possible, the disturbance and dispersion of sediments from the dredger and barges, during dredging operations and transport.
- Consider timing of operation to avoid or minimise environmental effects. Seek guidance from local country conservation agencies and other environmental agencies where relevant, on the identification of the most appropriate times to undertake dredging to avoid or minimise disturbance to marine habitats, particularly sensitive animals, such as shellfish, young and migratory fish and over wintering waterfowl. But common sense must be applied and full consideration given to seasonal operational constraints.
- Ensure that the most suitable dredging equipment (BATNEEC) is used in order to minimise the suspension of any fine sediments and contaminants at the dredge site, where considered appropriate.
- Consider investigating practical means of reducing the amounts of material dredged, where possible.
- Use the best practicable environmental option for the disposal of dredged material, promoting its beneficial use or disposal within the sedimentary system wherever practical.
- Investigate the possibility of using dredged material for intertidal recharge schemes to combat erosion of intertidal habitats caused by coastal squeeze and rising sea levels. Seeking advice from country conservation agencies, licensing authorities and the environment agencies who will take a long-term view of such proposals and localised short-term damage will be accepted where there are long-term benefits, in terms of sustainable management of broader areas of intertidal habitats.
- Consider establishing post dredge monitoring programmes to verify the effect of dredging and disposal on marine ecology and sediment regimes, where MAFF have identified potentially sensitive features to be monitored if considered necessary.

Endeavour to keep organised, up-to-date records of dredging operations, incorporating data from regular hydrographic surveys, which may have the following benefits:

- the need to dredge, or otherwise, can be clearly demonstrated,
- the possible identification of areas within ports and harbours where dredging can be reduced, or not undertaken at all, and
- the collation of this information eases the path to the renewal of dredging licences.
- Consider carefully the proposal of dredging methods in the port or harbour which are not presently regulated under the FEPA licensing process, such as water injection dredging, sea bed levelling and agitation dredging, and where practical, undertake the above recommendations to minimise the potential impacts. Furthermore, ports and harbours should consider consulting the country conservation agencies when these types of dredging are proposed within the port area to ensure that nature conservation considerations are taken into account.
- Feed all available data back into SAC management scheme.

6. Waste management

6.1 Background

The general consensus of opinion at the Workshop on ports and harbours in marine SACs was that routine operational waste arising from port activities is not considered to be a major issue with respect to the management of European marine sites. However, ports and harbours provide the interface to the land waste management and disposal system for ships and boats. Operational waste from vessels, if not properly managed, can end up in the sea where the potential for contamination or pollution occurs. Therefore, the following section about port waste management will focus on waste generated on-board ships and boats that is discharged or collected for disposal in ports.

Section 75 of the Environmental Protection Act defines waste as “any substance which constitutes a scrap material or an effluent of other unwanted surplus substance arising from the application of any process”. The following types of waste managed within ports and harbours have been raised by certain ports and harbours operating within or near marine UK SACs as potential issues:

- oil,
- sewage,
- garbage,
- ballast water,
- anti fouling paint scraps and maintenance wastes (Section 4), and
- contaminated dredged material (Section 5).

The last two wastes listed above are considered elsewhere in the report, but the remaining issues will be discussed in this section. The above wastes generated or landed in ports and harbours that are discussed here can be broadly divided into four main sources, operational and domestic waste from ships and boats, waste from commercial cargo activities, wastes generated from maintenance activities and associated maritime industry activities and domestic (office) waste generated by port and harbour employees and users. The latter source is not unique to ports and harbours and its impact should be no more than results from similar activities in other coastal, non-port, locations provided it is disposed via normal routes (landfill, recycling or incineration). However, the other three sources of waste if not properly managed have the potential to cause possible impacts on wildlife within European marine sites, and should therefore be examined more closely.

It is important to stress that waste enters the environment of ports and harbours from many sources, which makes the identification of specific impacts from ship/boat or port/harbour generated waste very difficult. It is widely recognised that the majority of pollution entering the marine environment comes from land based sources and atmospheric inputs from land based industrial activities, with only an estimated 12% originating from shipping activities (GESAMP 1990). These land based inputs can be divided into a wide variety of sources which include sewage discharges, industrial effluent, agriculture, municipal and urban runoff.

Although both commercial shipping and recreational boating remain responsible for inputs into the marine environment through accidental, operational and illegal discharges, over the past few decades the industry has demonstrated a notable and improving environmental performance. There has been a significant reduction in pollution from all types of shipping, despite an increase in world waterborne trade. Global improvements in waste management have been largely attributed to the measures required by environmental legislation and international conventions, which are discussed below, most significant of which are the requirements of MARPOL 73/78. Improvements have been further facilitated by technological advances in safety and environmental protection, new ship designs, improved operational techniques and marine transportation activities. In the UK improvements have also been made as a result of the implementation of port waste management plans and increased awareness among port and harbour users of the problems associated with pollution from ships and boats. This has been promoted by a number of education campaigns, including those of the Maritime and Coastguard Agency (previously the Marine Safety Agency), Environment Agency, BMIF and the RYA.

6.2 Existing regulations

Under the Water Resources Act 1991 it is an offence to cause pollution, either deliberately or accidentally. It is the responsibility of the Environment Agency to regulate polluting activities in “controlled waters”, including rivers, canals, estuaries and coastal waters out to three miles. The most wide ranging and comprehensive legislation for the control, ashore and afloat, of waste arising from shipping activities is the International Convention on the Prevention of Pollution from Ships (MARPOL 73/78). The objective of these measures are to regulate and minimise pollution from ships by oil and other harmful substances. Annexes I, II, IV and V provide specific requirements for the handling and discharge of ship generated wastes in ports and harbours. Under the Merchant Shipping Regulations 1997, ports, harbours, terminal operators and marinas have a duty to plan for the provision of reception facilities for certain ship and boat generated MARPOL wastes. This waste management plan is subject to approval by MCA. Port and harbours have a statutory “duty of care” to take all reasonable measures to ensure that waste is safely contained and is only transferred to authorised persons under the Environmental Protection Act 1990.

Ports have a statutory duty to prepare plans to meet the requirements of the Oil Pollution Preparedness Response and Co-operation (OPRC) Convention. Under the Merchant Shipping (OPRC) Regulations 1998, the production of such plans is required on a mandatory basis for all ports and harbours that meet the criteria listed in **Box 42**. The control and approval of such plans is the responsibility of the MCA. Most relevant authorities will have a role in contingency planning. Where accidental minor spills in a harbour area occur from ships, the statutory harbour authority has powers to prosecute offenders. Other relevant authorities may be requested to assist in provision of evidence. Where the source of the spill is on land, the Environment Agency is the prosecuting authority, and the harbour authority should assist in the provision of evidence.

International protocols and conventions relating to pollution, safety and the introduction of non-native organisms apply to shipping and ports. However, in some cases there is no translation into UK legislation to meet control pollution of sewage and contaminated ballast water from ships at present. These issues are currently addressed by encouraging voluntary compliance with guidelines and codes of conduct, such as the IMO guidelines on the prevention of introducing non-native organisms in ships’ ballast water. The main legislation covering waste management and pollution in ports and harbours is listed in **Box 37** and is summarised in **Appendix F**.

Box 37. List of legislation covering waste management and pollution in ports and harbours

- Berne Convention on the conservation of European wildlife and natural habitats 1979.
- Biodiversity Convention 1992.
- Bonn Convention for the conservation of migratory species of wild animals 1979.
- Collection and Disposal of Waste Regulations 1988.
- Control of Pollution Act 1974.
- Control of Pollution (Landed Ships’ Waste) (Amendment) Regulations 1989.
- Environmental Protection Act 1990.
- International Convention on the Prevention of Pollution from Ships (MARPOL 73/78).
- Litter Act 1983.
- Merchant Shipping Act 1995.
- Merchant Shipping (Dangerous or Noxious Liquid Substances in Bulk) Regulations 1996.
- Merchant Shipping (Dangerous or Noxious Liquid Substances in Bulk) (Amendment) Regulations 1998.
- Merchant Shipping (Oil Pollution Preparedness, Response & Co-operation Convention) Regulations 1998.
- Merchant Shipping (Prevention of Oil Pollution) Act 1971.
- Merchant Shipping (Prevention of Oil Pollution) Regulations 1996.
- Merchant Shipping (Prevention of Pollution by Garbage) Regulations 1988.
- Merchant Shipping (Prevention of Pollution by Garbage) Regulations 1998.
- Merchant Shipping (Prevention of Pollution) (Law of the Sea Convention) Order 1996.
- Merchant Shipping (Port Waste Reception Facilities) Regulation 1997.
- Merchant Shipping (Reception Facilities by Garbage) Regulations 1988.
- Merchant Shipping (Reporting of Pollution Incidents) Regulations 1987.
- Prevention of Pollution (Reception Facilities) Order 1984.
- Prevention of Oil Pollution Act 1971.
- Prevention of Oil Pollution Act 1986.
- United Nations Convention on the Law of the Sea (UNCLOS) 1982.
- Water Resources Act, 1991.
- Wildlife and Countryside Act 1981.

6.3 Environmental impacts associated with wastes managed within ports and harbours

The above regulations and existing waste management and operational practices operating within ports and harbours, effectively reduce the amounts of port and ship waste that reaches the marine environment, particularly with regard to MARPOL wastes. However, no matter how carefully regulated and managed wastes are within a port or harbour, there will always be risks of accidental and illegal discharges from ships, port operations and other non-port related sources. This section discusses the potential for these wastes to cause contamination or pollution of the marine environment.

6.3.1 Oil

There are a number of ways that oil may be introduced into the marine environment, including the operational, accidental and illegal discharges from shipping (and to a lesser extent boating), tanker accidents resulting in major oil spills, dumping of industrial wastes, sewage and industrial discharges and atmospheric deposition. For ports and harbours located within urbanised areas, all of these sources are likely to occur. For many estuaries, inlets or bays chronic inputs (for example sewage and industrial effluents) are the most important source of oils. It follows from this that within the port environment port or shipping related activities might not be the only cause, or the major cause, of any oil contamination that may exist.

Over 80% of reported oil spills occur within port and harbour areas, however the majority are small in size and result from normal operations such as loading and bunkering (MPCU 1997). Other inputs may occur from the transport of oil in tankers, including the accidental or illegal discharges of tank washings and oil-contaminated ballast water. However, oil pollution is not only a concern of ports with oil terminals or commercial traffic, but small ports, harbours and marinas can also contribute to the amounts of oils entering the marine environment. Inputs from recreational craft are generally recognised as being insignificant in comparison to the inputs from commercial shipping (BMIF 1997), but can contribute to the potential effects of oil pollution in European marine sites. For example, sources of oil contamination in marinas include, spills of fuel and lubricating oils, exhaust emissions, wood treatment solutions, and run-off from marina parking lots (Voudrais & Smith 1986). These are common sources that also arise from shipping and maintenance activities in ports and harbours.

It is difficult to assess the effect of oil in the marine environment because of the large variation in sources, quantities, and nature of the oil, also the physical, chemical and biological conditions of the environments involved. The majority of research relating to the effects of oil on the marine environment relate to major oil spill events, usually from shipping accidents and groundings, the environmental effects of which are well known by all, particularly the associations with oiled birds and mammals. However, very little literature describes the effects of chronic discharges from run-off or numerous small discharges of oil, which are common in port and harbour areas. A summary of some of the potential effects of oil on the environment is shown in **Box 38**. As well as causing environmental damage, oil pollution can be very costly to clean up.

The containment, dispersal or clean-up of oil spills can greatly minimise the extent of the effects on the environment. The use of dispersants assists in the breakdown of oil, removing it from the water surface and preventing its spread, therefore timely use in the right locations may prevent oil spills reaching the intertidal and may avoid or reduce impacts on birds. However, they promote the penetration of oil into the sediments, potentially affecting shallow fishing grounds and other sensitive intertidal habitats. In cases where oil cannot be prevented from covering intertidal habitats it may sometimes be better left untreated and allowed to be removed by tidal action, as the clean up operations are often more damaging than the effects of the oil alone (Howard, Baker & Hiscock 1989). For example, considerable damage was caused by vehicles driving over eelgrass *Zostera* beds during clean-up operations following the Sea Empress spill (SEEEC 1996). All environmentally sensitive areas should be identified in the risk assessment.

Box 38. Summary of the potential effects of oil on the environment

- Marine animals and plants tend to be tolerant of low level concentrations of oil in sediments from chronic or small discharges, however this is not always the case.
- Exposure to major and minor oil spills can lead to the mass mortality of benthic communities, fish, marine mammals and birds, and the severe damage of saltmarsh.
- Conversely, the effects of major oil spills on marine habitats and species can often be temporary and non-fatal (for example *Zostera* beds were exposed to oil after the Sea Empress incident with little or no observable effects).
- Saltmarsh vegetation often recovers well after a single spill, however chronic pollution may cause the long-term loss of saltmarsh vegetation (Toft *et al* 1994). Different saltmarsh species show different tolerance to oil, with the result that repeated spillages may alter the community structure and allow tolerant species to become dominant (Field Studies Council Oil Pollution Research Unit 1994).
- Contamination of sediments with oil may modify chemical, physical and biological processes (Berge, Lichtenthaler & Orelid 1987). Contaminants can be trapped in the sediments and later released as a result of disturbance, such as erosion.
- In sediments, as it is organic, oil will be broken-down relatively quickly by micro-organisms which may result in the localised removal of oxygen from the sediments and surrounding water with possible effects on marine life.
- The persistent toxic constituents of oil, such as heavy metals, can become stored in the sediments and taken up into the food chain. Therefore, following large oil spills, even where animals recover in diversity and density, they may continue to suffer physiological and behavioural disorders which can result in reduction of growth and reproduction, and in the worse cases, death. For example, liver lesions in flatfish are associated with high concentrations of oil in sediments (Weston 1990).
- The breakdown of oil tends to be slowest in intertidal areas, which leads to the highest concentrations and longest residence times (Keizer *et al* 1978).

6.3.2 Garbage

Garbage enters the port and harbour environment via numerous pathways, both from on and offshore one of which is through overboard dumping from ships and boats. The International Chamber of Shipping estimates that between 1.4 and 2.5 kg of wet garbage and 0.5-1.5kg of dry garbage is produced per person, per day on medium sized ships. Many vessels, especially passenger ships have sophisticated onboard systems virtually to eliminate this type of waste. Nevertheless many ships and boats rely on adequate and convenient reception facilities being available in ports and harbours for the disposal of garbage. Inadequate reception facilities may discourage users from disposing of their litter responsibly ashore, and may lead to garbage being disposed of overboard at sea. The development and implementation of mandatory waste management plans for ship generated waste in UK ports and harbours under the Merchant Shipping (Port Waste Reception Facilities) Regulations 1997 is addressing this problem.

Shipping is estimated to contribute between 10 and 20 % of the world's marine debris (Sheavly 1995; Faris & Hart 1994). The Marine Conservation Society's (MCS) Beachwatch survey in 1997 indicated that 14% (221 items/km) of the litter items found in survey areas along the UK coast were attributable to shipping. This made shipping the second largest source of debris in the marine environment in this study, after tourism (MCS 1998). However, present methods of determining the sources of litter wastes on beaches are far from scientifically rigorous. Efforts are now being made to bring a measure of standardisation to beach surveys and to improve methods of determining the sources of items of litter found on beaches (Earll 1998). The OSPAR Convention on the protection of the marine environment of the north-east Atlantic is undertaking a pilot project to monitor beach litter, among the objectives of which is to develop and test a harmonised survey protocol. Using current information the MCS revised its sourcing methodology and found that in the 1998 Beachwatch survey under 3% of the litter in the marine environment was attributable to shipping, making it the fourth largest source of debris in the UK (MCS 1999).

In most areas ships can safely and legally dispose of biodegradable wastes, such as ground paper and food wastes, overboard at least three miles offshore where they may provide a food source for marine animals, but within three miles of the coast even biodegradable items should not be thrown over board. However, the North Sea and the English Channel are MARPOL Special Areas for Garbage where the

disposal of any garbage into the sea is prohibited within 12 miles of land. It is the disposal of non-biodegradable items, particularly plastics, that poses a growing threat to marine life. The strength and durability of plastics make them very persistent, and they can be transported by currents and winds, sometimes great distances, to form accumulations of litter along certain beaches and other sinks. The Marine Conservation Society (MCS 1998) stress that the impact of litter on marine species and habitats is difficult to assess because of lack of research in this area.

Box 39. Summary of the potential impacts of marine litter on the environment (Laist 1997; MCS 1998; EA 1998; Fowler 1985; Westcott *et al* 1994)

- Larger pieces of debris, such as sheets of plastic, may cause smothering of benthic animals and plants in intertidal and subtidal habitats and abrasion of debris against hard sediment surfaces may cause damage.
- Plastic litter, including litter from ships such as plastic bags and strapping bands, can have adverse affects on birds and marine mammals, including dolphins and seals, as a result of entanglement and ingestion. However, discarded fishing nets and lines are the most common damaging items.
- Floating garbage items can also provide a means of transport for harmful aquatic organisms.

The impacts of marine litter on the environment are summarised in **Box 39**. A number of reviews (MCS 1998; EA 1998) provide case studies in the UK and abroad of damage and fatalities caused to marine mammals and birds by plastics. It is estimated that one million seabirds are killed annually world-wide by ingesting marine litter and entanglement (Huggett personal communication 1998). However, no examples have been given of such impacts occurring to designated marine mammals in SACs. In general, the effects of ship generated litter on marine are likely to be minimal and short-term in nature.

6.3.3 Sewage

There has been little or no research made on the amounts of sewage discharged into port and harbour areas during operational shipping or recreational activities. The major contributor to aquatic pollution in estuary and coastal areas is human sewage from population centres that is discharged from waste treatment plants. The adverse health, environmental and aesthetic impacts from sewage contamination in recreational coastal areas are well documented, and numerous environmental parameters, particularly microbiological, are continually monitored throughout the UK by the environment agencies (EA/SEPA/DOENI) and local authorities.

In accordance with MARPOL regulations, legal discharge of untreated sewage from ships normally occurs over 12 miles from the coast, which is further offshore than from the, so-called, long sea outfalls from land treatment plants. Legal discharges of treated or untreated sewage wastes from ships will not therefore effect marine SACs. Illegal discharges from commercial craft close inshore or in ports where they can be observed are unlikely to take place. Another source of sewage in the marine environment is that from recreational craft that tend to congregate in large numbers close inshore where the effects of uncontrolled discharge are most noticeable. Although increasing numbers of craft are fitted with holding tanks, their effectiveness depends on the availability of onshore waste disposal reception facilities. The provision of such facilities is generally uncommon, but increasing in UK harbours. Sewage may affect the marine environment in three main ways, through oxygen depletion, causing disease, and by nutrient enrichment, which are discussed in **Box 40**.

Box 40. Possible effects of high concentration of sewage entering the marine environment from recreational craft

Oxygen depletion: When sewage decomposes it uses up oxygen from the surrounding water and if the discharged concentration are too great, the amount of oxygen available for fish and other aquatic animals and plants will be insufficient and they may die.

Disease: Sewage can contain disease causing bacteria and viruses which pose a risk to public health for swimmers and those eating contaminated shellfish.

Nutrient enrichment: Sewage discharges also contain nutrients which when elevated slightly may increase algal and plant growth under certain background conditions. However, when present in high concentrations nutrients can be responsible for the formation of algal blooms which reduce light penetration through the water column, may produce toxins and can cause oxygen depletion when decomposition takes place.

Although under certain conditions sewage discharges from recreational craft may disturb marine wildlife, the extent to which this represents a problem in ports and harbours within European marine sites needs to be considered on a site-by-site basis. The amounts of sewage entering the marine environment from recreational craft needs to be considered in perspective with the far greater amounts entering from land-based sources. The impact of sewage from recreational craft in marine SACs will vary depending on the amount of sewage being disposed of into the water, background water quality, temperature, and volume of water and tidal movement. The effect is likely to be the greatest in enclosed areas and shallow water with little or no tidal flow in the summer and autumn when temperatures are at their highest, coinciding with the peak of the boating season.

In addition to the sewage itself, the chemical additives held in portable toilets and holding tanks such as chlorine, ammonium and zinc are toxic to marine life and therefore may potentially affect marine animals and plants. Bearing in mind that many yachtsmen use shore based marina facilities and some use holding tanks, recreational craft may be considered a minor contributor to sewage pollution. However, although boats discharge relatively small amounts of sewage, what is pumped out is often very concentrated and therefore has a high demand on oxygen levels (MIF 1997) and therefore it may present a localised problem to marine life under certain conditions.

6.3.4 Ballast water

The movement of vessels around the world requires the intake of ballast water to give them a safe degree of stability when light. This disposal of water, when it takes place within ports and harbours is classed as a waste product. The ballast water that is disposed of may contain a variety of harmful substances, including in certain cases oil contaminants (Section 6.3.1), non-native marine animals and plants, and disease causing organisms in sewage contaminated water.

This introduction of non-native species is considered to be one of the five major threats to marine biodiversity identified in the Convention of Biodiversity. The introduction of non-native species from ships' ballast water, in addition to other sources, is a matter that is causing increasing concern and is a potentially serious, but highly unpredictable problem, in all coastal marine ecosystems (Carlton 1996). A JNCC review of non-native marine species in British waters estimates that around a third of the 51 non-native animals and plants found in British waters have been introduced by shipping, both in ballast waters and on ship's hulls (Eno *et al* 1997).

The effects of introducing new animal and plants can be almost undetectable, or conversely they can completely dominate and displace native communities. Severe cases of introduced non-native organisms include the European zebra mussel into the North American lakes, causing billions of dollars worth of damage due to fouling, and a comb jelly into the Black Sea, causing the near extinction of anchovy and sprat fisheries. The bloom forming algae *Gymnodinium*, which causes paralytic shellfish poisoning, was introduced into Australian waters from Japan.

In general, the effects in British waters are not as bad as elsewhere in the world, with approximately 80% of introduced species in the UK having no effect on native species and ecosystems (Ribera & Bouderesque 1995). However, 20% of introduced species have had some effect on native communities, with severe results in some cases. Examples of actual and possible effects of non-native animals and plants which have been introduced to the UK from shipping are shown in Box 41 (Eno *et al* 1997).

It should be noted that ballast water has been disposed by ships in ports, harbours and coastal waters since the early 1900's and that during this time many non-native species have been introduced. However, it is a highly unpredictable issue and the probability of a harmful species being introduced in any one port is low, but the potential for harm is high should it occur. Recognising that the possible severity of the consequences, the IMO has taken action by developing guidelines for preventing the introduction of non-native species which aim to minimise the effects (Section 6.4.3) and the Oslo and Paris convention are also considering action.

Box 41. Examples of animals and plants introduced from ballast water and shipping in the UK (Eno et al 1997)

- Various species of bloom forming phytoplankton are thought to have been introduced from ships' ballast water and have in some cases displaced native species to the point of being dominant, including one species, which can produce a thick grey slime with toxic properties.
- A number of fouling organisms have been introduced from ballast water and ships hulls, causing both economic problems associated with the fouling of ships, buoys and harbour structures, and environmental impacts, such as competing with native species of barnacle for example. *Hydroides ezoensis* is a severe fouling organism in Southampton Water, however it also potentially benefits other animals by providing food and shelter.
- In the Tay Estuary a marine worm introduced in ballast competes with native benthic species.
- The most well known non-native species probably introduced from ship's ballast water is cordgrass *Spartina* introduced to Southampton Water from North America. This cordgrass, subsequently crossed with the native species and produced common cordgrass *Spartina anglica* which spread rapidly colonising mudflats throughout Britain, forming dense swards and out-competing native cordgrass and other saltmarsh species. The spread of common cordgrass is thought to have contributed to the decline of *Zostera* beds in some areas, such as Lindisfarne (Percival, Anderson & Denny 1996; Dee Davison Associates 1998).
- Both introduced and native cordgrasses are considered of high conservation importance and the *Spartina* swards in which they can be found are designated coastal features of the Solent Maritime and Essex Estuaries SACs.

6.4 Means of avoiding, minimising and addressing the potential impacts associated with wastes managed within ports and harbours

The main means of avoiding, minimising and addressing the potential effects of port, harbour and ship generated wastes on the marine environment are provided by the following management practices:

- the continued education and motivation of port and harbour users,
- the production of waste management plans and provision of adequate reception facilities,
- the preparation and implementation of oil and chemical contingency plans, and
- the observation by ships of IMO guidelines to avoid introducing non-native species and contaminants in ships' ballast waters.

Many of these management practices are regulated by other authorities and bodies, including the IMO, MCA, port state control, the environment agencies, MAFF, and local authorities, and not the port and harbour authorities themselves. The role of these bodies in waste management regulation and guidance is described in the following sections. The ports can, and should, support campaigns initiated by these bodies to ensure that measures to avoid, minimise and address environmental impacts are implemented effectively.

6.4.1 Port waste management planning for ship generated waste: Oil and garbage

The production and implementation of waste management plans in ports and harbours presents the most effective means of minimising and avoiding the potential effects of operational and illegal discharges of oil and garbage from ships on the marine environment. Since January 1998 it has become a statutory requirement on all ports and terminals, including any facility capable of transferring people or goods between water and sea. This includes marinas, yacht harbours, boat building yards and public slipways. This will be achieved through the provision of adequate reception facilities that encourage the disposal of wastes in ports and terminals, and remove as far as is practical any incentives for illegal discharges at sea, reducing the amounts entering the marine environment. However, the extent to which the management of ports and harbours can reduce the amounts of garbage and oil entering the marine environment from ships is limited.

Accidental spillages and discharges from ships do happen and despite the consequences of not following the regulations, such as heavy fines and damage to a company's image, illegal discharges continue (Section 4.3 and 4.4). The regulation of such spills and discharges from ships is the

responsibility of the MCA, not the port. Ports do not know which vessels have been guilty of malpractice in this respect, nor could they exclude them if they did for the reasons explained in **Section 3.2.**

Based upon best practice shown in UK ports and harbours during the voluntary implementation of waste management plans, DETR have prepared guidelines *Port waste management planning - how to do it* which promote an eight-step waste management planning process, which is summarised in **Appendix N** (DETR 1998). A similar approach is adopted in the *Port waste management planning - a guide for marina operators and coastal clubs* jointly produced by the BMIF and RYA that interprets the Waste Management Regulations for the recreational boating sector. The BMIF/RYA guide was produced in co-operation with the DETR and MCA and is a practical and easy to use document that has been well received by the operators of recreational boating facilities.

As good practice for ports and harbours in European marine sites there are a number of simple considerations that can be incorporated in the waste management process which are as follows:

- **Consultation:** In addition to statutory consultees, ports and harbours may consider consulting with local representatives from country conservation agencies. Improvements in consultation could assist the efficient and sustainable treatment of ship generated wastes.
- **Information:** In order to increase awareness in port users, waste contractors, ships' agents and those working in the port area of the nature conservation importance of the site in which they operate, summary information on the marine SAC or SPA might be provided in the waste management plan.

In most ports, the operation of waste facilities is carried out by contractors properly approved by the local environment agency and the local authority. They have the expertise and capability to develop the efficiency of the waste system, and the motivation to do so. Most ports and harbours encourage and facilitate the work of other authorities in the responsible management of waste, including waste minimisation and recycling, at the point of generation, transportation and disposal. However, the extent to which waste can be minimised by ports is extremely limited and is a matter for shipowners who are now being required to produce ship-based garbage management plans administered through the MCA port state control mechanism, not the ports (ICS 1998).

The feasibility of promoting recycling of ship and boat generated wastes landed in ports and harbours should be considered to determine whether it presents a practicable environmental option and does not incur excessive costs or result in a loss in the ease of use of the facilities, an important consideration emphasised by Lord Donaldson (Safer ships, Cleaner Seas). A partnership approach to recycling schemes is likely to be the best way forward in ports and harbours, where practical, with the recycling activities being undertaken by the waste contractors. Information and advice can be sought from the local waste industry, local authorities, country conservation agencies and those involved in estuary management planning.

Management of wastes behind the quayline is subject to the same controls and regulations as any other industrial site and does not warrant special consideration in the SAC scheme of management. Further regulatory interests in waste management include the special concern of MAFF with respect to imported food waste and the Forestry Commission with regard to the risk of the introducing non-native arboreal pests in packing materials and dunnage imported with timber cargoes.

6.4.2 Emergency response: Oil and chemical spill contingency planning

Despite rigid enforcement of good working practices, oil spills in port and harbours can and do occur, usually as a result of accidents during normal operations, such as loading and bunkering (refuelling). Port and Harbour Authorities are responsible for dealing with pollution from spillages of oil and other hazardous substances within port and harbour areas. When a spill occurs there is a need for immediate action in order to minimise the potential for environmental and economic damage. The main means for ports and harbours to provide the immediate response required is to develop an emergency response

plan. Under the Merchant Shipping (OPRC) Regulations 1998, the production of such plans is required on a mandatory basis for all ports and harbours that meet the criteria listed in **Box 42**.

Box 42. Ports and harbours required to prepare oil spill contingency plans under OPRC

The Merchant Shipping (OPRC) Regulations 1998 apply to all ports/harbours that meet the following criteria:

- (a) harbours with a statutory harbour authority having an annual turnover of more than £1 million,
- (b) any harbour or any oil handling facility offering berths alongside, on buoys or anchor, to ships over 400Gt or oil tankers over 150GT,
- (c) other harbours or oil handling facilities for which the Secretary of State considers maritime activities undertaken there involve a significant risk of oil spills over 10 tonnes, and
- (d) As for (c) above, but where the Secretary of State considers there is risk of significant economic damage as a result of an oil spill.

The control and approval of contingency plans is the responsibility of the MCA and most relevant authorities will have a role to play in the contingency planning process. **Appendix O** provides further information on the contingency planning process and guidance for those smaller ports which fall outside the OPRC criteria, drawing extensively on MCA's publication *Oil spill contingency planning – Guidelines for ports, harbours and installations* (1998). The Environment Agency have produced guidance to minimise the risk oil pollution from boats and refuelling facilities in marinas which are contained in **Appendix K**.

6.4.3 Ballast water management

Recognising the potential effects on marine ecosystems from introductions of harmful non-native animals and plants from ballast waters, the IMO has taken action by developing guidelines which aim to minimise the risks of environmental damage, whilst maintaining ship safety. These guidelines were prepared to assist port and harbour authorities and ships' masters, operators and owners in providing a precautionary approach to the management of ballast water in order to avoid and minimise the risk of introducing harmful non-native species and disease-causing micro-organisms. In the USA, guidelines on the control of the introduction of non-native species by ships' ballast water "*hemming the tide*" has been prepared by the Committee on Ships' ballast operations of the National Research Council (1996). This guide identifies the safety of the operation as being of paramount importance and provides detailed guidance on the three stages of control options which are:

- On or before departure control is based on preventing or minimising the intake of organisms during the loading of ballast water at the port of origin,
- During the voyage control is based on the removal of viable organisms prior to the discharge of ballast water at the destination port either by treatment or by open ocean ballast water change. Shipboard treatment could commence immediately upon departure and continue throughout the voyage.
- On arrival control at the port of arrival begins when the vessel's master intends to discharge all or some of the ballast water on board. Control strategies are aimed at preventing the discharge of unwanted organisms that could survive in the target environment.

The feasibility of using various control options varies depending on vessel size and type. Technology for the onboard treatment of ballast water is developing, although proven methods are not yet available. The IMO recommendations for action to be taken by ports and harbours today include the following:

- inform local agents and/or ships of areas and situations where uptake of ballast water should be avoided, such as near sewage outfalls, areas known to be contaminated with harmful organisms or in very shallow water where there is a risk of sediment being introduced to the ballast tanks,
- encourage the exchange of ballast water at sea (where it is safe to do so), and
- discourage unnecessary discharge of ballast water.

The arrangements for the control of ballast water transfer will eventually be supervised by classification societies and the MCA through the port state control mechanism, and not by ports. Ballast water management plans are proposed as the main way of implementing these measures in the future, and the discharge of ballast waters to port waste reception facilities has been suggested as a further option to minimise the potential risk of unwanted introductions. An emphasis has also been placed on the promotion of new technology used in ballast water exchange and the possible treatment of ballast waters using various methods, including ultraviolet light or heat to remove disease-causing micro-organisms where necessary. However, it is generally considered impractical and unnecessary for ports to undertake shore-side ballast water treatment at present, although in the future ports may have to provide reception facilities for materials filtered out of ballast waters.

6.4.4 Sewage wastes from recreational craft

A range of guidelines and codes of practice have been prepared by maritime industry, recreation associations, the Environment Agency and port and harbour authorities which provide guidance for minimising and avoiding sewage inputs from boats into marinas, harbours and coastal areas (RYA 1997; UK CEED & BMIF 1998, Carrick District Council 1997, EA 1996 (**Appendix K**)).

Port and harbours should encourage all boat users to use on-shore toilet facilities whenever possible. To encourage their use, onshore toilet and shower facilities should be clean, located close to where the boats are moored and if a charge is deemed to be necessary for the use of the facilities, it should be small. Whilst moored within marinas and harbours, boat owners may be discouraged or, where considered necessary to reduce adverse environmental impacts, prohibited from using of vessel toilets. Ports and harbours may also encourage the provision of public facilities by local authorities and marina operators.

The disposal of sewage from boats should be discouraged, or where considered necessary prohibited, where doing so adversely affects water quality or the amenity value of local waters. This could be considered in weakly tidal, sheltered and enclosed waters in areas where background water quality is good and local sewage is adequately treated before sea disposal. Also in crowded anchorage near environmentally sensitive areas and amenity beaches.

In order to avoid environmental harm, boat users need to be encouraged to use holding tanks where fitted and to dispose of sewage in areas as far as possible from shore in regions of strongest tidal streams or at onshore pump-out facilities whenever possible. A few harbours and marinas operating within European marine sites provide onshore facilities for pumping-out sewage wastes from recreational boats. The use of pump-out facilities would be encouraged by giving careful consideration to their location and accessibility and the publication of leaflets outlining the location of the facilities to all users. Consideration should also be given to the charges made for the use of pump-out facilities, to ensure that they do not act as disincentive to their use (**Box 43**).

Wessex Water have published an initiative in which they have undertaken to provide free sewage connections to marinas installing pump-out facilities. The provision of adequate pump-out facilities in harbours also limits the amount of chemicals used in holding tanks and the portable toilets entering the marine environment. Harbour users should be discouraged from emptying chemical toilets into the sea and from overdosing toilet systems with chemicals and using them when it is not necessary.

Box 43. Chichester Harbour sewage pump-out station

Chichester Harbour Conservancy have installed a sewage pump-out facility at their public jetty at Itchenor. In order to encourage maximum use of these facilities, they are provided free-of-charge.

This has been enabled, in part, by funding from the Environment Agency, who have contributed 50% of the total costs. Water quality is of particular concern in Chichester Harbour and it is classed as a sensitive area under EC Nitrates Directive. This approach might be considered in other marine SACs where water quality and pollution from sewage discharges are of high concern.

The new boat building Directive requires that all but the smallest vessels are either equipped with holding tanks or have facilities for these to be retrofitted. However, only a small proportion of leisure craft are likely to have holding tanks within the next decade. Even those craft that do have holding tanks, will often not use them to pump waste ashore because of a number of possible reasons:

- there are insufficient pump-out facilities,
- there is a lack of inclination on the part of the owners to pay for pump out services when overboard discharge remains free of charge,
- many craft with holding tanks are waiting for the International (ISO 228/11) or a European Standard for pump-out connections to be implemented in the UK before modifying their vessels, a process that may take several years, and
- due to the pattern of boat usage, facilities are likely to be in very high demand as the weekend comes to an end and queuing for pump-out facilities will not be popular or practical.

This is supported by the case where pump-out facilities in one large marina on the south coast were only used ten times in one year (UKCEED 1993). The circle needs to be broken. Holding tanks will not become common until pump out arrangements improve, and facilities will not be provided until there is sufficient demand. All harbours and marinas in marine SACs should provide onshore facilities for pumping-out sewage wastes where consultation with users identifies a need and/or where there are real concerns over the environmental effects of the discharge of untreated sewage wastes into the marine SAC. The RYA is in the process of developing a technical guide to provide help and encouragement to boat owners of existing old boats to retro-fit holding tanks, which is no easy task because most spaces on board a small yacht are already in use.

Box 44. Useful technical and environmental guidance for waste management

- Garbage management plans, guidelines for the preparation of garbage management plans incorporating a model plan (ICS 1998).
- Guidelines for the control and management of ships' ballast water to minimise the transfer of harmful aquatic organisms and pathogens (IMO 1998).
- Guide to Boating and the Environment (BMIF 1997).
- Manual on shore reception facilities (IMO 1995).
- Navigate with Nature, Coastal Waters (UK CEED, BMIF, DETR, RSPB & Varsity Perkins 1998).
- Oil spill contingency plan guidelines for ports, harbours and oil handling facilities (MCA 1998).
- Pollution Prevention Guidance Note 14: Marinas and craft (PPG 14) (Environment Agency 1996).
- Port Waste Management Planning – How to do it (DETR 1998).
- Port Waste Management Planning – A guide for marina operators and coastal clubs (BMIF & RYA 1998).
- Practical Guidelines for Ports on Environmental Issues. Water Pollution: a concern for Port Authorities (International Association of Ports and Harbours 1991).
- Stemming the tide - Controlling introductions of non-indigenous species by ships' ballast water (National Academy Press 1996).
- Tide Lines- Environmental Guidance for Boat Users (RYA 1997).
- The Prevention of pollution by garbage from ships (MSA 1995).

| Port and Harbour Operations Potential issues, key processes & potential impacts | Considerations and comments | Potential impacts on marine sites | Possible means of avoiding, minimising and addressing impacts |
|---|--|-----------------------------------|--|
| | | Beneficial Minimal Adverse | |
| <p>Issue: Sewage discharge from recreational craft</p> <p>Key process: Non-toxic contamination (organic/nutrient enrichment & turbidity) Toxic contamination</p> <p>Potential impact: Discharges of high concentrations of sewage may cause a localised deterioration in water quality, which may result in oxygen depletion, increased suspended solids, nutrient enrichment and increased risk of algal blooms which may disturb animals and plants. Chemical additives in portable toilets and holding tanks (including chlorine, ammonium & zinc) are toxic to marine life. Generally the impacts associated with sewage discharged by recreational craft are minimal in comparison with those which arise from the far greater amounts discharged from land-based sources. Impacts are generally localised and temporary.</p> | <p>Potential impacts depend on numbers of vessels, amounts of sewage, water quality, temperature and depth, tidal movement and proximity of sensitive species. Greatest effects are likely to occur when many vessels congregate in enclosed areas or shallow water with little or no tidal exchange in summer and autumn. In some cases nutrient enrichment from sewage may increase productivity, the benefits of which are likely to be seen in higher organisms in estuaries or bays, such as feeding bird populations. However, despite small possible incidental benefits, this should not be to the detriment of water quality in the site.</p> | Min/Adv | <p>Consider providing onshore reception facilities for pump-out sewage wastes.</p> <p>Encourage use of shore-side toilet facilities, holding tanks where fitted and disposal of waste at pump-out facilities, and while underway as far offshore as possible in areas where strong currents ensure dispersion and dilution.</p> <p>Discourage/prohibit discharge of sewage wastes where doing so would harm marine features.</p> |
| <p>Issue: Discharge of ballast water</p> <p>Key process: Introduction of non-native species</p> <p>Potential impact: The introduction of non-native animals and plants in ships ballast water may have a range of effects, from undetectable to the complete detriment of native communities. Species introduced to the UK from ballast water include various bloom forming phytoplankton, a number of fouling organisms, marine benthic animals that compete with native communities and an American cordgrass <i>Spartina species</i>, which crossed with the native species to form common cordgrass that has since spread throughout Britain, replacing native saltmarsh species.</p> | <p>In the UK, around 80% of introduced species have no effect, however 20% from a number of sources do have some effect on native communities, in many cases causing disturbance and damage. The introduction and potential effects of harmful non-native species are highly unpredictable, but can be very serious.</p> | Min/Adv | <p>Comply with IMO guidance and support MCA in encouraging shipowners to comply with IMO guidance.</p> <p>Inform local agents and ships of areas where uptake of ballast water should be avoided.</p> <p>Encourage the exchange of ballast water at sea, where it is considered safe to do so, which will be regulated by the MCA</p> <p>Discourage / prohibit the unnecessary discharge of ballast water in the port and harbour area, where appropriate.</p> |

6.6 Good practice

In order to avoid and minimise the potential effects of ship and boat generated wastes on marine features ports and harbours operating in or near European marine sites should:

- Develop and implement port waste management plans according to Merchant Shipping Regulations, the DETR guidelines or the BMIF/RYA guidelines written specifically for the recreational boating sector. Provide adequate reception facilities for oil, chemical and garbage wastes, and remove, as far as is practicable, any disincentives to landing waste in the port. As part of this process ports and harbours should:
 - consider consulting with local representatives of country conservation agencies, in addition to other statutory and relevant consultees, to improve understanding of waste management planning and to ensure that environmental considerations are addressed,

- consider incorporating brief information on the European marine site in the port waste management plan,
 - encourage the responsible management of waste, including minimisation and recycling, at the point of generation on ships, reception in ports/harbours, transportation and disposal, and
 - ensure that port and harbour employees and users dispose of garbage and other wastes responsibly in facilities provided and report any spills or large pieces of floating garbage to the port authority.
- Prepare, implement and practice oil spill contingency plans according to Merchant Shipping (OPRC) Regulations and MCA guidelines in order to provide guidance and direction to those responding to oil or chemical spills and to set in motion all the necessary actions to stop or minimise the pollution and reduce its effects on the environment. As part of this process ports and harbours should:
 - undertake a thorough risk assessment of the area to be covered by the plan, with particular attention to sensitive marine features and the response times necessary to minimise the potential adverse effects on them,
 - give the highest priority of response where practicable, after human safety, to sensitive habitats and species that are likely to be adversely effected by potential spills. These sensitive areas should be clearly shown on the response guide chart,
 - identify areas where the use of dispersants presents little or no concern, and areas containing sensitive marine features where their use should be avoided, unless this increases risk of adverse effects of oil pollution on marine features, seeking advice from the country conservation agencies where appropriate, and
 - ensure, as far as practical, that clean-up operations are undertaken in such a way as to avoid or minimise damage to sensitive intertidal animals and plants.
 - Assist MCA to make sure shipowners comply with IMO guidance for ‘the control and management of ship's ballast water to minimise the transfer of harmful aquatic organisms and pathogens’. The guidelines recommend that ports and harbours should:
 - inform local agents and/or ships of areas and situations where uptake of ballast water should be avoided, such as near sewage outfalls, areas known to be contaminated with harmful organisms or in very shallow water where there is a risk of sediment being introduced to the ballast tanks, and
 - encourage the exchange of ballast water at sea, where it is considered safe to do so.
 - Encourage all boat owners to use the shore-side toilet facilities as much as possible.
 - Provide onshore reception facilities in ports, harbours and marinas for pumping-out sewage wastes and undertake regular consultation with boat users over the adequacy of these facilities.
 - Encourage the use of holding tanks where fitted and the disposal of waste at shore side pump-out facilities whenever possible, and while underway as far offshore as possible in areas where strong currents will ensure dilution and dispersion.
 - Discourage, or where considered necessary prohibit, discharge of sewage wastes where doing so would affect water quality and harm marine features in ports and harbours and surrounding waters.

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Appendices

- A Glossary of terms and abbreviations used in the guidelines
- B List of consultees
- C Useful contact details
- D Marine Special Areas of Conservation: The features for which UK Marine SACs have been proposed for designation and the ports and harbours located within or near them. Description of marine Annex I habitats and Annex II species.
- E Marine Special Protection Areas: Classified and potential SPAs with intertidal elements in the UK
- F Selected legislation affecting port and harbour operations and activities
- G Environmental management systems
- H Commercial passenger boat code prepared for harbours operating within the Cardigan Bay candidate SAC
- I Examples of possible symbols to be used for marine environmental pilotage purposes
- J Examples of zoning scheme
- K Environment Agency Pollution Prevention Guidance note for marinas and craft (PPG14)
- L A summary of the main dredging methods used in the UK and their potential for sediment resuspension and environmental affect
- M Beneficial use case studies
- N Waste management planning process
- O Emergency response: Oil and chemical spill contingency planning

Appendix A

Glossary of terms and abbreviations used in the guidelines

| | |
|--|--|
| Advisory group | The body of representatives from local interests, user groups, and conservation groups, forwarded to and notified by the Department of the Environment and Heritage Ireland as being of special interest for biological species listed in Annex II of the Habitats Directive for which Special Areas of Conservation have been designated. |
| Areas of Special Scientific Interest (ASSIs) | Quantifiable aspects of an estuary that can be used to help define Special Areas of Conservation. |
| Annex II Species | Basic Avifaunal and Ichthyofaunal Conditioning Exercises. These may include population size, sex ratio, age distribution, and bacterial attachment on the sediment surface (Gloagou 1996) over a diurnal period, sand suspension, turbidity, and sedimentation rates. |
| Attribute | The characteristics of a system that are used to describe and measure the biological diversity of a system. |
| BATNEEC | Basic Biological Diversity (BBD) Option European Union through the implementation of dredging activities to maintain and improve the ecological quality of water bodies. |
| Biochemical oxygen demand (BOD) | Basic Biological Diversity (BBD) Option European Union through the implementation of dredging activities to maintain and improve the ecological quality of water bodies. |
| Biological diversity | Basic Biological Diversity (BBD) Option European Union through the implementation of dredging activities to maintain and improve the ecological quality of water bodies. |
| Birds Directive | Basic Biological Diversity (BBD) Option European Union through the implementation of dredging activities to maintain and improve the ecological quality of water bodies. |
| BMIF | Basic Biological Diversity (BBD) Option European Union through the implementation of dredging activities to maintain and improve the ecological quality of water bodies. |
| BPEO | Basic Biological Diversity (BBD) Option European Union through the implementation of dredging activities to maintain and improve the ecological quality of water bodies. |
| Capital dredging | Basic Biological Diversity (BBD) Option European Union through the implementation of dredging activities to maintain and improve the ecological quality of water bodies. |
| CCW | Basic Biological Diversity (BBD) Option European Union through the implementation of dredging activities to maintain and improve the ecological quality of water bodies. |
| CEDA | Basic Biological Diversity (BBD) Option European Union through the implementation of dredging activities to maintain and improve the ecological quality of water bodies. |

| | |
|------------------------|---|
| Characteristic species | Special to or especially abundant in a particular situation or biotope. |
| CIRIA | Charismatic species Research and Information Association and easily identifiable (discovered in 1996) |
| Competent authority | Any Member State department, public or statutory undertaker, public body or representative of a public authority that operates at the |
| Conservation (marine) | habitats of or represents natural areas of public importance that are sites that are |
| Conservation objective | protected (ENs of the 1992) reasons: Habitat Directive Annex I habitats |
| Conservation interest | Specific to a particular site of a particular area and where biodiversity is of |
| DEFRA | importance for the UK, from the UK's perspective. The UK's policy is to |
| DOENI | manage the environment in a sustainable way. The UK's policy is to |
| Dominant species | manage the environment in a sustainable way. The UK's policy is to |
| EA | manage the environment in a sustainable way. The UK's policy is to |
| EMAS | manage the environment in a sustainable way. The UK's policy is to |
| EN | manage the environment in a sustainable way. The UK's policy is to |
| ESPO | manage the environment in a sustainable way. The UK's policy is to |
| European marine Site | A European site (SAC/SPA) which consists of, or so far as it consists of, marine areas. |

| | |
|----------------------------|--|
| Eutrophication | Excessive nutrient enrichment causing the over fertilisation of water, |
| Factor | Factor |
| Favourable conservation | Favourable conservation |
| FAO | FAO |
| GESAMP | GESAMP |
| Habitats Directive | Habitats Directive |
| Habitats Regulations | Habitats Regulations |
| Harbour | Harbour |
| Harbour authority | Harbour authority |
| Harmful substance | Harmful substance |
| HSE | HSE |
| IADC | IADC |
| ICE | ICE |
| ICES | ICES |
| ICS | ICS |
| IMDG | IMDG |
| IMO | IMO |
| Interest feature | Interest feature |
| (Interest feature of site) | (Interest feature of site) |
| Introduced species | Introduced species |
| ISO 14001 | ISO 14001 |
| JNCC | JNCC |
| MAFF | MAFF |
| Maintenance dredging | Maintenance dredging |
| Management group | Management group |
| Management scheme | Management scheme |

| | |
|----------------------------|---|
| Pollution | The introduction by man, directly or indirectly, of substances or |
| Port | Ports in the commercial harbour, combined with other activities, which results |
| Port State Control | On the basis of the regulations of the International Convention for the |
| Precautionary | Principle of precautionary action, which states that where there are threats of |
| Principles/approach | the precautionary principle should be applied where there are threats of |
| Recoverability factors) | Recovery factors, which are factors that determine the ability of an |
| Relevant authority | Authority, which is the authority responsible for the implementation of the |
| RSPB | Royal Society for the Protection of Birds, a charity that works to |
| RYA | Royal Yachting Association, a charity that promotes and regulates |
| SEPA | Scottish Environment Protection Agency (Scottish Environmental |
| Sensitivity | The extent to which an area is sensitive to change or disturbance |
| Site of Special Scientific | Interest (SSSI) is a site of special scientific interest, which is a |
| SSSI | Site of Special Scientific Interest (SSSI) is a site of special scientific |
| SNH | Scottish Natural Heritage, a charity that works to protect and |
| Special Area of | Conservation (SAC) is a site of special interest, which is a |
| Special Area of | Conservation (SAC) is a site of special interest, which is a |
| Statutory nature | Statutory nature reserve, which is a site of special interest, which is a |
| Suspended matter | Suspended matter, which is a substance that is suspended in a |
| Sustainable development | Sustainable development, which is a development that meets the |
| Tolerance | Tolerance, which is the ability of an organism to withstand |
| Toxicity | Toxicity, which is the ability of a substance to cause harm |
| Turbidity | Turbidity, which is the cloudiness or haziness of a fluid |
| VHF | VHF, which is a type of radio frequency used for |
| Voluntary principle | Voluntary principle, which is a principle that states that |
| VTS | VTS, which is a system that provides information to |
| Vulnerability | Vulnerability, which is the ability of an organism to |
| Waste | Waste, which is a substance that is discarded or |

Appendix B

List of consultees

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Maritime and Coastguard Agency

Spring Place
105 Commercial Road
Southampton
SO15 1 EG
01703 329100

Ministry of Agriculture, Fisheries & Food

Nobel House
17 Smith Square
London
SW1P 3JR
0645 335577

Scottish Environmental Protection Agency

Head Office
Erskine Court
Castle Business Park
Stirling
FK9 4TR
01786 547700

The Scottish Office

Pentland House
47 Robb's Loan
Edinburgh
EH14 1TY
0131 5568400

The Welsh Office

Cathays Park
Cardiff
CF1 3NQ
01222 825111

Port, Harbour & Related Industry Organisations**British Ports Association**

Room 217
Africa House
64-78 Kingsway
WC2B 6AH
0171 2421200

British Marine Industries Federation

Meadlake Place
Thorpe Lea Road
Egham
Surrey
TW20 8HE
01784 473377

Chamber of Shipping

Carthusian Court
12 Carthusian Street
London
EC1M 6EB
0171 4178400

Royal Yachting Association

RYA House
Romsey Road
Eastleigh
Hampshire
SO50 9YA
01703 627430

Royal Yachting Association – Northern Ireland

North Ireland Council
House of Sport
Upper Malo
Belfast
BT9 5LA

Royal Yachting Association – Scotland

Caledonia house
South Gyle
Edinburgh
EH12 9DQ

Royal Yachting Association - Wales

4, Llys Y Mor
Plan Menai
Caernarfon
BT17 9JU

Shipbuilders & Shiprepairers Association

33 Catherine Place
London
SW1 6DY
0171 8280933

UK Harbour Masters Association

5 Greenbank
Eton Road
Chester
Cheshire
CN4 5EH
01244 675965

UK Independent Ports Association

c/o Port of Felixstowe
Tamline House
The Dock
Felixstowe
Suffolk
IP11 8SY
01394 604500

UK Major Ports Group

6 Marshalsea Road
London
SE1 1HL
0171 4042708

Non-Governmental Organisations**Marine Conservation Society**

9 Gloucester Road
Ross-on-Wye
Herefordshire
HR9 5BU
01989 566017

Royal Society for the Protection of Birds

The Lodge
Sandy
Beds
SG19 2DL
01767 680551

**Royal Society for the Protection of Birds
Scotland**

Dunedin House
25 Ravelston Terrace
Edinburgh
EH4 3TP
0131 3116500

Wildlife Trust Head Office

The Green, Witham Park
Waterside South
Lincoln
Lincolnshire
LN5 7JR
01522 544400

WWF-UK

Panda House
Weyside Park
Catteshall Lane
Goldaming
Surrey
GU7 1XR
01483 4264444

Appendix D

Marine Special Areas of Conservation:

**The features for which UK Marine SACs
have been proposed for designation and
the ports and harbours located
within or near them**

**Description of marine Annex I habitats
and Annex II species**

Table showing candidate and possible marine SACs, the interest features for which they have been proposed for designation and ports and harbours located in or near them (UK Marine SACs Project's 12 pilot sites are shaded in grey)

| Name of marine SAC | Interest features | Ports and harbours |
|---------------------------------------|--|-------------------------|
| Benacre to Easton Bavents | • Lagoons | • Lowestoft |
| Berwickshire and North | • Intertidal mud and sand flats | • Berwick-Upon-Tweed |
| Northumbria and Coosmarsh and | • Reefs | • Bury |
| Cardigan Bay | • Bottlenose dolphin | • Aberaeron |
| Chesil and the Fleet | • Lagoons | • Portland |
| Forth Firth | • Annual vegetation of drift lines | • None identified |
| Scottish Coast | • Perennial vegetation of stony banks of | • None identified |
| Essex Estuaries | • Intertidal mud and sand flats | • Brightlingsea |
| England Helford | • Subatlantic de-calcified fixed dunes | • Colchester |
| England Holm of Faray (Orkney) | • Atlantic salt meadows and flats | • None identified |
| Scotland Inch Head | • Reefs | • Maldon |
| England Sillies Complex | • Atlantic salt meadows | • Slough & North |
| Loch Duich, Long and Alsh | • Subtidal sand banks | • None identified |
| Loch nam Madadh (Loch | • Lagoons | • Loch nam Madadh (Loch |
| Morecambe Lagoons | • Large shallow inlets and bays | • None identified |
| Scotland Orkney (Orkney) | • Lagoons | • None identified |
| Scotland Orkney | • Reefs | • None identified |
| Orkney Islands | • Grey Seal | • None identified |
| Scotland Orkney | • Bottlenose dolphin | • Invergordon |
| Morecambe Bay | • Intertidal mud and sand flats | • Barrow |
| Morecambe Bay (Shetland) | • Large shallow inlets and bays | • None identified |
| Scotland Norfolk Coast and | • Lagoons | • Heysham |
| Scotland Norfolk Coast and | • <i>Sarcocornia</i> and other annuals | • Lancaster |
| Scotland Norfolk Coast and | • Grey seal | • None identified |
| Scotland Norfolk Coast and | • Perennial vegetation of stony banks | • None identified |
| Scotland Norfolk Coast and | • Lagoons | • None identified |
| Papa Stour | • Reefs | • None identified |
| Scotland Orkney Islands | • Sea caves | • Milford Haven |
| Pen Llŷn a'r Sarnau (Llyn | • Estuaries | • Aberdyfi |
| Plymouth Sound and Estuaries | • Subtidal sand banks | • Cattewater |
| England Plymouth Sound and Estuaries | • Estuaries | • None identified |
| Scotland Plymouth Sound and Estuaries | • Large shallow inlets and bays | • (Naval) Barry |
| Scotland Plymouth Sound and Estuaries | • Shoredock | • Milford Haven |
| Scotland Plymouth Sound and Estuaries | • Subtidal sand banks | • See Shetland Maritime |
| Scotland Plymouth Sound and Estuaries | • Intertidal mud and sand flats | • Salford |
| Scotland Plymouth Sound and Estuaries | • Estuaries | • Beaune |
| Scotland Plymouth Sound and Estuaries | • Atlantic salt meadows | • Cardiff |
| Scotland Plymouth Sound and Estuaries | • Common seals | • None identified |
| Scotland Plymouth Sound and Estuaries | • Atlantic salt meadows | • Cardiff |
| Scotland Plymouth Sound and Estuaries | • Reefs | • Cardiff |
| Solway Firth | • Subtidal sand banks | • Annan |
| Sound of Arisaig | • Subtidal sand banks | • Arisaig |
| Scotland Sound of Arisaig | • Intertidal mud and sand flats | • Kirkcubright |
| Scotland Sound of Arisaig | • Reefs | • None identified |
| Strangford Lough | • Large shallow inlets and bays | • Portaferry |
| Scotland Strangford Lough | • <i>Sarcocornia</i> and other annuals | • None identified |
| Scotland Strangford Lough | • Reefs | • None identified |
| Scotland Strangford Lough | • Colonising mud and sand | • None identified |
| Scotland Strangford Lough | • Lagoons | • None identified |
| Scotland Strangford Lough | • Lagoons | • Ramsgate |

| Name of marine SAC | Interest features | Ports and harbours |
|--|--|---|
| The Wash and North Norfolk Coast (England) | <ul style="list-style-type: none"> Subtidal sand banks Intertidal mud and sand flats Large shallow inlets and bays Common Sea Atlantic salt meadows | <ul style="list-style-type: none"> Boston Fosdyke Kings Lynn Sutton Bridge Wisbech |

| Common name for marine Annex I habitats and Annex II species | Directive name for marine Annex I habitats and Annex II species |
|--|---|
| Estuaries | Estuaries (<i>Estuarialia</i>) |
| Intertidal mud and sand flats | Mudflats and sandflats not covered by seawater at low tide |
| Lagoons | Lagoon |
| Large shallow inlets and bays | Large shallow inlets and bays |
| Mediterranean and thermo-Atlantic halophilous mudflats | Mediterranean and thermo-Atlantic halophilous mudflats |
| Mediterranean salt meadows | Mediterranean salt meadows (<i>Salicornia</i>) |
| Reefs | Reefs (<i>Reefia</i>) |
| <i>Salicornia</i> and other annuals colonising mud and sand | <i>Salicornia</i> and other annuals colonising mud and sand |
| Sea caves | Submerged or partly submerged sea caves |
| <i>Spartina</i> swards | <i>Spartina</i> swards (<i>Spartinion</i>) |
| Subtidal sand banks | Sand banks which are slightly covered by seawater throughout the time |
| Bottlenose dolphin | <i>Phoca vitulina</i> |
| Common seal | <i>Phoca vitulina</i> |
| Grey seal | <i>Haliocoeris grypus</i> |

Description of marine Annex I habitats/Annex II species

Estuaries

Estuaries are semi-enclosed bodies of water which have a free connection with the open sea and within which the seawater is measurably diluted by freshwater from the surrounding land. They are large features which often contain a complex range of habitats that reflect the variations in tidal influence and substrate type.

Mud and sand flats not covered by seawater at low tide

Intertidal mudflats and sandflats are submerged at high tide and exposed at low tide. They form a major component of estuaries and embayments in the UK but also occur along the open coast. The physical structure of intertidal flats can range from the mobile, coarse-sand beaches of wave exposed coasts to the stable, fine-sediment mudflats of estuaries and embayments. Within this range the plant and animal communities present vary according to the type of sediment, its stability and the salinity of the water.

Sandbanks which are slightly covered by sea water all the time

Sub-tidal sandbanks are permanently covered by seawater at all times to depths of up to 20 meters below low water mark. They include muddy sands, clean sands and maerl beds (carpets of small, unattached, calcareous seaweed).

Large shallow inlets and bays

These are bays and inlets such as rias and voes (drowned river valleys in south-western parts of the UK and Shetland respectively), and fjards (shallow inlets in western Scotland and Northern Ireland). They are often large physiographic features which may contain a range of marine habitats. Several of these habitat types are proposed as Annex I interests in their own right.

Lagoons

Lagoons are areas of shallow coastal saltwater of varying salinity, separated from the sea by sandbanks, shingle or less frequently, rock. Five main sub-types of lagoon have been identified in the

UK on the basis of their physiography as meeting the definition of the habitat type. These include isolated lagoons, percolation lagoons, silled lagoons, sluiced lagoons and lagoonal inlets.

Reefs

These are areas of subtidal rock or biological concretions which may extend as an unbroken transition onto the shore. These form the habitat for a variety of biological communities such as those characterised by encrusting animals and attached seaweeds.

Submerged or partly submerged sea caves

These may be tunnels or caverns on the shore or below the sea surface, in which vertical and overhanging rock faces provide the principal habitat. Sea caves can vary in size, from only a few meters to more extensive systems, which may extend hundreds of meters into the rock.

Common seal

About 50% of the European population of common seals breed in the UK. Common seals range around the shore of the UK and are the characteristic seal of sandflats and estuaries, but are also found on rocky shores in Scotland. Site selection has favoured sites that are important both as haul-out and for pupping.

Grey seal

Grey seals spend most of the year at sea. They come ashore in the autumn to form breeding colonies on rocky shores, beaches, in caves, occasionally on sandbanks, and inland on small uninhabited islands. It is these breeding areas that are proposed for protection. Grey seals are among the rarest seals in the world and approximately 50% of the world population and 95% of the EC population breeds on the UK's coast.

Bottlenose Dolphin

Bottlenose dolphins occur infrequently in European Union waters. There are only two resident populations known to exist in UK inshore waters - Cardigan Bay and Moray Firth. The population in the inshore waters of the UK is probably between 300 and 500 individuals.

Appendix E

Marine Special Protection Areas:

**Classified and potential SPAs
with intertidal elements in the
UK and the ports and harbours
located within or near them.**

Table showing classified and potential SPAs with an intertidal element in the UK, and the ports and harbours located within or near them.

| Name of marine Special Protection Area | Ports and harbours |
|---|--------------------------------------|
| Ailsa Craig | None identified |
| (Scotland) Ailsa Craig Estuary | None identified |
| (England) Ailsa Craig | Liverpool |
| (England) Ailsa Craig | Kirkwall |
| (Scotland) Ailsa Craig Lough | Belfast, Carrickfergus |
| (Northern Ireland) Ailsa Craig Barents | Lowestoft |
| (England) Ailsa Craig and Southend Marshes | (see Thames Estuary and Marshes) |
| (England) Ailsa Craig Estuary (Mid-Essex Coast) | Brightlingsea, Maldon |
| (England) Ailsa Craig Water | Great Yarmouth |
| (England) Ailsa Craig Flats, Islay | None identified |
| (Scotland) Ailsa Craig Ness to Collieston | Fraserburgh |
| (Scotland) Ailsa Craig | Burry |
| (Wales) Ailsa Craig Eday | None identified |
| (Scotland) Ailsa Craig Sanday | None identified |
| (Scotland) Ailsa Craig | None identified |
| (Scotland) Ailsa Craig Lough | Warrenpoint |
| (Northern Ireland) Ailsa Craig Coast | Milford Haven, Pembroke Dock |
| (Wales) Ailsa Craig Beach and The Fleet | Portland |
| (England) Ailsa Craig and Langstone Harbours | Chichester, Langstone |
| (England) Ailsa Craig | None identified |
| (Scotland) Ailsa Craig Estuary (Mid-Essex Coast) | Brightlingsea |
| (England) Ailsa Craig Island | None identified |
| (England) Ailsa Craig | None identified |
| (Scotland) Ailsa Craig Firth (proposed) | Cromarty Firth, Invergordon |
| (Scotland) Ailsa Craig Estuary | Felixstowe |
| (England) Ailsa Craig Crouch Marshes (Mid-Essex Coast) | Crouch |
| (England) Ailsa Craig (Mid-Essex Coast) | Brightlingsea, Colchester, Crouch |
| (England) Ailsa Craig Firth & Loch Fleet | None identified |
| (Scotland) Ailsa Craig Estuary | None identified |
| (England) Ailsa Craig to Pett Levels (proposed) | Rye |
| (England) Ailsa Craig Sanday Coast | None identified |
| (Scotland) Ailsa Craig | Exmouth |
| (England) Ailsa Craig | None identified |
| (Scotland) Ailsa Craig | None identified |
| (England) Ailsa Craig | None identified |
| (Scotland) Ailsa Craig North (proposed) | Burntisland, Grangemouth, Kirkcaldy, |
| (Scotland) Ailsa Craig Tay & Eden Estuary (proposed) | Dundee, Perth |
| (Scotland) Ailsa Craig Brough Head and Bempton Cliffs | Bridlington |
| (England) Ailsa Craig Isles | None identified |
| (Scotland) Ailsa Craig Islands | (see Firth of Forth) |
| (Scotland) Ailsa Craig | None identified |
| (Scotland) Ailsa Craig (Mid-Essex Coast) | Crouch, (see Thames Estuary) |
| (England) Ailsa Craig Point (The Wash) | Wells |
| (England) Ailsa Craig Ynys Gybi (Holy Island Coast) | Holyhead |
| (Wales) Ailsa Craig Cleanan | None identified |
| (Scotland) Ailsa Craig | None identified |
| (Wales) Ailsa Craig Yarmouth North Denes | Great Yarmouth |
| (England) Ailsa Craig Flats, Islay | None identified |
| (Scotland) | |

| Name of marine Special Protection Area | Ports and harbours |
|---|---|
| Severn Estuary (England/Wales) | Barry, Bridgwater, Bristol, Cardiff, Newport, Gloucester, Lydney, Newport, Sharpness |
| North Channel (Ireland) | None identified |
| Skokholm and Skomer (Wales) | Milford Haven, Pembroke Dock |
| Dist Machair & Lochs (Scotland) | None identified |
| Porton Water and Solent Marshes (England) | Beaulieu, Bembridge, Cowes, Hamble, Lymington, Harwich, Newmarket, Newtown, Portland, Southampton, Yarmouth |
| Orwell Estuaries (England) | London, Stratford |
| Lough (Ireland) | None identified |
| Green Gull Stack (Northern Ireland) | None identified |
| Head (Scotland) | None identified |
| Island (Scotland) | Larne |
| Northern Isles Complex (Northern Isles) | Cattewater, Dockyard Port of Plymouth, Millbay, Sutton |
| North and Cleveland Coast (England) | Port of London, Sheerness, Thamesport |
| Estuary and Marshes (proposed) (England) | Ramsgate |
| Coast and Sandwich Bay (England) | Mostyn Docks |
| Duich Estuary (England/Wales) | Whitstable |
| Wadh (England) | Boston, Fosdyke, Kings Lynn, Sutton |
| Wetlands (proposed) (England) | Ridge, Wisbech |
| Lan (Lavan Sands – Conway Bay) (Scotland) | Bangor |
| ish Isles (Wales) | None identified |
| nnan & Lion's Heads (Scotland) | None identified |
| Upper Severn Estuary (part of the Severn Estuary) (Scotland) | (See Severn Estuary) |
| Flats and Marshes (England/Wales) | Annan, Silloth, Workington |
| Waghol Sea (Wales/Scotland) | None identified |
| Podig, Cemlyn Bay and The Skerries (Scotland) | Holyhead |
| Estuary, Sands of Forvie & Meikle Lochs (Scotland) | None identified |

Appendix F

Selected legislation affecting port and harbour operations and activities

Examples of legislation affecting ports and harbours

In addition to the EC **Habitats Directive**, **Birds Directive** and the **Habitats Regulations**, there is a wealth of both national and international legislation influencing port and harbour operations, in terms of both safety and environmental protection. Examples of this legislation are listed below and a selection of international conventions and UK legislation is then described further.

Examples of environmental legislation affecting port & harbour operations

- Coast Protection Act 1949.
- Collection and Disposal of Waste Regulations 1988.
- Conservation (Natural Habitats & c.) Regulations 1994.
- Control of Pollution Act 1974.
- Control of Pollution (Landed Ships' Waste) (Amendment) Regulations 1989.
- Control of Substances Hazardous to Health Regulations 1994.
- Dangerous Substances in Harbour Areas Regulations 1987.
- Dangerous Vessels Act 1985.
- Docks and Harbour Act 1972.
- Environment Act 1995.
- Environmental Protection Act 1990.
- Environmental Protection (Prescribed Processes and Substances) Regulations 1991.
- Food & Environment Protection Act 1985 (FEPA).
- Food Safety Act 1990.
- Harbours Act 1964.
- Harbour Works (Assessment of Environmental Effects) Regulations 1998.
- Harbour Works (Assessment of Environmental Effects) (Amendment) Regulations 1996.
- Hazardous Waste Regulations 1998.
- Health and Safety at Work Act 1974.
- Landfill Tax Regulations 1996.
- Litter Act 1983.
- Merchant Shipping Act 1995.
- Merchant Shipping and Maritime Security Act 1997.
- Merchant Shipping (Dangerous or Noxious Liquid Substances in Bulk) Regulations 1996.
- Merchant Shipping (Dangerous or Noxious Liquid Substances in Bulk) (Amendment) Regulations 1998.
- Merchant Shipping (Fees) Regulations 1991.
- Merchant Shipping (International Safety Management (ISM) Code) Regulations 1998.
- Merchant Shipping (Oil Pollution Preparedness and Response Convention) Regulations 1997.
- Merchant Shipping (Prevention of Oil Pollution) Act 1971.
- Merchant Shipping (Prevention of Oil Pollution) Regulations 1996.
- Merchant Shipping (Prevention of Pollution by Garbage) Regulations 1988.
- Merchant Shipping (Prevention of Pollution by Garbage) Regulations 1998.
- Merchant Shipping (Prevention of Pollution) (Law of the Sea Convention) Order 1996.
- Merchant Shipping (Prevention of Pollution) (Limits) Regulations 1996.
- Merchant Shipping (Port Waste Reception Facilities) Regulation 1997.
- Merchant Shipping (Reception Facilities by Garbage) Regulations 1988.
- Merchant Shipping (Reporting of Pollution Incidents) Regulations 1987.
- Merchant Shipping (Salvage and Pollution) Act 1994.
- Noise Act 1996.
- Noise at Work Regulations 1989.
- Prevention of Oil Pollution Act 1971.
- Prevention of Oil Pollution Act 1986.
- Prevention of Pollution (Reception Facilities) Order 1984.
- Town & Country Planning (Assessment of Environmental Effects) Regulations 1995.
- Town & Country Planning (Environmental Assessment and Permitted Development) Regulations 1988.
- Town & Country Planning (General Permitted Development) Order 1995.
- Transfrontier Shipment of Hazardous Waste Regulations 1988.
- Transfrontier Shipment of Waste Regulations 1994.
- Transport and Works Act 1992.
- Transport and Works Act (Assessment of Environmental Effects) Regulations 1995.
- Waste Management Licensing Regulations 1994.
- Water Resources Act 1991.
- Wildlife and Countryside Act 1981.

Coast Protection Act 1949

Permission is required from the Marine Directorate of the Department of Environment Transport & the Regions for any dredging works proposed in navigable waters under the Coast Protection Act 1949. Section 34 of this Act provides the mechanism for controlling the effect of marine works on navigation. In addition to this permission a disposal license is required in order to deposit the dredged material.

Convention on Biological Diversity, 1992 (Biodiversity Convention)

The Convention has three objectives: the conservation of biological diversity, the sustainable use of its components, and the fair and equitable sharing of the benefits arising out of the utilisation of genetic resources. All parties are required to co-operate for the conservation of biodiversity, in respect of areas beyond national jurisdiction and other matters of regional interests, and must develop national strategies for the conservation and sustainable use of biodiversity and integrate this into sectoral or cross-sectoral qualities.

The Convention requires its contracting parties as far as is possible and appropriate 'to prevent the introduction of, control or eradicate those alien species which threaten ecosystems, habitats or species'.

Dangerous Substances in Harbour Areas Regulations 1987

The Dangerous Substances in Harbour Areas Regulations 1987, controls the carriage, loading, unloading and storage of all classes of dangerous substances within harbour areas. The former Department of Transport (DoT) regulates control of routine activities on board ship under various Merchant Shipping Acts including the **Merchant Shipping Regulations 1981**.

Environment Act 1995

This Act together with the earlier **Environmental Protection Act 1990** and the **Waste Management Licensing Regulations 1994** and subsequent amendments provide the legal framework for dealing with contaminated dredged material. The Environment Agency in England and Wales and the Scottish Environmental Protection Agency (SEPA) in Scotland regulate applications for waste disposal licenses. One of the problems identified during the initial workshop for this project was exactly what constitutes a waste? This is a particular problem where novel solutions for the use of contaminated dredged material have been proposed. Early consultation with the EA or SEPA is advised.

Environmental Protection Act 1990

Part I of the Environmental Protection Act 1990 sets out the framework for controlling releases to air, land and water from prescribed process. These processes are listed under the **Environmental Protection (Prescribed Processes and Substances) Regulations 1991** and include some port and harbour operations. Part A processes defined therein are subject to Integrated Pollution Control by the Environment Agencies. Part B processes are subject to air pollution control only by local authority Environmental Health Departments.

Part III of the Environmental Protection Act 1990 combats statutory nuisances. The pollution complained of must be prejudicial to health or considered a nuisance. Dust, smoke fumes, other gases and odours could all constitute a nuisance under some circumstances. Local authorities are required to investigate complaints of nuisance within their boundaries. Under Section 80 of the Act local authorities are able to serve abatement notices or enforce fines of up to £20,000. **The Clean Air Act 1993** also gives powers to district councils to combat the local effects of air pollution by means of imposing controls on combustion processes. Cargo handling operations are generally provided and operated in accordance with the principles of Best Practical Environmental Option (BPEO) and Best Available Technology Not Entailing Excessive Costs (BATNEEC).

Local government, environmental health departments are responsible for dealing with complaints relating to nuisance within territorial waters. These include those arising from noise pollution or release of noxious substances under the Environmental Protection Act 1990. The local environmental health officer has the power to serve an enforcement order where a statutory nuisance has occurred

according to various British Standards and in line with the relevant regulations. The Marine Safety Agency has produced a code of practice for noise levels in ships (1983). This publication defines the latest noise standards for the protection of seafarers. Appropriate British Standards for different port operations should be adhered to, including those required during construction work.

The Environmental Protection Act 1990 imposes a duty of care on all persons in the waste management chain to take all reasonable measures to ensure that waste is safely and legally disposed of, specifically, to ensure that no offence is made by anyone else in the waste chain. Waste must be safely contained, may be transferred only to authorised persons and a waste transfer note must be completed by the two parties when the waste changes hands. These notes must be kept for a minimum of two years. An authorised person is a holder of a Waste Management Licence under Section 35 of the Environmental Protection Act or a registered waste carrier under the **Control of Pollution (Amendment) Act 1989**.

Under the Environmental Protection Act 1990 and the Northern Ireland Litter Order 1994 competent authorities are responsible for keeping land clear of litter.

Food & Environmental Protection Act (Part II) 1985 (FEPA)

FEPA provides the means for the UK to fulfil its commitments under the London and Oslo Conventions (1972 and 1974 respectively). The Act lists prescribed activities that require prior approval from the regulatory authority. The regulatory authority in England and Wales is the Ministry of Agriculture Fisheries and Food (MAFF), in Scotland it is the Scottish Office Environment, Agriculture and Fisheries Department (SOEAFD) and in Northern Ireland it is the Department of the Environment for Northern Ireland (DOE(NI)).

A FEPA disposal licence is normally required from MAFF or the Scottish and Northern Ireland alternatives for the deposit of dredged material at sea or works that involve materials or articles being placed in the sea. It is the disposal of material and not the dredging activity itself that is licensed. Nevertheless, the regulatory authority has the power to impose conditions and limitations on the areas where dredging is permitted. As part of the licensing process FEPA licence applicants must provide detailed information about the quantity of material and physical and chemical properties of the material to be deposited before a license is issued. The licensing authority may request additional samples if levels of contamination need further investigation and where contamination is identified they may specify an area where dredging is not permitted by reference to charts and co-ordinates. Alternatively, they may advise that alternative disposal on land should be sought. EA/SEPA, with the involvement of local authorities, regulates disposal of contaminated dredged material on land. Any effects on the environment must also be considered prior to a FEPA licence being issued. In addition, greater emphasis has been placed on evaluating options for beneficial use of dredged material in recent years. This trend is likely to continue.

FEPA has been amended by Section 146 of the **Environmental Protection Act 1990** to include UK controlled waters. The **Deposits in the Sea (Exemptions) Order 1985** lists activities that are exempt from licensing. These exemptions include the return of some matter to the sea removed during dredging or deposited for coastal protection or harbour works. From 1994 exempted activities must be registered with MAFF under an amendment contained within the **Waste Management Licensing Regulations 1994**.

Within marine SACs the renewal of licenses for the disposal of maintenance dredgings, should be relatively straightforward provided that adequate information is provided in line with government guidance. In general, maintenance dredging has been carried out within ports, harbours and estuaries over several years if not decades and is in essence an intimate part of the sediment regime and dynamics of an area. It is widely acknowledged that there are gaps in the scientific understanding of hydrodynamics and sediment transport and therefore in some cases a monitoring programme may be required to establish that disposal has not caused unforeseen problems. It is generally viewed that the regulations and controls in existence, as outlined in this section, provide the most suitable route to account for maintenance dredging within the SAC management schemes and constitutes good practice.

Harbours Act 1964 and Transport and Works Act 1992

The Transport and Works Act 1992 amends Section 48 of the Harbours Act 1964 and places a responsibility on a harbour authority to consider the environment in its management of a port or harbour. The form this consideration takes depends on the sensitivity of the site(s) involved and the level of disturbance from proposed works or activities. Section 48 states:

It shall be the duty of a harbour authority in formulating or considering any proposals relating to its functions under any enactment to have regard to -

- a) the conservation of the natural beauty of the countryside and of flora, fauna and geological or physiographical features of special interest;
- b) the desirability of preserving for the public any freedom of access to places of natural beauty;
- c) the desirability of maintaining the availability to the public of any facility for visiting or inspecting any building, site or object of archaeological, architectural or historic interest;

and to take into account any effect which the proposals may have on the natural beauty of the countryside, flora, fauna or any such feature of facility.

The Act also amends Schedule 2 of the Harbours Act to allow harbour authorities to apply for a harbour revision order to:

“confer duties or powers (including powers to make byelaws) for the conservation of the natural beauty of all or any part of the harbour or of any of the fauna, flora or geological or physiographical features in the harbour and all other natural features.”

Hazardous Waste Regulations 1988

The Trans-frontier Shipment of Hazardous Waste Regulations 1988 applies to the handling of hazardous cargo. Under these regulations the trans-frontier shipment of hazardous waste is prohibited unless the parties involved have already entered into a contract. Consent is required from the local authority if hazardous substances are to be present within the port or harbour estate unless it can be shown that their presence is solely for transfer between parts of the transport chain.

International Regulations for Preventing Collisions at Sea 1972

The International Regulations for Preventing Collisions at Sea 1972 aims to lessen the risk of collision. It is particularly important that these Regulations are adhered to within confined and congested areas. The Regulations include rules relating to the maintenance of a proper look out and safe speed.

Landfill Tax Regulations 1996

Under the Landfill Tax Regulations uncontaminated maintenance dredged material from inland waterways and ports is exempt from the tax. However, availability of landfill in the UK is limited and it is not considered good practice to dispose of material in this way. In any case, it is often impractical to do so given the volumes of material involved and the necessity for road journeys in order to deposit the material.

MARPOL 73/78 - International Convention on the Prevention of Pollution from Ships

The most wide ranging and comprehensive legislation for the control, ashore and afloat, of waste arising from shipping activities is the International Convention on the Prevention of Pollution from Ships (MARPOL 73/78). The objective of the measures introduced by MARPOL is to regulate and minimise pollution from ships by oil and other harmful substances. The International Maritime Organisation (IMO) maintains the convention through its marine environment protection committee. MARPOL 73/78 covers the five main forms of ship generated waste in five specific annexes which are summarised in the table below.

Annexes I, II, IV and V provide specific requirements for the handling and discharge of ship generated wastes. Annex IV regarding the discharge of sewage from ships has not yet come into force, although many Member States have signed up to the Annex, including the UK. These regulations will apply to ships over 200 tons gross or a ship carrying more than 10 persons.

Annex V sets out the measures to be followed in the disposal of ship generated garbage, taking account of all the physical nature of the material which includes a total ban of the disposal of all plastics into the sea anywhere. IMO has published 'Guidelines for the implementation of Annex V of MARPOL 73/78' which are intended to assist in compliance with the requirements of the Convention. Cargo waste is generally accepted as being a lesser problem than ships operational (domestic) waste. Cargo handling companies, whether independent or part of the port authority, are expected to keep quays and berths clear. Indeed it has been suggested that cargo waste should be either recognised as a separate Annex to MARPOL or removed completely from the jurisdiction of the Regulations. A new additional Annex (Annex VI) is being developed to extend MARPOL regulations to cover air pollution from ships.

MARPOL regulations relating to port reception facilities for ship generated wastes.

| Annex | Category of Waste | Annex in force? | Reception facilities required? | Types of waste for reception |
|-------|------------------------------------|-----------------|--------------------------------|---|
| I | Oil | ✓ | ✓ | Covers all types of wastes from the discharge of oil, fuel, engine from ships. |
| II | Noxious liquid substances | ✓ | ✓ | chemicals, fuel, engine from ships. |
| III | Harmful substances carried in bulk | ✓ | ✗ | chemicals, fuel, engine from ships. |
| IV | Sewage from ships | ✗ | ✓ | Raw sewage - retained in holding tanks for discharge in port or outside 12nm. |
| V | Garbage from ships | ✓ | when annex comes into force | Garbage in port or outside 12nm (food and packaging) and operational (maintenance, hold and miscellaneous) wastes in port or outside 4nm. |
| VI | Air pollution from ships | ✗ | when annex comes into force | Partially treated sewage (retained in holding tanks) and operational (maintenance, hold and miscellaneous) wastes in port or outside 4nm. |

MARPOL regulations are empowered in UK legislation in the **Merchant Shipping Acts and Regulations**. These include the **Merchant Shipping (Prevention of Oil Pollution) Act 1971**, the **Merchant Shipping (Reporting of Pollution incidents) Regulations 1987** and the **Merchant Shipping (Dangerous or Noxious Liquid Substances in Bulk) Regulations 1996**.

MARPOL Regulations for the provision of reception facilities for ship generated waste are installed in UK legislation under the **Prevention of Pollution (Reception Facilities) Order 1984** and the **Merchant Shipping (Reception Facilities by Garbage) Regulations 1988**. These regulations require port and harbour authority operators to provide reception facilities for ships that, in their opinion, are using the harbour or terminal for a primary purpose other than using the reception facilities. The facilities must be adequate (of sufficient capacity and appropriate design) to meet the needs of ships using them without causing them undue delay.

Merchant Shipping (Oil Pollution Preparedness Response and Co-operation Convention) Regulations 1997

Many UK ports and harbours are currently in the process of developing or revising their oil pollution emergency or contingency plans according to the requirements of the Merchant Shipping (Oil Pollution Preparedness and Response Convention) Regulations 1997. The Marine Pollution Control Unit (MPCU) have produced guidelines for ports, harbours and oil handling facilities in developing the new oil spill contingency plans.

Oil spill contingency plans represent a preconceived plan of action to follow in the event of an oil spill to assist in providing the immediate response. Such plans are needed in addition to other plans and procedures that aim to prevent oil spills in the first place, because accidents can and do occur. Such plans are important in the context of oil spills because of the inevitable close proximity of oil to the shoreline. The purpose of the plan is to provide direction and guidance to those involved in responding to an oil spill incident and to set in motion all the necessary actions to stop or minimise the pollution and reduce its effects on the environment.

Oil contingency plans should be compatible with the national contingency plan for marine pollution from shipping and the offshore industry and must be submitted to the Marine Pollution Control Unit as the competent national authority, for approval. The plans are constructed with the approval of the various government departments, environment and countryside agencies. Each plan is based upon a set of guidelines but is specific to the area concerned.

Merchant Shipping (Port Waste Reception Facilities) Regulation 1997

In 1993, an inquiry carried out by Lord Donaldson 'Safe ships, clean seas' concluded that there was no single solution to prevent the different types of wastes from entering the sea. As a result of this it was decided that three tasks needed to be undertaken, and are as follows:

- Make controls more effective through improving regulations and their enforcement;
- Improve the facilities for the legal disposal of wastes in ports and;
- Increase the penalties for illegal discharge.

A mechanism by which these three tasks can be met was introduced in January 1998, by the Merchant Shipping (Port Waste Reception Facilities) Regulations. The Merchant Shipping (Port Waste Reception Facilities) Regulation 1997 require ports, harbours, terminals, installations, marinas, piers and jetties in the UK to produce a report to the Government on how they plan their port reception facilities for ship generated waste. In order to comply with the Regulations the report must be submitted to the local office of the Maritime and Coastguard Agency (MCA), in the first instance, by September 1998 and then at two yearly intervals thereafter. Guidelines have been drawn up by the Department of the Environment, Transport and the Region (DETR, 1998), with input from its Marine Pollution Advisory Group.

Basically, a waste management strategy is a systematic approach that outlines how and by whom waste is managed. It outlines the practical action, such as collection, transport and disposal and the legislative controls that ensure that these actions are carried out. A total waste management strategy incorporates handling of both ship generated wastes, which are received in a port, and land generated waste, either from domestic or industrial origin (IMO, 1995). The production of a waste management plan requires that each type of waste generated by ships is considered separately, according to the relevant regulations.

United Nations Convention on the Law of the Sea (UNCLOS), 1982

The main objective of UNCLOS is to establish "the legal order for the seas and oceans which will facilitate international communication and will promote the peaceful use of the seas and oceans, the equitable and efficient utilisation of their resources, the conservation of their living resources, and the study, protection and preservation of the marine environment".

Part XII of the Convention addresses the protection of the marine environment and requires states to protect the environment by taking all measures necessary to prevent, reduce and control pollution of the marine environment from any source. Article 211 specifically requires states to establish international rules and standards to prevent, reduce and control pollution of the marine environment from vessels. The regulations adopted by the IMO, such as MARPOL 73/78, are considered to comprise the relevant international standards on pollution from vessels.

Article 212 of the United Nations Convention on the Law of the Sea (UNCLOS) requires member states to take measures to control atmospheric pollution. Consequently, emissions from shipping are receiving increasing international attention. Considerable work has been carried out by IMO on the development of an air pollution Annex to MARPOL. Much of this work has focused on the reduction of sulphur dioxide emissions.

Appendix G

Environmental management systems

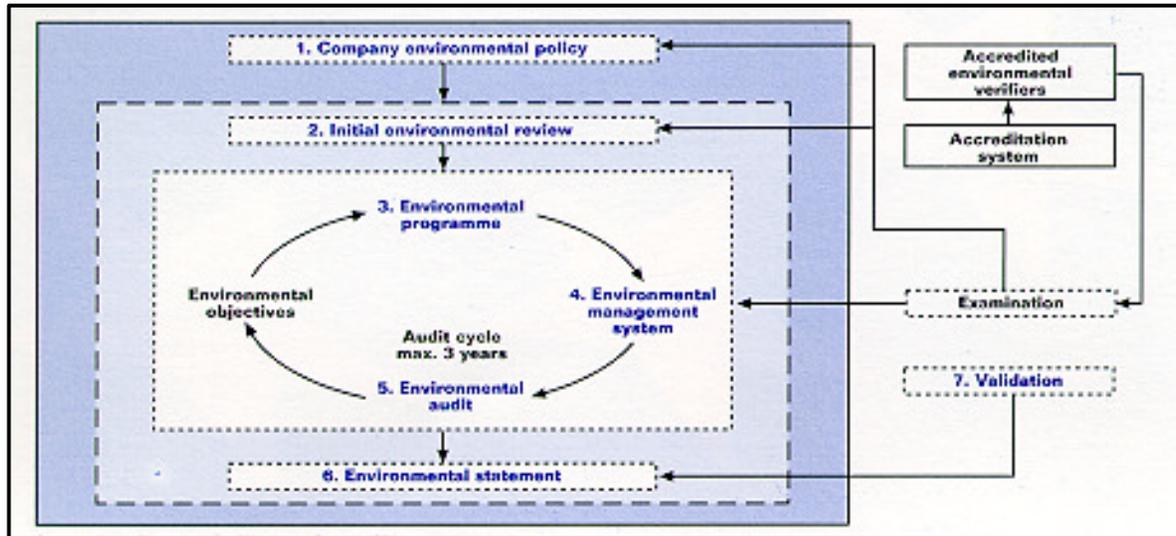
Environmental management systems: A step by step approach

Environmental management systems are an internal system of procedures and reviews that seek to identify and minimise the impacts of port operations. In some cases environmental management systems have been developed through an informal process simply to provide a more strategic approach to ports' existing management procedures, in other cases they have been developed to meet the International Standards for environmental management systems ISO14001 or the European Eco-Management and Audit Scheme (EMAS). At present EMAS registration is restricted to companies in the mining, manufacturing, utility or waste sectors, although it is due for revision for implementation in the year 2000. The specifications of EMAS are changing to amore user-friendly format based on ISO 14001 management systems. If a regulatory regime comes into force then EMAS will be central to it, and any voluntary system must achieve or approach EMAS certification to be regarded as acceptable (Meacher 1998).

For a company to be a registered EMAS site a number of steps need to be implemented to create an audit cycle (IEA 1998):

- **Environmental Policy**
The company must have an overall corporate environmental policy this must be adopted and reviewed at the highest level. It must contain two central elements; a commitment to compliance with all relevant environmental regulations; and to continuous improvement of environmental performance. The policy should be written down, and be readily available to both staff and public.
- **Environmental Review**
The next step is to identify all the existing environmental impacts, and determine how these measure up to your stated policy and to environmental regulations, to see which areas need improvement. Following this, there needs to be specific targets included in the environmental policy and prioritised.
- **Environmental Programme**
The environmental programme exists to put the policy into practice. Once the priorities have been set, the programme has to be implemented, with a description at every stage.
- **Environmental Management System**
The programme must be properly defined, and document the responsibilities of everyone on the project and the interrelations between key personnel. It must be fully integrated into the company's existing management structure, and a senior manager must maintain and implement the management system.
- **The Environmental Audit**
The programme's progress must be audited at regular intervals, some activities will need to be audited more often than others, in the case of treatment of effluents. The audits must be objective, systematic and fully documented, and executed according to the relevant parts of the ISO 14011 international standard.
- **Environmental Statement**
EMAS requires the company to issue a public statement linked to the audit, outlining in clear and concise language exactly how they have met their stated objectives. The statement must include significant changes since the last statement, a deadline for the next validated statement and identification of accredited verifier
- **Validation**
Before publication, an accredited verifier who is independent of the site's auditor must validate the environmental statement.

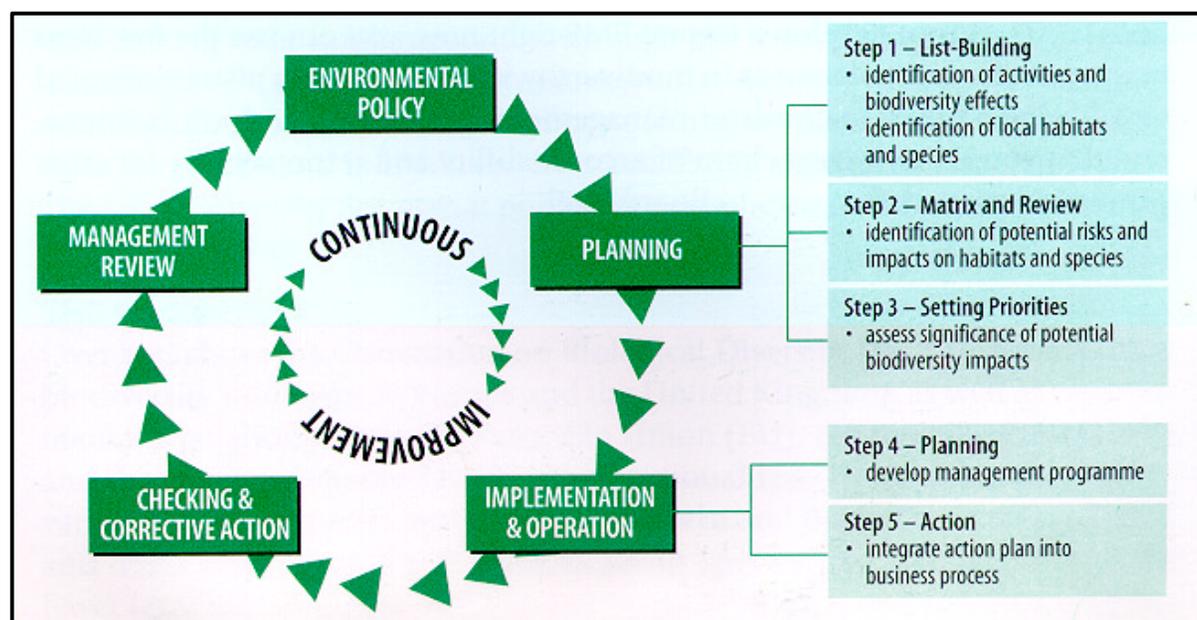
The cyclic process shown in the figure overleaf will be repeated at suitable intervals, the intention at all times is to maintain a continuous improvement of environmental performance (IEA 1998).



The European Eco-Management and Audit Scheme (EMAS) (Taken from: EMAS – An introductory guide for industry. Department of the Environment, 1995).

PIANC has set up a Working Group to develop a generic framework, which can be used as a guide to implementing environmental management in ports and related industries. The PIANC proposed EMF (Environmental Management Framework) has four main components; policy, plan, act and continual improvement and is shown in the figure overleaf (PIANC in prep).

Environmental management systems can be modified to incorporate other action plans important when dealing with the marine environment, such as biodiversity action plans. The main elements of the environmental management system are shown in the figure below, namely environmental policy, planning, implementation and operation, checking and corrective action, and management review. There are five main steps to follow during the planning, and implementation and operation phases, which apply to all environment and business considerations, not just biodiversity planning. The first three steps improve understanding of the important issues and the last two steps help formulate a decision for action. It is important that there is a clear chain of accountability and responsibility for environmental matters throughout any business (Earthwatch 1998).



Taken from: Business and Biodiversity, Earthwatch 1998.

PIANC Environmental Management Framework for Ports and Related Industry

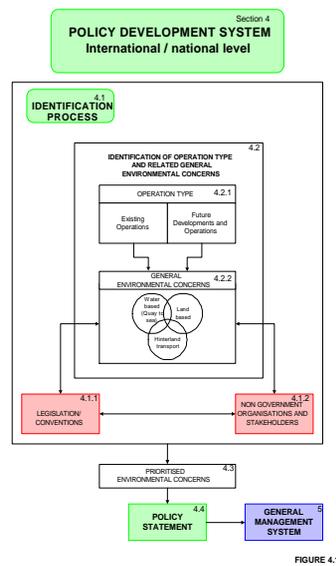
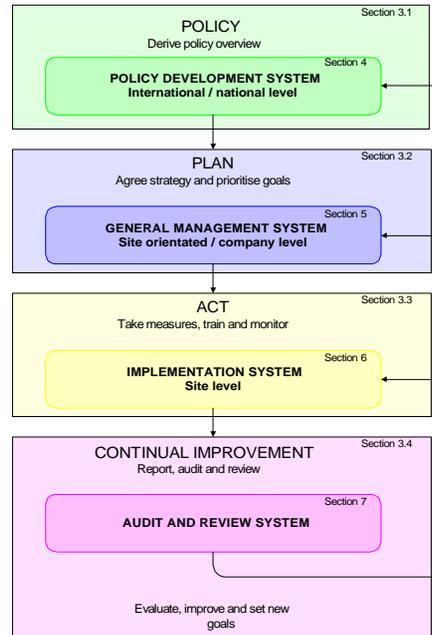
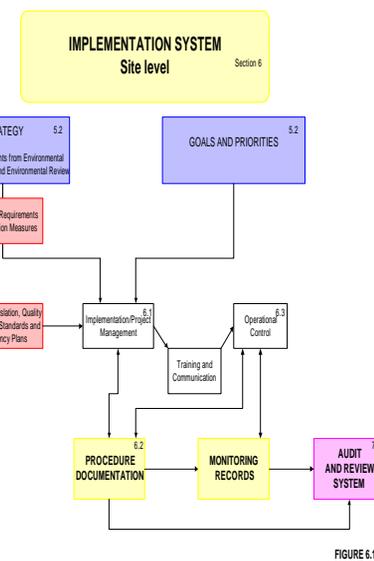
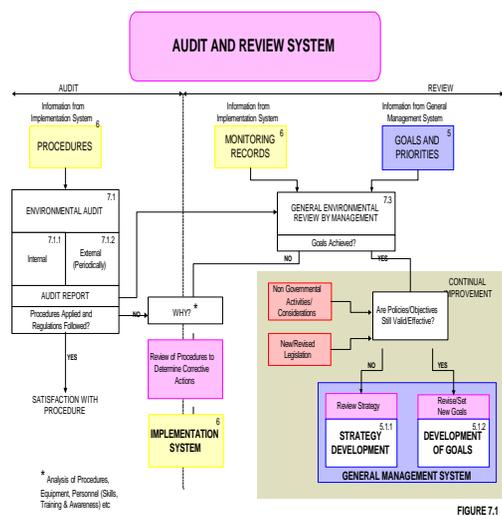
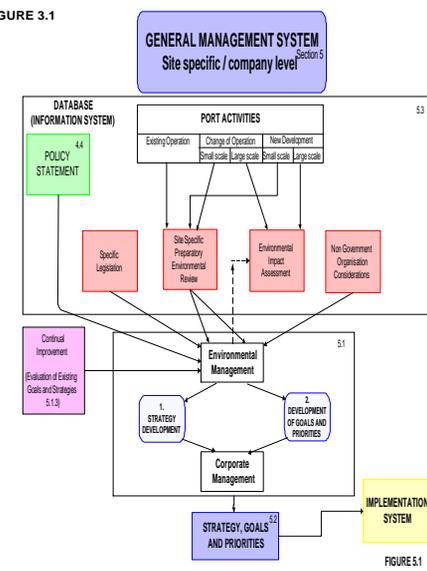


FIGURE 3.1



Adapted from: Environmental management framework for ports and related industries, PIANC in preparation.

Appendix H

**Commercial passenger boat code
prepared for harbours operating within
the Cardigan Bay Candidate SAC**

COMMERCIAL PASSENGER BOAT CODE

This code has been produced by the owners and skippers of commercial passenger boats operating out of New Quay and Aberaeron, in conjunction with officers from Ceredigion County Council. It has been prepared with the best available advice/information on how to avoid disturbance to wildlife. The guidance applies to all licensed operators.

It is recognised that the Ceredigion Marine Heritage Coast (MHC) and candidate Cardigan Bay Special Area of Conservation (SAC) are important areas for marine wildlife, and the following practices should therefore be followed at all times within the area:

General

- * Speed limit within the MHC of 8 knots.
- * Speed limit of 8 knots within 300m from high tide line along other stretches.
- * Adhere to harbour speed limits.
- * Outside these areas be aware of wildlife and adopt suitable behaviour when coming into contact with them.
- * Approach coves as slowly as possible, that is throttle back before the boat enters the field of view. **NB** onshore winds make boats audible long before they are in view.
- * Manoeuvre the boat as little as possible when close. Minimise the need to switch engines on/off and anchor or lodge the boat in stationary position wherever possible. If conditions require frequent manoeuvring, limit time spent at site.
- * Explain appropriate behaviours to passengers before moving in close: that is no sudden movements, get camera ready before hand, keep a low profile and keep voices low.
- * Do not ground the boat on the upper beach on the top of the tide. Keep a minimum of one boat length from the tide line. Leave the area slowly and with the minimum use of throttle.

Seals

- * Keep a distance of 50m away from those haul out sites indicated on map.
- * Keep a distance of 50m away from those pupping areas indicated on map from mid August.
- * Avoid pointing the bow of the boat at the seals on approach.
- * Watch for submerged cows on approach as the majority are on the bottom just a few metres offshore. Do not position the boat between mother and pups and avoid blocking beach access in narrow or shallow inlets.
- * Watch the seals for signs of disturbance; that is rapid swimming to and fro, looking wide-eyed at the boat, sudden panic dives. If animals remain nervous or alert, consider withdrawing. If animals move back into the water, you have disturbed them, make an immediate withdrawal quietly to prevent an extended stampede.

Birds

- * Keep a distance of 50m away from those auk colonies indicated on map from March to mid July.
- * Approach quietly and with caution. Be prepared to back off quietly if there is any indication of distress (bobbing of heads, erratic movements) to colonies.

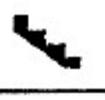
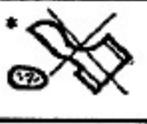
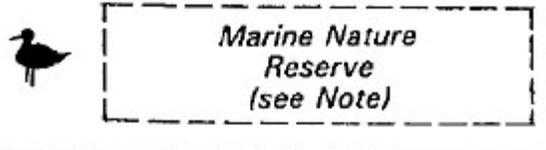
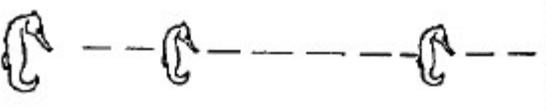
Cetaceans

- * Any individual should not be approached head on.
- * Throttle back from 300m when approaching.
- * Remain stationary or cruise by at 100m from any individual or group - let them come to you.
- * Do not circle around individuals or group.
- * Avoid 'bunching' around animals.
- * Avoid deviating from agreed routes to see animals.

Appendix I

**Examples of possible symbols
to be used for marine environmental
piloting purposes**

**Proposed Small Craft Chart Symbols to be used for
Marine Environmental Pilotage purposes.**

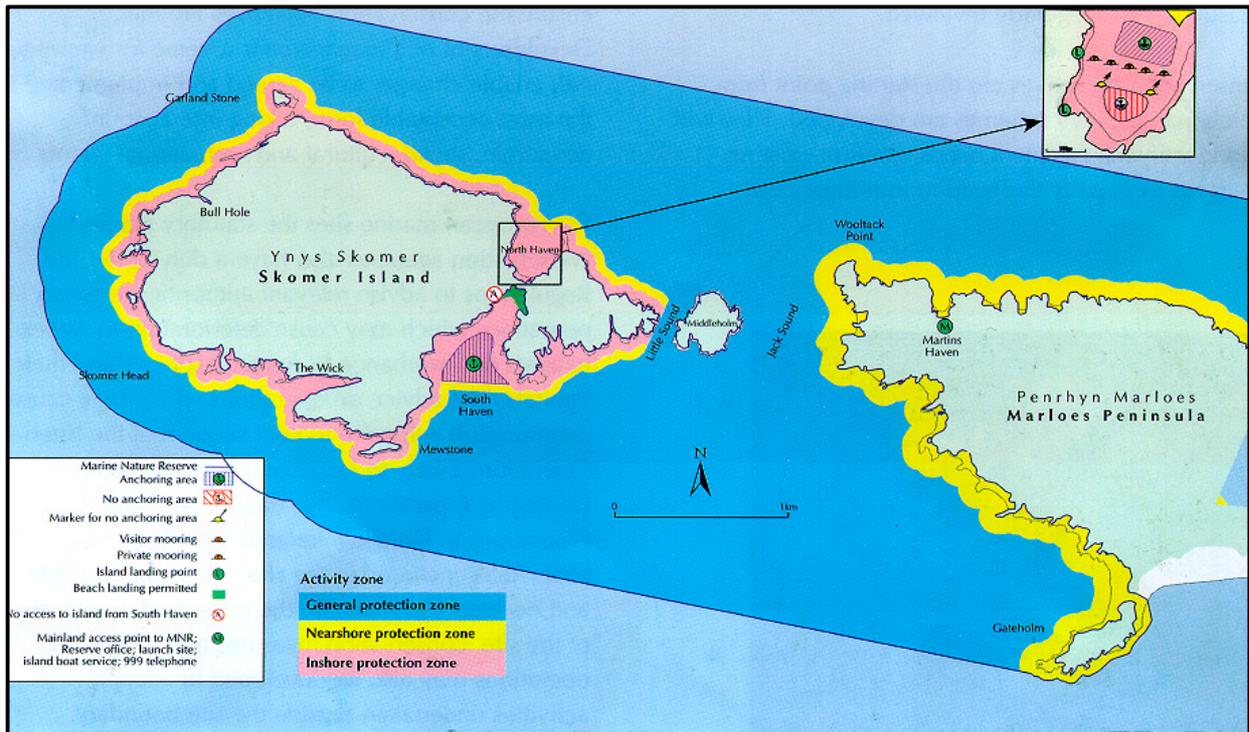
| | | |
|---|---|---|
|  |  | No anchoring indicating benthic species of nature conservation interest could be harmed. |
|  | | Visitors mooring buoys may be used where anchoring is prohibited as above. |
|  | | Public slipway to be used for landing and launching in preference to undefined locations which could be of nature conservation importance. |
|  | | Public landing place, steps or ladder to be used in preference to indiscriminate landing. As above. |
|  | | Public Toilets to be used in preference to sea toilets on vessels moored in confined waters close to the shore. |
|  | | Refuse bin available for the disposal of operational waste (garbage) as defined in MARPOL Annex V. |
|  | | Container for the disposal of waste oil from ships, not cargo residues. See MARPOL Annex I. |
|  | | Sewage pump out station with a waste water fitting, ship to shore, complying with ISO 228/1. (Sewage discharge fitting for yachts and small boats). |
|  | | Bird nesting site where landing should be avoided. If seasonal, exclusion dates will be shown in brackets. |
|  | | Plants of nature conservation interest where landing could result in damage. |
|  | | Site of marine nature conservation importance, mainly intertidal, where extra caution is required to avoid disturbance. Predominantly for the ornithological interest. |
|  | | Site of marine nature conservation importance, mainly sub-tidal where special vigilance is required to minimise pollution and caution when anchoring. See also chart symbols for the nature of the sea bed. |

* Indicates proposed new small craft chart symbol.

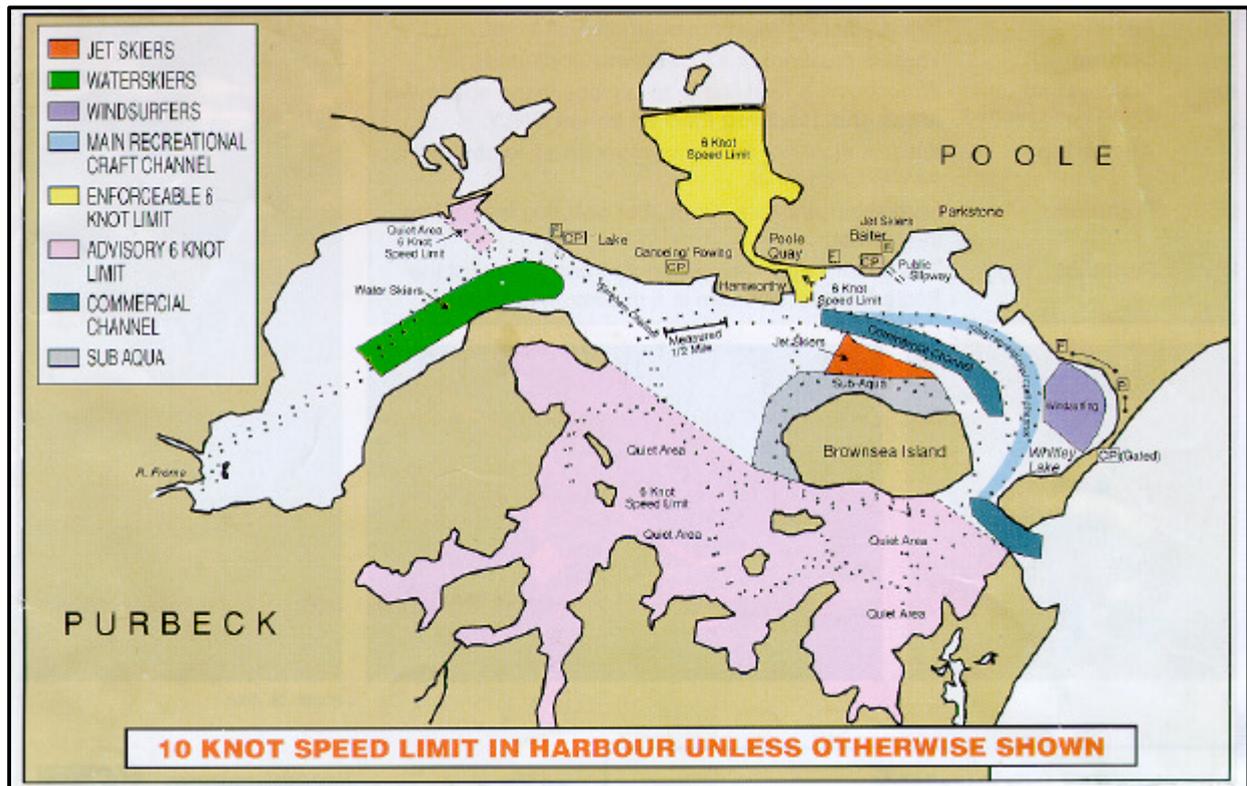
(Lankester, 1996)

Appendix J

Examples of zoning schemes



Skomer Marine Nature Reserve Zoning Scheme (CCW 1996)



Poole Harbour Aquatic Plan – Recreational Zoning Scheme (Poole Harbour Commissioners 1995)

Appendix K

Environment Agency Pollution Prevention Guidelines for marinas and craft (PPG14)



MARINAS
AND CRAFT:
PPG14

POLLUTION
PREVENTION
GUIDELINES

These notes are for general guidance and the information given is without prejudice to any specific legislation, bye-laws or licensing conditions.

Note. Reference is made in these guidelines to oil absorbents which are materials which attract oil and repel water. Suitable oil absorbents should be available from chandlers.

Under no circumstances should emulsifiers or detergents be used on oil spillages.

1. GENERAL

The Environment Agency is responsible for the protection of "controlled waters" from pollution under the Water Resources Act 1991 and it is an offence under the Act to cause pollution, either deliberately or accidentally. "Controlled waters" include all watercourses and canals, estuaries and coastal waters out to three miles. Diesel, oil and petroleum spirit, sewage and contaminated bilge water can all cause pollution if discharged into controlled waters.

It is important that all who enjoy the use of canals, rivers, estuaries and coastal waters, for business or pleasure, are aware of the following requirements, in order that they can help protect the environment and maintain a valuable amenity for all.

2. FUELS AND OILS

The most frequently reported type of water pollution incident involves fuels and oils. By following the guidance in this section you can minimise the risk of your boat or marina being a cause of such pollution. If a spill should occur in freshwaters contact the Environment Agency Emergency Hotline (0800 80 70 60). In estuarial and coastal waters contact the nearest port or harbour authority or the coastguard for major spills. Do not attempt to clean up with detergents or emulsifiers, as these will increase the risk of harming the environment.

a. Craft

- i. All powered craft should be properly maintained to minimise emissions both to the atmosphere and to water.
- ii. Portable fuel tanks and spare fuel containers should be filled away from the waters edge and never overfilled, as spillage and bilge contamination will result. They must be sited and secured safely on the vessel to minimise the risk of collision damage, accidental spillage overboard or unauthorised interference.
- iii. A small quantity of oil absorbent material should be kept on the craft at all times for use in the event of a spill. Used oil absorbents should be properly disposed of at approved facilities at Marinas, Lock Stations or Local Authority Waste Disposal sites.
- iv. Fixed fuel tanks should be carefully filled adjacent to the fuel supply facility, ensuring that no fuel is discharged overside or into any part of the vessel. Some free space should be left in the tank to avoid overflow should the craft tilt. Any spillages must be mopped up with a suitable absorbent.
- v. Inboard engines must have a drip tray under the engine and gearbox to prevent contamination of the bilge. This should be maintained in a clean and dry condition. For additional guidance on drip tray specification see Reference 1.
- vi. It is an offence to discharge contaminated bilge water into any watercourse. If bilge water should become contaminated, it should be pumped to suitable facilities ashore or absorbents should be used. **On no account should detergents or emulsifiers be used in bilge water.**

- vii. If the vessel develops a problem involving loss of oil/fuel, then stop at the nearest accessible mooring point for maintenance. On rivers and canals, do not moor immediately upstream of any water abstraction point or attempt to travel a great distance on the river.

b. Refuelling facilities

- i. Fuel installations should be well maintained and all delivery hoses, pipework and delivery nozzles kept to a high standard and secured to prevent unauthorised interference. "Trigger" delivery nozzles with automatic cut-off on release should be used.
- ii. Above ground fuel and oil storage tanks should be fully bunded and pipework protected against failure, accidental impact, theft and vandalism. Detailed guidance is available on above ground oil storage facilities (Reference 2). Underground oil tanks and pipelines may be subject to damage or corrosion and above ground facilities are preferred. In areas where groundwater is sensitive to pollution such facilities may be subject to restrictions.
- iii. Waste oils should be kept in a bunded tank or in sealed drums in a secure dedicated store or surrounded with a kerb bund. The oil should be disposed of, with due consideration to the "Duty of Care" for waste matter, to an oil bank, recycling centre or by a licensed waste disposal contractor. Contact the Oil Bank Helpline on freephone 0800 663366 for information on oil bank locations. A guidance note on the safe storage and disposal of used oils is available (Reference 3).
- iv. "Spill kits" containing absorbents and other materials should be kept readily available to contain and remove any spillage that has occurred, either directly into the water or onto the ground. Contaminated absorbents must be disposed of safely to a licensed waste disposal site.
- v. Bowsers should be maintained to a high standard. Where fuel is to be delivered by pump an anti-syphon valve should be incorporated in the delivery line. When not in use bowsers should be kept securely locked, preferably in a bunded compound well away from the water's edge or surface water drains.

3. SEWAGE

Sewage effluent must not discharge from shore installations into controlled waters without the consent of the Environment Agency. Discharges to British Waterways canals will also require BW consent. Sewage discharges from vessels to rivers and canals are not permitted. For tidal and coastal waters, reference should be made to local harbour authority by-laws.

a. Freshwater navigations

Vessels with sanitation systems discharging sewage overboard must be sealed (or rendered inoperable) when entering freshwater navigations so that no toilet waste may be discharged overboard or onto land. "Grey Water" from sinks and showers may be discharged but care is needed to avoid the release of polluting materials such as strong cleaning agents and cooking oil. Holding tanks must be pumped into approved sanitary stations and never allowed to overflow.

b. Tidal waters

Discharges from sea toilets are not prohibited. However, consideration should be given to other water users and any bye-laws covering waters in the control of local harbour or port authorities. Chemical toilet waste should be pumped to an approved sanitary station and must not be discharged overboard.

c. Sanitary stations

Sanitary stations should, where possible, be connected to the public foul sewer. In remote situations this may not be possible and an alternative method of sewage disposal, such as cesspool, septic tank or package sewage treatment plant, will have to be considered. These options will require special consideration and consultation with your local Environment Agency Office is advisable. Any sewage disposal facilities will need adequate maintenance to ensure correct operation and to prevent overflows to the watercourse. Chemical toilet waste should not be accepted at stations served by septic tanks and package sewage treatment plants as the chemicals can harm the micro-organisms responsible for treating the sewage. For further guidance on sewage disposal see Reference 4.

4. BOAT HULL CLEANING, PAINTING AND ANTIFOULING

Most antifoulant products are designed to kill or discourage naturally occurring organisms and, as such, may cause damage to the water environment if used carelessly. In order to prevent your cleaning activities from becoming a pollution risk, you should observe the following guidelines;

a. Removing old coatings

All maintenance and blasting should be carried out in dry dock if possible. When removing old antifouling paint layers, care must be taken to prevent effluent and solids from these activities being discharged to a watercourse. If near to the waters edge, the use of suitable screening/barriers will prevent solids from entering the watercourse.

b. Application

Remove your craft to dry dock. Avoid any spillage of paint, solvent or antifoulant onto land, into drains or watercourse. Take specialist advice on the choice of paint, bearing in mind local conditions and then apply the recommended product in accordance with the manufacturers instructions. Note that current legislation prohibits the use of TBT and TPT antifoulants on private vessels of less than 25 metres. (Reference 5). Operations involving larger vessels and TBT or TPT require authorisation from The Environment Agency (Reference 6).

c. Cleaning

If possible, remove your craft from the water. When cleaning or hosing off, never use more abrasion than necessary. Use a sponge or cloth on soft (copolymer type) antifouling. A pigmented runoff indicates that too much force is being used, anti-foulant is being lost and that toxins are being flushed into the water. To prevent this from happening, reduce the water pressure you are using. You may only use clean water on the external surfaces of the vessel if it remains afloat - on no account may detergents, degreasers or any other chemical cleaner be used.

d. Clean-up

Clean-up when you have finished. Make sure that old tins, brushes, solvents, blasting debris or scrapings are collected and disposed of as recommended by the manufacturer. Clean-up any spilt antifouling paint.

5. LITTER

All water users have a duty of care to protect and enhance the environment. Refuse must, therefore, be kept securely on board until unloaded into a proper litter facility. Burning of refuse is strongly discouraged.

6. REPORTING POLLUTION

Water pollution is an ever constant threat. If you notice anything unusual, such as dead fish or a suspected polluting discharge, or you observe bad practice, please notify the Environment Agency as soon as possible on the Emergency Hotline number, 0800 80 70 60

7. REFERENCES

1. Boat Safety Specification

available from:

Manager, Boat Safety Scheme,

British Waterways, Willow Grange, Church Road, Watford, Hertfordshire WD1 3QA.

The Boat Safety Specifications booklet is also available from The Environment Agency.

Pollution Prevention Guidance notes

2. PPG2 Above ground oil storage tanks.
3. PPG8 Safe storage and disposal of used oils.
4. PPG4 Disposal of sewage where no mains drainage is available.

Available from the Environment Agency

5. The Control of Pollution (Anti-fouling Paints and Treatments) Regulations 1987 S11987/783.
6. Chief Inspectors Guidance to Inspectors on The application or removal of Tributyltin or Triphenyltin coatings at shipyards or boatyards.

Available from HMSO

Other relevant publications:

Oil Care on Your Boat

Water Wisdom

Available from Environment Agency offices

The Waterways code for boaters

Available from British Waterways

Take to the Water - A beginner's Guide to boating on Inland waterways

Available from both British Waterways and the Environment Agency

BRITISH WATERWAYS HEAD OFFICE

Willow Grange, Church Road, Watford WD1 3QA

Tel: 01923 226422 Fax: 01923 201300

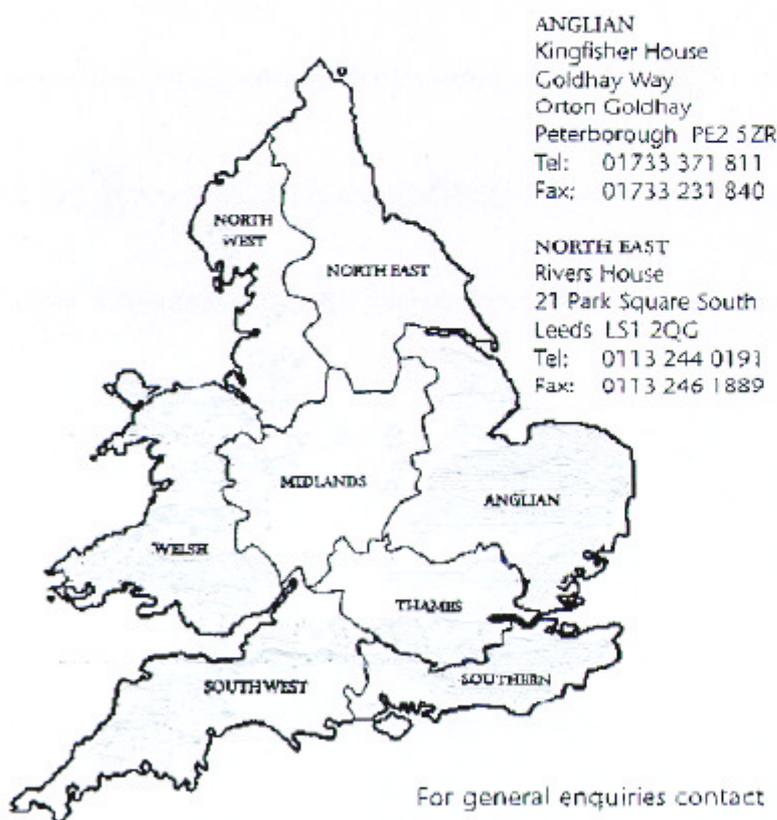
24hr Emergency Contact: **Freephone "Canals"**

ENVIRONMENT AGENCY HEAD OFFICE

Rio House, Waterside Drive, Aztec West, Almondsbury, Bristol BS12 4UD

Tel: 01454 624 400 Fax: 01454 624 409

ENVIRONMENT AGENCY REGIONAL OFFICES



ANGLIAN
Kingfisher House
Goldhay Way
Orton Goldhay
Peterborough PE2 5ZR
Tel: 01733 371 811
Fax: 01733 231 840

NORTH EAST
Rivers House
21 Park Square South
Leeds LS1 2QG
Tel: 0113 244 0191
Fax: 0113 246 1889

NORTH WEST
Richard Fairclough House
Knuttsford Road
Warrington WA4 1HG
Tel: 01925 653 999
Fax: 01925 415 961

MIDLANDS
Sapphire East
550 Streetsbrook Road
Solihull B91 1QT
Tel: 0121 711 2324
Fax: 0121 711 5824

SOUTHERN
Guildbourne House
Chatsworth Road
Worthing
West Sussex BN11 1LD
Tel: 01903 832 000
Fax: 01903 821 832

SOUTH WEST
Manley House
Kestrel Way
Exeter EX2 7LQ
Tel: 01392 444 000
Fax: 01392 444 238

THAMES
Kings Meadow House
Kings Meadow Road
Reading RG1 8DQ
Tel: 0118 953 5000
Fax: 0118 950 0388

WELSH
Rivers House/Plas-yr-Afon
St Mellons Business Park
St Mellons
Cardiff CF3 0LT
Tel: 01222 770 088
Fax: 01222 798 555

The 24-hour emergency hotline number for reporting all environmental incidents relating to air, land and water.

**ENVIRONMENT AGENCY
EMERGENCY HOTLINE**

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Appendix L

**A summary of the main dredging
methods used in the UK and their
potential for sediment resuspension
and environmental affect**

A summary of the main dredging methods used in the UK and sediment resuspension (Bray, Bates & Land 1997; Bates 1998)

Grab dredgers

Grab dredgers are a relatively simple method of dredging which involves the collection of sediments in a crane mounted bucket, the jaws of which are opened and closed (rope operated or hydraulically) like a clamshell trapping sediments. There are various grab buckets designed for different types of material, such as mud grab, sand grab and the heavy digging grab. The upper structures of conventional grab buckets are open, and if they are overfilled, which is a common occurrence, sediments spill out of the bucket as it is raised through the water column. Suspended sediments are also released from the impact of the grab on the bottom, pulling the grab out of the sediments, seepage from grabs due to poor closure and from overflow of barges or hoppers.

Specially designed grabs are available with a closed plated upper structure which reduces spillage by over-topping, however whilst they appear to reduce suspended sediment levels in the upper water column, there is evidence to suggest that they may increase levels near the bottom. When dredging thin layers of sediment, for example to remove a thin layer of contaminated sediments, the closing arc of a conventional grab may cause over-dredging which can be avoided by using a 'cable arm grab' which closes horizontally.

Backhoe dredgers

Backhoes are shore-based or pontoon mounted 'diggers' which can be used in marine environments. Especially where ground conditions are difficult, such as shallow waters and confined spaces. Suspended solids can be released into the water column during excavation of the sediments, as the bucket is raised and lowered to the seabed, and from the overflow of barges. Suspended solid levels generated during this activity are likely to be similar to those generated using grab dredgers. This method of dredging is highly accurate and which may be of particular benefit when working in environmentally sensitive areas or contaminated sediments.

Trailing suction hopper dredgers 'trailer'

The trailing suction hopper dredger or 'trailer' is commonly used for maintenance dredging in coastal areas. As the ship moves slowly ahead sediments from the seabed are pumped through trailing dragheads into a hopper (reception tank). Suspended sediments can be generated as the draghead moves over the seabed, and from various other operating activities, although the largest contribution to increased concentration arises from overflow during loading. Trailer dredgers can be used for maintenance dredging in environmentally sensitive area if special care is taken. For example, they were successfully used for the deepening of the navigation channel in Lough Foyle, Northern Ireland without adverse affects to important shell fisheries in close proximity (Bates 1998). Certain modifications can be made to equipment to minimise the release of suspended solids including:

- use of special dragheads which minimise sediment suspension,
- reduced trailing speed,
- increased under keel clearance to minimise propeller scour,
- use of degassing to maximise pump performance in organic materials,
- use of underwater pumps to maximise solid concentration, and
- avoid using draghead water jets.

Water injection dredging

Water injection 'jetsed' is relatively new method of dredging which operates by injecting water into certain fine-grained sea bed materials, reducing their density to the point where they act as a fluid and flow over the bed through the action of gravity to lower levels. The aim of this type of dredging is not to raise sediments into the water column, and where properly applied environmental affects due to suspended solids are restricted to the vicinity of the seabed and are minimised greatly. However, some resuspension of sediments can occur using this equipment, intentionally or otherwise. At present this practise is exempt from FEPA licensing, as the sediments are not raised from the surface of the water and therefore no disposal takes place. However, this situation may be subject to review.

Seabed levelling

Another technique without the requirement for FEPA licensing because it there is no disposal is seabed levelling whereby a plough or seabed leveller is towed behind a suitable boat to flatten areas without lifting material from the seabed and dumping it elsewhere. There are three main types of plough; agitators, levellers and material movers. There is no available information on the potential for this dredging technique to increase levels of suspended sediments, although this is likely to occur during sediment movements.

Appendix M

Beneficial use case studies

Port of Truro, beneficial use of silts as capping material

Good practice in using dredged materials for construction purposes, can be illustrated by recent beneficial use schemes undertaken by the Port of Truro in the Fal and Helford SAC (Brigden 1996). The Port of Truro has been investigating the feasibility of mixing de-watered dredged material with china clay waste sands and other waste substances for composting (sewage sludge and green wastes) to cap derelict land on the site of former arsenic works. Two derelict experimental sites are already underway, the first of which used basic dredged spoil and was left to colonise naturally, the other where the dredged material mix was used and sown with grass seeds. Vegetation has become established at both sites where no plants had grown before the placement of dredged material, with the first site taking just three years to become established through wind borne seeding of native grasses, and the second sown site developing considerably quicker.

Adoption and adaptation of this beneficial use of dredged silts for 'composting' derelict sites may provide a number of benefits to other ports and harbours with a supply of silt, nearby storage places for dewatering dredgings, and access to suitable waste materials for mixing. However, the project has not been without its problems, for example the experimental site needed licensing by the Environment Agency under the Waste Management Licensing Regulations 1994 because the material was classed as a waste, despite the fact that the material was providing a beneficial use to create land of greater quality (less contaminated) than much of the existing derelict land.

Unfortunately, the licensing requirements introduce a cost which may act as a disincentive to undertaking such beneficial use schemes. If such beneficial use schemes are to be encouraged in the future there is a need for all of the relevant regulatory bodies involved to work together and reach consensus over ways that current regulatory disincentives may be removed, wherever possible.

Harwich Harbour Authority, intertidal recharge using dredged sands and silts for coastal defence and habitat creation

Harwich Harbour has been responsible for more beneficial use schemes than any other port in the UK. Dredged sands and gravels from channel deepening works have been used in a number of varied schemes, including intertidal recharge for coastal defence in the Stour, Orwell and Blackwater Estuaries and Horsey Island, reclamation works for port development at Felixstowe, construction of low water berms for foreshore stabilisation, and the creation of shellfish and crustacea habitat. Harwich Harbour committed to a programme of beneficial use research and monitoring under the guidance of an agreement with English Nature, RSPB and the Wildlife Trusts following the consent for the 1994 channel deepening consent.

Numerous experimental intertidal recharge schemes were undertaken in 1993 and 1994 with the objective of using the coarse dredged sediments to protect eroding saltmarshes and the infrastructure behind them. At Parkeston Marshes Copperas Bay on the north bank of the Stour Estuary, with funding from the Environment Agency, 250,000m³ of dredged sands from Harwich Harbour were sprayed onto the intertidal mudflats using rainbow discharge, raising them approximately 2m in height (Mark Dixon Environment Agency, personal communication 1996).

Post-scheme monitoring of the shore profile, sediments and animal communities has indicated that erosion of the foreshore has been arrested and the wetland is naturally being restored. Within two years a diverse benthic community is reported to have colonised the dredged material, however, due to the coarser nature of the dredged sands these communities are different to those previously inhabiting the intertidal flats with a reduction in typical mud dwelling animals. This change in benthic community is often accompanied in reduced food supplies for feeding birds and foraging fish, but conversely the new material may provide alternative habitats for breeding and nesting birds. Costs of undertaking such beneficial use schemes are greater than the alternative of disposal to sea, because of the higher costs involved with using smaller vessels and rainbow discharge techniques (Murray 1994a).

In addition to schemes using sand and gravels, a number of schemes have been undertaken to investigate the feasibility of using fine maintenance dredged material for intertidal recharge, whilst providing both the benefits of coast protection and habitat restoration. The first experimental scheme undertaken on Horsey Island in Hamford Water was unsuccessful in that material sprayed on to a small area of saltmarsh was washed off the recharge site by Spring tides (Carpenter and Brampton 1996). In Trimley Marshes on the Orwell Estuary, fine muds and sands were sprayed on to the intertidal mudflats in between gravel groynes placed perpendicular to the eroding shoreline with fencing and straw bales used to retain the material on the site.

Harwich Harbour have recently carried out two experimental intertidal recharge trials, each using over 20,000m³ of maintenance dredged muds (HR Wallingford & Posford Duvivier Environment 1998 Woodrow 1998). In the North Shotley scheme in the lower Orwell Estuary, 22,000m³ of maintenance material was pumped through a pipeline into a gravel bunded area to protect sea wall and the internationally important freshwater wetlands behind. In the Horsey North and Horsey Beach scheme, 20,000m³ of silt has been placed on a degraded marsh at Island Point to protect and regenerate saltmarsh.

Further initiatives for the future use of maintenance materials are being investigated by Harwich Haven Authority plan, as part of their proposals to provide a beneficial use for dredged material arising from the deepening of approach channels for the Ports of Felixstowe and Harwich. These schemes include intertidal recharge, dispersion of muds within the estuary system (trickle charge) and the placement of material behind seawalls to raise to intertidal levels (HR Wallingford & Posford Duvivier Environment, 1998).

Medway Port, intertidal recharge (trickle charge) using silts

An intertidal recharge experiment using maintenance dredgings from the port was undertaken in 1996 in a tributary of the Medway Estuary which is an SPA (Environmental Tracing Systems Ltd 1996; Pethick and Burd 1996). The objective of the scheme was to dispose of fine dredged material within an area of outstanding nature conservation interest and to retain the dredgings within the estuary system in a manner that is not harmful to the environment. The experiment was jointly funded by Medway Ports, MAFF's Flood and Coastal Defence Division, the Environment Agency and English Nature.

The 4000m³ of fine dredged materials taken from Cadnam Basin were placed on the lower intertidal by split bottom barges and were left for natural hydraulic processes to gradually move it up the foreshore (trickle charge/feed). This approach enables the sediments to be redistributed within the intertidal system and promote the natural evolution of intertidal habitats. Early results from this experimental recharge scheme indicates that bottom dumping and trickle feeding is a success for relatively small infrequent volumes of fine dredged material. Around 50% of the materials estimated to have been retained at the recharge site.

Appendix N

Waste management planning process

Port Waste Management Planning for Ship Generated Waste – Oil and Garbage

The production of waste management plans in ports and harbours presents the most effective means of minimising and avoiding the potential effects of operational and illegal discharges of oil and garbage from ships on the marine environment. Since January 1998 it has become a statutory requirement on all ports and terminals, including any facility capable of transferring people or goods between water and sea. This includes marinas, yacht harbours, boat building yards and public slipways. This will be achieved through the provision of adequate reception facilities that encourage the disposal of wastes in ports and terminals, and remove as far as is practical any incentives for illegal discharges at sea, reducing the amounts entering the marine environment. However, the extent to which the management of ports and harbours can reduce the amounts of garbage and oil entering the marine environment from ships is limited. Accidental spillages and discharges from ships do happen and despite the consequences of not following the regulations, such as heavy fines and damage to a company's image, illegal discharges continue. The regulation of such spills and discharges from ships is the responsibility of the MCA, not the port.

Most of the main ports and terminals located within or near marine SACs have developed and been operating waste management plans on a voluntary basis for a number of years. As a result of these voluntary plans the adequacy of waste reception facilities in UK ports and harbours has been addressed and in many cases improved. Although there has been some considerable progress in the voluntary development and implementation of these plans, in order to encourage and enforce further improvements, in January 1998 it became mandatory for ports and terminals to produce a report to Government on how they plan their port waste reception facilities. Based upon best practice shown in UK ports and harbours during the voluntary implementation of waste management plans, DETR have prepared guidelines 'Port waste management planning - how to do it' which promote an eight-step waste management planning process, summarised overleaf (DETR 1998).

RYA and BMIF have also produced a Port Waste Management Plan for recreational boat users and the leisure boating industries (RYA & BMIF 1998) based on the governments guidelines. They follow a similar eight-step approach adapted for facilities at landing places. The guide promotes the production of waste management plans tailored to meet the specific requirements of users, for example if a landing place caters for mainly dingys, windsurfers and canoeists, then facilities only need to be provided to meet the needs of those users.

Waste management plans for ship and boat generated waste also generally incorporate the management of waste generated and transported within the port and harbour area. In order to minimise levels of garbage entering the marine environment ports and harbours advise that rubbish must not be disposed of overboard or from the quayside. Most garbage items can be easily transported and disposed of into waste reception facilities. As good practice in marine SACs there are a number of simple considerations that might be incorporated in the waste management process which are:

Consultation

In addition to statutory consultees, ports and harbours should consider consulting with local representatives from country conservation agencies to improve their understanding of waste management planning and the measures taken by ports and harbours to minimise the potential impacts of wastes on the environment. Although long-term adverse effects on marine species and habitats are unlikely to occur from operational discharges from ships and boats in ports and harbour areas, where there is evidence of such affects in a marine SAC consultation with country conservation agencies should allow them to be addressed, where appropriate, within the waste management process.

Information

To ensure that reception facilities are fully used ports and harbours provide information to all mariners on the location, cost and procedures for using the facilities available and consultation arrangements for comments and complaints. In order to increase the awareness in port users, waste contractors, ships' agents and those working in the port area of the nature conservation importance of

the site in which they operate, summary information on the marine SAC should be provided in the waste management plan. A brief description can be given of the SAC and the features for which it has been designated, with particular reference to habitats and species in the site which are known to be sensitive to impacts of pollution from ship and boat generated wastes, such as the sensitivity of marine mammals to plastic litter.

Waste minimisation and recycling

In most ports, the operation of waste facilities is carried out by contractors properly approved by the local environment agency and the local authority. They have the expertise and capability to develop the efficiency of the waste system, and the motivation to do so. Most ports and harbours encourage the responsible management of waste, including waste minimisation and recycling, at the point of generation, transportation and disposal. However, the management of waste onboard ships and the extent to which waste is minimised at source, is clearly a matter for ship operators and owners who are now being required to produce waste management plans administered through the MCA port state control mechanism, not the ports.

Recycling is the waste management technique which has the potential for the greatest measurable reduction in a ship's garbage waste-stream (ICS 1998). The feasibility of promoting recycling of ship and boat generated wastes landed in ports and harbours should be considered to determine whether it presents a practicable environmental option and does not incur excessive costs or result in a loss in the ease of use of the facilities, an important consideration emphasised by Lord Donaldson ('Safer ships, Cleaner Seas'). Some ports, harbours and marinas provide recycling facilities for ship and boat generated garbage (such as paper, plastic, cans, bottles, engine oil and batteries) and ship and boat users are encouraged to separate out their wastes as far as is practicable. Oily waste (sludge) is recycled in most UK ports and harbours, in many cases generating revenue whilst reducing the amounts for disposal and hence disposal costs. A partnership approach to recycling schemes is likely to be the best way forward. Information and advice can be sought from local authorities, the local waste industry, country conservation agencies and those involved in estuary management planning.

Summary of DETR's eight step process for waste management planning in ports and harbours - What questions need to be answered in the port waste management plan?

1. Consult with interested parties

- The consultation process is fundamental to the production of effective waste management plans and all ports must consult with representatives of port users, local MCA and EA, and where relevant with the port health authority, local authority, MAFF and those responsible for estuary management planning.
- Who are the individuals and organisations consulted, what method of consultation was used, what were the consultees comments and how have they been addressed?

2. Analyse the estimated amounts and types of waste generated

- How many vessels of different types used the port in the last two years and how many are expected to use the port in the next two years?
- What amounts of different wastes were actually landed by ships using the port in the last two years?
- What are the estimated maximum amounts of waste that should have been landed over past two years and that might be landed in next two years? (assuming that all ships use waste reception facilities for the disposal of all wastes that can not legally be discharged at sea)
- How much waste is stored on board ships using the port for disposal outside the port area?

3. Consider if the type and capacity of facilities are adequate

- What types of waste reception facilities are provided at the port for the collection of different wastes and how much waste can they hold?
- Is their capacity adequate for the amounts of wastes that are actually landed in the port or the maximum amounts of wastes that should be landed?

4. Consider if the location and ease of use of facilities provide a disincentive to the use

- What is the location of reception facilities in the port and what conditions or arrangements are imposed for their use?
- Based on consultation, does the location of facilities or the arrangements for their use act as disincentive to landing waste?

5. Consider if the cost of facilities provide a disincentive towards use

- What method is adopted to charge for the use of different reception facilities?
- Based on consultation, do these charging methods act as a disincentive to the use of reception facilities and why were other methods of charging were not considered appropriate?
- Indirect charges for the use of reception facilities through port dues or contracts covering the use of facilities over a fixed period are considered unlikely to act as a disincentive towards use. However, garbage wastes are more suited to direct charging methods than wastes that involve large volumes or high levels of toxicity, such as oily wastes, where a direct charge is more practicable.

6. Ensure that effective publicity is given to the facilities

- Are users aware of the location of waste reception facilities and how to use them?
- What information is provided to ships on the location and operation of waste reception facilities?
- How is this information is transmitted to users (particularly new and irregular users)?

7. Submit a written plan to Government

- Initial draft plans to be submitted to local MCA offices for approval by the end of September 1998.
- All approved plans will be held in Southampton office of the MCA.

8. Review the planning process regularly

- The waste management process will be reviewed every two years from the time the first plan is approved
- It may be necessary to review the plan in the meantime, if substantial changes in operation or legislation take place

Appendix O

Emergency response:

Oil and chemical spill contingency planning

Emergency Response – Oil and chemical spill contingency planning

The new OPRC Regulations and the MCA have precipitated a review of emergency response plans by all harbours handling all but the smallest vessels, an essential component of which is an assessment of risk. While most harbours have had such plans for many years based on the professional judgement of the marine staff, the new regime calls for the risk assessment to be written down. All ports have a plan, which is tailored to the types of port user. This document can be used to increase transparency of the port operation. The plan cannot be too prescriptive because the one certainty in accidents is they will be unlike any foreseen scenario. The continuous process of contingency planning is summarised in the figure overleaf.

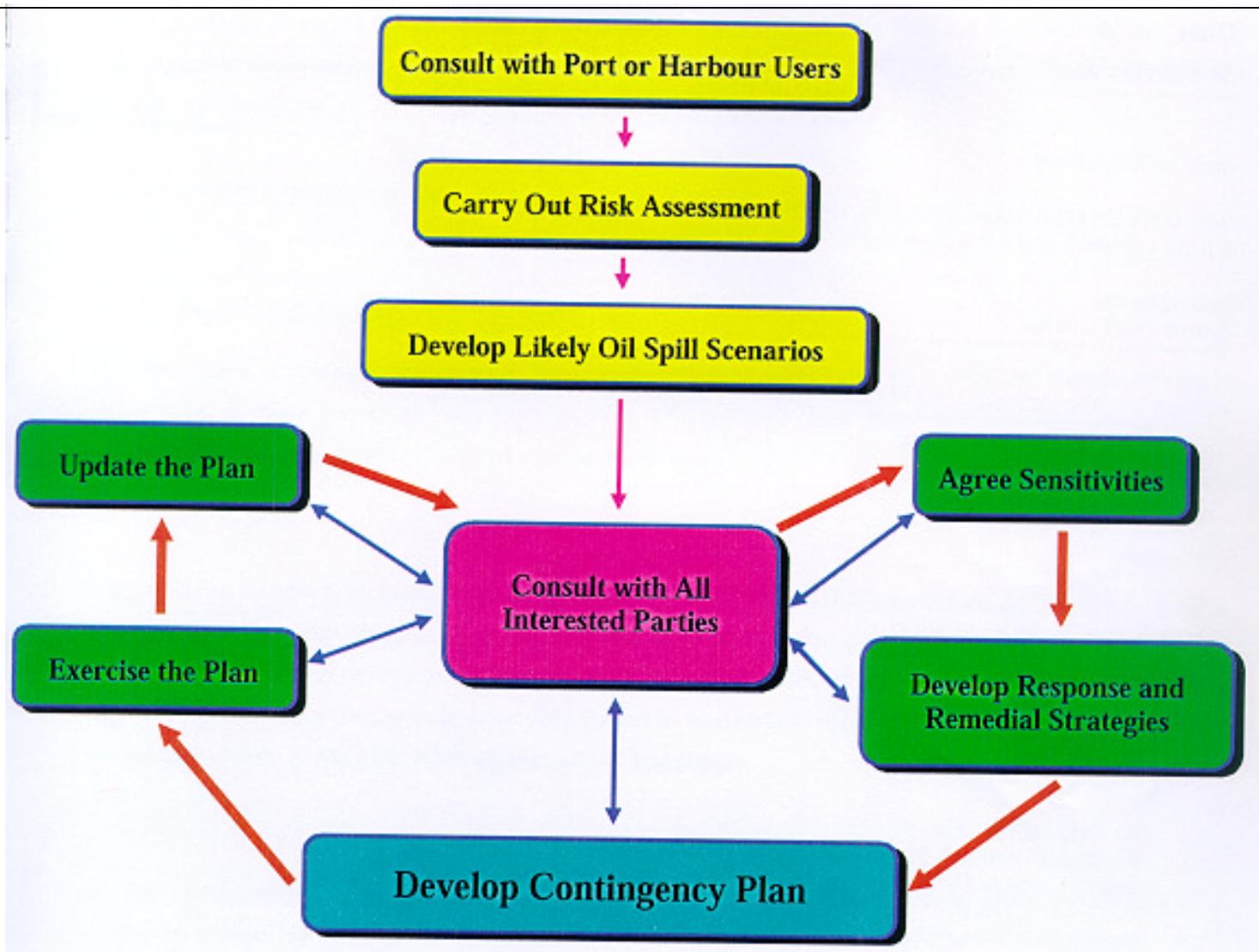
The objective of emergency or contingency planning is to ‘provide guidance and direction to those who have to respond to an oil spill and to set in motion all the necessary actions to stop or minimise the pollution and reduce its effects on the environment’ (MCA 1998). Consultation forms an essential part of the contingency planning process and according to the regulations ports and harbours must consult with port users, MAFF, SOAEFD or DOENI, the environment agencies, and, unlike waste management planning, the country conservation agencies. A priority activity in the contingency planning process is to undertake a thorough risk assessment of the area to be covered by the plan. The risk assessment must identify the following:

- the location of all potential oil spill sites and an estimation of the size of the potential oil spills, which can be based on the level of shipping, types of oil handled, location of oil handling facilities and any passing tanker traffic,
- the fate of and the possible movement of potential oil spills,
- all environmentally and commercially sensitive areas likely to be adversely effected by potential spills, and
- the time it will take a likely spill to reach the identified sensitive areas, giving an indication of the response times necessary to minimise the effects on the identified sensitive marine features.

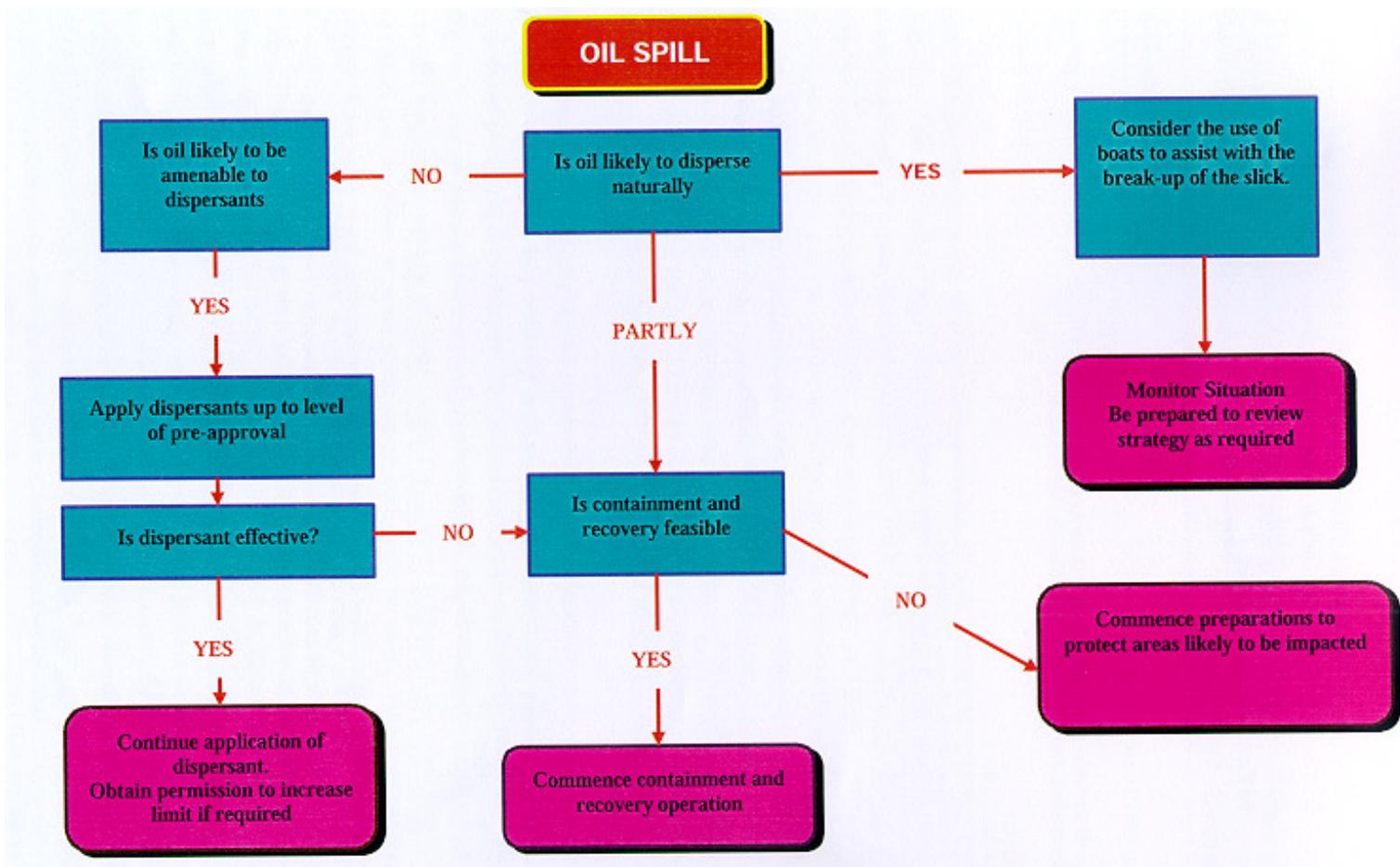
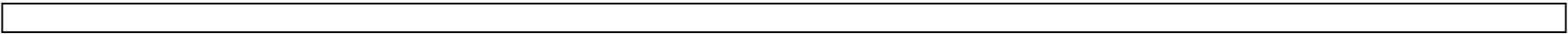
When planning response operations, areas identified as likely to be adversely affected by potential spills should, where practicable, be given the highest priority of response in marine SACs. These areas should be clearly and accurately shown on the response guide which is a simple annotated chart, see second figure overleaf. The guidelines identify three main issues over which there has been some debate, and agreement between ports and harbours and consultees has yet to be reached. These are:

- The use of dispersants to assist in the breakdown of oil, removing it from the water surface and preventing its spread, but which also promote the penetration of oil into the sediments, potentially affecting shallow fishing grounds and other sensitive intertidal habitats.
- The protection of ecologically sensitive shorelines, such as salt marshes, is considered of high priority, although protection of long stretches of habitats is often impracticable and short-term economics often receive higher priority.

Clean-up ecologically sensitive areas may actually cause more ecological damage in the long-term and may recover more quickly if left alone.



The Contingency Planning Process as illustrated in the OPRC guidelines (Maritime and Coastguard Agency 1998)



A simple response strategy decision guide taken from OPRC guidelines (Maritime and Coastguard Agency 1998)