Common Standards Monitoring Guidance

for

Inlets and Bays

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Contents

NOTE: It is **essential** that the "Introduction to the marine guidance", found at the start of the marine section, should be read prior to this guidance.

1 Definition of Inlets and Bays

Inlets and bays are large indentations of the coast, generally more sheltered from wave action than the open coast. They are relatively shallow, usually averaging less than 30m in depth across at least 75% of the site. They are often complex systems composed of an interdependent mosaic of subtidal and intertidal habitats. Many of these habitats, such as intertidal mudflats and sandflats, sandbanks, saltmarshes and reefs, are identified as notified features in their own right and are covered in separate guidance.

Inlets and bays may also support populations of important species. The physiographical character of inlets and bays is similar to that of an estuary, but the influence of freshwater is reduced by comparison.

The term 'inlets and bays' include the habitats listed in Box 1.

Box 1. Habitats included in 'inlets and bays'

Habitats Directive	BAP Broad habitat type[1]	BAP Priority habitat/Action Plan[1]	OSPAR Threatened Habitat[2]
Large shallow inlets and bays	Inshore sublittoral sediment	May include a wide range of priority habitats	Intertidal mudflats[3]
	Inshore sublittoral rock		May include a range of other threatened habitats
	Littoral sediment		
	Littoral rock		

[1] These are derived from both the *Biodiversity: The UK Steering Group Report - Volume II: Action Plans and* the *UK Biodiversity Group Tranche 2 Action Plans - Volume V: Maritime species and habitats*. Further information on these habitat types can be found on the UK Biodiversity web site at **http://www.ukbap.org.uk/habitats.htm –** and form the reporting categories used within the Site Condition Monitoring Programme.

[2] These are derived from a provisional list agreed by the OSPAR Biodiversity Committee at their Leiden Workshop, 5-9 November 2001, and therefore may change when the final list is agreed.

[3] The habitat originally proposed was 'estuarine intertidal mudflats' and was subsequently amended to 'intertidal mudflats', hence its inclusion in this guidance.

2 Attributes, targets and condition assessment

A condition assessment of inlets and bays should be based on the attributes[4] and their associated targets (derived from the generic attributes table, Table 1, Section 6) that are considered most likely to represent the feature. It will be necessary to develop a site-specific expression of some or all of these generic attributes to represent the conservation interest of the feature adequately and to fully reflect local distinctiveness (see Section 3).

Selecting the attributes to define the condition of an inlet or bay feature is often complicated by the fact that it may contain habitats and species that are notified features in their own right. It must be emphasised however, that the condition of these individual features does not automatically relate to the condition of the broader complex feature in which they are located. Furthermore, there may be other habitats and species integral to the condition of the complex feature that are not themselves notified features, which should nevertheless contribute to the condition assessment. It is important to establish the relationship between the condition of these 'simple' features and the 'complex' feature prior to selecting the attributes to assess that complex feature's condition. Establishing this relationship requires a clear understanding of the key conservation interest of the complex feature. Refer to the generic introduction for marine features for further guidance on selection of attributes to assess the condition of an inlet and bay.

3 Background, targets and monitoring techniques for individual attributes

Table 1 (Section 6) lists four attributes, all of which (*Extent of entire feature, Diversity of component habitats, Distribution/spatial pattern of habitats and Water quality*) are considered mandatory for all sites.

3.1 Extent of the entire feature

Extent is an essential structural component of the inlet or bay feature and therefore **must be assessed for all sites**.

3.1.1 Background to the attribute

Some changes may be considered acceptable or 'natural' and may be attributable to the following:

- *Saltmarsh encroachment*

This is the colonisation of part of the feature by saltmarsh plants. Consideration of this issue is dependent on whether the 'boundary' for the inlet and bay feature is drawn to include or exclude saltmarsh. Succession is typically led by the pioneer *Salicornia* species, which stabilise the sediment and facilitate the colonisation of perennial species. Unfavourable colonisation may occur from the non-native cord-grass *Spartina anglica*, considered to be an invasive species that may have an impact on intertidal mud flats, pioneer and low-mid marsh communities. If this occurs a monitoring programme would be triggered and there may be a need for management action. An indicative target for *Spartina* has been set at less than 10 % expansion to pioneer saltmarsh in the last 10 years, but this figure may have to be revised following consultation. Encroachment by *Spartina* is considered a contentious issue and there is a need to be cautious about advocating *Spartina* control when its presence is considered to be due to a natural process. Specialist advice is required when dealing with this issue.

- *Erosion following winter storms or floods*

Wave energy or high tides/river levels may cause erosion of the littoral sediment part of the feature, or changes to river/drainage channel patterns. These should generally be perceived as acceptable

[4] The Common Standards text defines an attribute as: a *characteristic of a habitat, biotope, community or population of a species which most economically provides an indication of the condition of the interest feature to which it applies.*

changes, although some erosion may be exacerbated by coastal defences, and should be treated similarly to 'coastal squeeze'. However natural re-establishment through sediment accretion may occur over time and the sediment flats are therefore expected to appear in some areas as they disappear elsewhere.

Where the field assessment judges the extent to be unfavourable, and subsequent investigation reveals the cause is clearly attributable to cyclical natural processes, the final assessment will require expert judgement to determine the reported condition of the feature. The feature's condition could be declared favourable where the officer is certain that the conservation interest of the feature is not compromised by the failure of this attribute to meet its target condition. Where there is a change outside the expected variation or a loss of the conservation interest of the site, (e.g. due to anthropogenic activities or unrecoverable natural losses) then condition should be considered unfavourable. Staff should refer to the flow diagrams in the introductory text to the marine features for more information on these issues.

Changes in extent may be attributable to anthropogenic effects, where defence works interrupt natural coastal processes. Changes in extent would be considered unfavourable if attributable to *coastal squeeze* which is the term applied to the effect of hard defences (including beaches fixed in position by control structures) when they interrupt the natural response of the shoreline to sea level rise. A rise in sea level acts as part of the coastal squeeze, attempting to move the intertidal zone upwards and inland. Under natural conditions coastal ecosystems are capable of responding to such changes. This inland movement is, however, now generally prevented by sea defences such as sea walls or other embankments, which are often too steep to allow natural encroachment, restricting the natural landward retreat and resulting in the intertidal zone being 'squeezed'. This causes reduction in the extent of intertidal habitat as a result of the higher levels of energy occurring in the intertidal zone. Land-claim is part of a more general squeeze that is pushing the high water mark seawards (through land-claim, sea defences, barrages and rising sea levels) and low water mark landwards (through effects of dredging, barrages and rising sea-level).

3.1.2 Setting a target

In principle the target should be set at no loss of area of the whole inlet or bay feature during the monitoring cycle, but accommodating any known geomorphological trajectory. It may be necessary to set a target that declines in steps over each monitoring cycle, but this will depend on there being sufficient data available to predict (via a model) a downward trend in extent due to an inherent geomorphological trajectory[5]. Departure from this predictive target would then be a trigger for investigation and the condition of the feature may be considered unfavourable.

The target should indicate the recognised area of the feature measured in hectares. It is important that targets set for this attribute are flexible enough to relate to the natural coastal processes associated with this feature (see above).

When measuring extent, the following issues should be considered:

- Check that all aerial photographs and broad-scale biotope maps have the same upper and lower boundaries, are at the same scale and to the same datum
- Determine whether watercourses (rivers, drainage channels, creeks etc) have shifted position. An increase in depth or width of such water courses may consequently lead to a loss of the feature's extent.
- Storm events and flood water can transport sediment into the system. This may lead to sediment deposition and an increase in extent.
- Storm events can lead to sediment erosion and consequent loss of extent.
- Anthropogenic factors such as coastal protection schemes can lead to extent loss/increase.

[5] It may also be possible to predict an increase in extent for littoral flats where sediment accumulation occurs.

An example of how a target for this attribute might be expressed is shown in Box 2

Box 2. A site-specific target for the attribute 'Extent'

Targets	Comments
No decrease in extent of bay from 107800 ha.	Baseline data from Wash & North Norfolk European marine site Regulation 33 package (2000), estimated extent at 107800 ha. Condition would be judged unfavourable if loss in extent due to factors other than cyclical natural processes.

3.1.3 Suggested techniques

Extent can be measured in absolute terms, using estimates from aerial imagery or an index approach such as point sampling over a grid, or by inference based on the absence of any known pressures and impacts. The type of measure used should be linked to the known or likely threats posed by anthropogenic activities and take into account necessary consideration of dynamic processes. The extent of an inlet or bay is unlikely to change significantly over time where pressures/impacts are low/absent but nevertheless it needs to be measured periodically to inform target values.

For those bays bounded by rocky shores or solid anthropogenic boundaries such as harbour walls or seawalls, measuring the extent may be a straightforward cartographic exercise using the most up-to-date maps of the area.

Bays with ‘soft’ boundaries such as saltmarsh may require a more sophisticated mapping exercise such as remote sensing, particularly in dynamic areas where tidal currents result in erosion and/or accretion of these ‘soft’ habitats.

The Marine Monitoring Handbook (Davies *et al.*, 2001) contains details of the techniques appropriate for monitoring the condition of designated features.

A possible method provided in the handbook for measuring the extent of the feature is:

- 1-1 Intertidal resource mapping using aerial photographs.

Other proposed methods, not as yet detailed in the handbook are:

- Satellite and airborne multi-spectral remote sensing (remote imaging);
- Aerial photography and photogrammetry (air photo interpretation).

3.2 Diversity of component habitats

Diversity of component habitats is an essential aspect of the feature, representing the *structure* and, in part the *function* of the inlet or bay and therefore **must be assessed for all sites**.

The site-specific representation of this attribute should clearly reflect the overall biological character of the habitats that represent the conservation interest of the feature.

3.2.1 Background to the attribute

This attribute should encompass the variety of habitats and their associated biological communities present within the feature that directly reflects the conservation interest of the particular site.

This attribute aims to measure the overall variety of habitats throughout an entire site and is distinguished from the attribute *Distribution/spatial pattern of biotopes* discussed below, which measures the presence or absence of biotopes at specific locations.

This attribute may address the following:

- overall habitat composition where the feature supports a diverse range of communities
- specific habitats indicative of the character of the site or of conservation interest[6]
- a limited range of habitats that may be used to define the specific conservation interest of the feature and best describes the feature's condition.

The resolution to which these habitats are expressed in the target will have to be considered with regard to their use in condition assessment.

This attribute should be used where the continued presence of a variety of habitats is fundamental to the maintenance of favourable condition of the overall inlet and bay feature. The habitats selected may be notable (i.e. of significant conservation value), highly representative of the communities present within the site, or serve an important role in the structure and function of the wider inlet and bay feature. In all cases the loss of the habitats specified would represent a loss of the conservation interest of the site and render condition of the feature unfavourable.

Where the field assessment judges this attribute to be unfavourable and subsequent investigation reveals the cause is clearly attributable to natural processes (e.g. winter storm/ flood events, changes in supporting processes or mass recruitment, dieback of characterising species (where the species is the habitat e.g. mussel beds, maerl beds), the final assessment will require expert judgement to determine the reported condition of the feature. The feature's condition could be declared favourable where the officer is certain that the conservation interest of the feature is not compromised by the failure of this attribute to meet its target condition. Where there is a change outside the expected variation or a loss of the conservation interest of the site, (e.g. due to anthropogenic activities or unrecoverable natural losses) then condition should be considered unfavourable. Staff should refer to the flow diagrams in the introductory text to the marine features for more information on these issues.

3.2.2 Setting a target

In principle the target should be set at no change in diversity of the component habitats during the monitoring cycle and should either be based on a subset of the habitats present (where the feature supports a diverse range of communities) or represent the overall habitat diversity. Information can be derived from habitat maps or from other more detailed survey records.

Targets that require the determination of the presence of a subset of habitats should be drawn from selected areas within a site over the monitoring cycle (sampling locations are also likely to be governed by access and health and safety issues[7]). It is important that the targets and measures set are clear and unambiguous. The targets and measures should determine the resolution (i.e. whether the assessment is based on habitat complex, habitat or sub-habitat level) and the scale of the assessment (i.e. intensity of sampling). The targets should also clearly identify what must be achieved in order to pass or fail (i.e. habitats X, Y, Z must be present within the feature).

Targets should also take into account not just decline in the number of habitats but also increase, which could lead to a change in extent or alter the communities of the habitats of conservation interest of the site. Thus targets may need to specify both an upper and a lower limit.

SSSI citations, SAC Regulation 33 packages, biotope maps or more detailed survey records should help to determine the habitats of nature conservation importance within a site, which in turn will determine the target list. Due consideration should also be given to activities occurring within sites.

[6] Examples would be nationally rare or scare biotopes, or biotopes supporting species of conservation value.

[7] Information on health and safety issues can be obtained in the Marine Monitoring Handbook **http://www.jncc.gov.uk/marine** or from appropriate country agency risk assessments.

3.2.3 Suggested techniques

Sampling locations should be distributed throughout each site so that an assessment of overall site condition can reasonably be made. However, because of the large and complex nature of many sites it is likely that a degree of sub-sampling will be essential in most cases. In such cases emphasis should be placed on assessing the continued presence of those habitats of greatest conservation value. Within some sites these habitats may be clumped disproportionately within a small section of a larger site, and here it would be important also to include habitats and sampling locations representative of the remainder of the site. More detailed sampling effort should focus on those habitats of highest conservation value, and habitats considered to be most threatened by adverse anthropogenic activities.

Ideally, a mapping or inventory study of all habitats would be undertaken to provide baseline information to identify the conservation objective for the site-specific attribute. Such a study would also guide more detailed targeted studies to assess biological quality. DGPS should be used for recording position on extensive intertidal or subtidal habitats. Photographs and/or diagrams of characteristic topographical features should supplement maps.

All quantitative sampling must be effort-limited to ensure comparability between monitoring events. The sampling strategy will depend on the local topography: transects are more suited to steeply inclined habitats; a grid sampling strategy is appropriate to extensive level habitats.

The Marine Monitoring Handbook (Davies *et al.*, 2001) contains details of the techniques appropriate for monitoring the condition of designated features.

Possible methods for measuring the diversity of component habitats are:

- 1-1 Intertidal resource mapping using aerial photographs; with ground validation
- 1-3 Seabed mapping using acoustic ground discrimination interpreted with ground truthing
- 1-4 The application of side scan sonar for seabed mapping.

Other proposed methods, not as yet detailed in the handbook are:

- Satellite and airborne multi-spectral remote sensing (Remote imaging); validated with effort-limited habitat identification techniques
- Point sample mapping using effort-limited biotope identification techniques.

3.3 Distribution/ spatial pattern of habitats[8]

Distribution/spatial pattern of habitats is an essential component of the feature, representing the structure and particularly the function of an inlet or bay. Therefore this attribute **must be assessed for all sites.**

3.3.1 Background to the attribute

This attribute is concerned with the position of the target habitats and their spatial relationship to one another. This attribute ensures that the distribution of the features of conservation interest is maintained throughout the feature. Distribution refers to the geographic location of habitats throughout the feature. Spatial pattern refers to the local zonation or juxtaposition of habitats at specified locations.

Assessing the distribution of habitats throughout the feature should highlight any progressive loss or change in the biological integrity of the feature. Zonation patterns are a biological integration of the

[8] The term habitat is used generically to include the feature (whole Annex 1) or sub-features (biotopes incl. NVC types)

prevailing environmental processes that structure marine communities. A change in zonation may signal an important shift in the local environmental regime due to an anthropogenic activity: for example a shift in the maximum depth of the kelp zone may indicate a change in the ambient light levels due to increased sediment loading of the water column.

This attribute may highlight important structural and functional components of the feature, depending on the habitats chosen. If the ‘habitats’ of interest are biotopes, as opposed to notified features in their own right (such as intertidal mudflats and sandflats, sandbanks, saltmarshes and reefs), then it is important to understand cyclical succession of biotopes. These cycles are normally an acceptable part of the interest of the feature and must be considered when phrasing target values. Biotopes are often defined by differing abundance of species; certain biotopes will cycle about each other, and may disappear and reappear over time. Their distribution may vary on a seasonal basis and this should be considered when setting targets and planning survey timing. A suite of the biotopes expected at the site should be listed with their “cyclical partners”.

The resolution to which habitats are expressed in the target should be considered with regard to their use in condition assessment. It may be appropriate to use higher level biotopes (e.g. biotope complexes) in preference to the more detailed ones that are difficult to identify in the field. However, it may be that the detailed biotopes are considered ‘notable’ and hence require to be maintained.

Where the field assessment judges this attribute to be unfavourable and subsequent investigation reveals the cause is clearly attributable to natural processes (e.g. due to a movement of a drainage channel), the final assessment will require expert judgement to determine the reported condition of the feature. The feature’s condition could be declared favourable where the officer is certain that the conservation interest of the feature is not compromised by the failure of this attribute to meet its target condition. Where there is a change outside the expected variation or a loss of the conservation interest of the site, (e.g. due to anthropogenic activities or unrecoverable natural losses) then condition should be considered unfavourable. Staff should refer to the flow diagrams in the introductory text to the marine features for more information on these issues.

3.3.2 Setting a target

In principle the target should be set at no change in distribution/spatial pattern of habitats during the monitoring cycle. The target must consider any expected shift(s) in distribution and spatial pattern due to cyclical changes or an expected trajectory. It is possible to use an absolute measure or an index approach to measuring habitat distribution.

Normally a subset of the habitats present should be identified where the feature supports a diverse range of habitats. Alternatively, where appropriate, the overall sub-feature composition could be determined and specified. SSSI citations, SAC Regulation 33 packages, habitat maps, or more detailed survey records should help to determine the sub-features/biotopes of nature conservation importance within a site, which in turn will determine the target list of habitats. Due consideration should also be given to activities occurring within sites.

When setting target values, it is important to consider the following issues:

- Specify which habitats are to be addressed (all or a subset selected on the basis of the conservation interest of the feature).

- Habitat distribution may change in response to extreme low frequency events such as increased storm occurrence.

- Is it logistically feasible to establish the distribution pattern over the whole site or should it be done within limited/ indicative areas?

- Is the habitat transitional or likely to alter position? Some habitats will change distribution and/or spatial pattern naturally over time, in a cycle with other habitats (and the target should identify these if possible).

An example of how a target for this attribute might be expressed is shown in Box 3.

Box 3 A site-specific target for the attribute 'Distribution/spatial pattern of habitats'

Target	**Comments**
Maintain the distribution/spatial pattern of identified sub-feature habitats of the Morecambe Bay European marine site.	The sub-feature habitats are identified in the Morecambe Bay European marine site Regulation 33 package (2000). Baseline map established in Management Scheme for EMS.

3.3.3 Suggested techniques

Emphasis will be most likely placed on assessing the continued presence of those habitats of greatest conservation value. Within some sites these may be clumped disproportionately within a small section of a larger site. Ideally, a mapping or inventory study would be undertaken to provide baseline information to identify methods and targets for this site-specific attribute. Such a study would also guide more detailed targeted studies to assess biological quality within specified habitats (e.g. species composition attributes).

The Marine Monitoring Handbook (Davies *et al.*, 2001) contains details of the techniques appropriate for monitoring the condition of designated features.

Possible methods provided in the handbook for measuring the distribution/spatial pattern of habitats are:

- 1-1 Intertidal resource mapping using aerial photographs
- 1-2 Fixed viewpoint photography at specified locations
- 1-3 Seabed mapping using acoustic ground discrimination interpreted with ground truthing (AGDS)
- 1-4 The application of side scan sonar for seabed mapping
- 1-5 Mosaicing of sidescan sonar images to map seabed features (electronic version available only)
- 3-1 *In situ* intertidal biotope recording
- 3-3 *In situ* survey of subtidal (epibiota) biotopes and species using diving techniques
- 3-11 Littoral monitoring using fixed quadrat photography (intertidal photography at stations along a transect)
- 3-14 *In situ* survey of sublittoral epibiota using towed sledge video and still photography.

Other proposed methods, not as yet detailed in the handbook are:

- Shore transects using effort-limited biotope identification techniques
- Satellite and airborne multispectral remote sensing
- Aerial photography and photogrammetry
- Descriptive and quantitative surveys using remote operated vehicles and a transect-based (or occasionally a grid) sampling strategy
- Point sample mapping (from Grab sampling, ROV or Drop-down video data).

Note: Remote sensing techniques (AGDS/sidescan sonar) have a limited capability to discriminate between detailed biotopes and are more suited to broad habitat patterns.

Note: A transect based sampling strategy is most appropriate to identify zonation patterns. Transects should be located throughout the feature using a stratified sampling strategy.

3.4 Water Quality

Water Quality is an essential functional component of the feature and therefore **must be assessed for all sites.**

Water quality encompasses physico-chemical properties and non-toxic and toxic contamination. It should be noted that technical advisory groups affiliated with The Environment Agency's Review of Consents (England and Wales only) is currently providing guidance on standards/targets that could be used to inform risks and impacts on water quality at European Marine Sites. The guidance will be iterative and based on best available information. It should also be noted that a series of site characterisation studies are being carried out on European Marine sites to get a better understanding of the structure and functioning of sites, and the current affects of anthropogenic activity. The reader should refer to the Environment Agency/English Nature joint guidance on agency permissions and activities (Environment Agency, 2001).

It is essential that a site-specific representation of this attribute is developed in relation to the actual conservation interest of the inlet and bay feature, particularly taking into account any known or anticipated anthropogenic threats to the feature's status. Furthermore, it may be necessary to include multiple water quality attributes to maintain the status of an extensive and/or complex feature.

3.4.1 Background to the attribute

3.4.1.1 Physico-chemical parameters

- Salinity and temperature

Water temperature and salinity are characteristic of the overall hydrography of the area. Any changes in the prevailing temperature and salinity regimes may affect the presence and distribution of species (along with recruitment processes and spawning behaviour).

Where changes in temperature or salinity through adverse impacts (e.g. thermal discharge plumes, industrial discharges, water abstraction etc.) cause a severe loss or shift in community structure such that the conservation interest is adversely affected, condition should be judged as unfavourable. Where changes in temperature or salinity are due to natural processes such as severe winter temperatures, then this will be an acceptable change to the feature.

Reference should also be made to the water quality overview document (Hailey *et al*., 2003) recently updated and waiting to go on the UK Marine SACs website.

- Water clarity

Algal communities normally occur on inshore sublittoral rock to a depth where light availability equates to approximately 1% of surface irradiance. This depth limit varies around the UK coast due to local factors such as the discharge from turbid estuaries (e.g. the Severn), the presence of adjacent sedimentary shores or shallow sublittoral sediment habitats, and eroding cliffs. Anthropogenic activity that results in a reduction of water clarity, for example the disposal of dredge spoil or demersal fishing activity, may lead to a reduction in the lower depth limit and/or the composition of algal assemblages. Such changes are only likely to occur if water clarity is reduced over an extended period of time (months to years), and particularly during the late spring and early summer growth phase of algal communities.

3.4.1.2 Non-toxic contamination

- Organic matter

Organic pollution occurs when the rate of input of organic matter exceeds the capacity of the environment to process it. Commonly, there is an accumulation of organic matter on the sediment surface that smothers organisms, and depletes the oxygen concentrations in the sediment and sometimes the overlying water. This in turn changes the sediment geochemistry and increases the exposure of organisms to toxic substances associated with organic matter. The response of the benthic invertebrate community is characterised by decreasing numbers of species, total number of individuals and total biomass, and dominance by a few pollution tolerant annelids. This type of impact is not common other than in localised areas in the estuaries and coastal waters of the UK, but has recently been observed in relation to cage fish farm installations. (Cole *et al.*, 1999).

- Nutrient status/Organic Carbon budget

Nutrient status is important in inlets and bays because it drives primary production both in the water column and in the benthos. This, in turn, manifests itself in the production of organic carbon that deposits in sediments in combination with other anthropogenic sources of carbon input. However, the expression of this primary production is dependent on limiting factors such as the residence time of the water, the turbidity of the bay and levels of nutrients such as nitrogen, phosphorus and silica. Changes in the nutrient status of a system may involve biological change even if the system does not become eutrophic. More information on the impacts of nutrients on marine water quality is detailed in a water quality overview document produced under the UK marine SACs project (Hailey *et al.* 2003) plus the guidance documents being prepared for the Water Framework Directive and the OSPAR assessments[9].

As a result of the combined factors of tidal oscillations and riverine input, enclosed bays tend to retain organic matter. As a consequence, they may have high overall productivity and are rich in nutrients. In most cases the main source of nutrients entering an inlet and bay are from fresh water inputs (rivers), direct discharges (e.g. sewage treatment works) and coastal water exchange. Other potential nutrient sources may include groundwater seepage, and atmospheric deposition. A significant proportion of the nutrient load arising from river inputs can often be attributed to diffuse agricultural inputs, and hence nutrient levels could be largely determined by the rate of freshwater input and the nature of the local catchment area. If the local catchment area is fertile, intensively farmed land then higher quantities of nutrients would be expected to enter the marine system than if the catchment is mountainous and sparsely populated. However, other factors may influence nutrient levels, including tidal flushing rate of the inlet and bay (which determines the retention time of nutrients within the system), seasonality (which influences the rate of nutrient uptake by actively growing organisms) and climatic factors (such as temperature and rainfall).

There are many indicators that could be chosen to assess the impact of nutrients and work is currently being undertaken to inform the Environment Agency's review of consents, in addition to the development of attributes and indicators to implement the Water Framework Directive.

An example indicator of nutrient pollution is the presence blanketing mats of algae (*Enteromorpha* sp., *Vaucheria* sp. and *Ulva* sp.). On eelgrass beds, such mats can cause shading of the eelgrass, inhibiting its photosynthesis. Nutrient enrichment may also break down the eelgrass immune system, making it more susceptible to disease (Den Hartog, 1988). Where algal mats lie on sediment habitats, the covering of algae over the sediment surface can reduce the dissolved oxygen exchange between the sediment and the water column, leading to the establishment of anoxic conditions in the sediment, thus increasing BOD and the release of ammonia and hydrogen sulphide which can be toxic to aquatic life. Some benthic invertebrate species are tolerant of the effects of eutrophication, with the result that they thrive at the expense of the more sensitive species and so alter community composition. Other indicators are increased frequency or duration of phytoplankton blooms and an increase in the chlorophyll-a concentration in the water column.

Generally the nitrogen content measured within green algae can be used to reflect the availability of nutrients to the system (i.e. an indicator of raised inputs). When a system is nutrient-rich the nitrogen content of the algae is high and consequently extensive algal mats flourish (Schramm & Nienhuis, 1996). However, extent or presence/absence of algal mats alone will not necessarily indicate nutrient enrichment, and algal growth *per se* cannot be expressed in terms of nitrogen inputs (Khan, 1998). It is often a change in the location or extent of green algal mats that indicates a change in the nutrient

[9] For example the CEFAS report *Establishing practical measures for the assessment of eutrophication risks and impacts in Estuaries* [CEFAS Contract Report C1706].

loading to the estuary and thus often used as an indicator of eutrophication. The extent of mats may be used *in conjunction* with the nutrient content of the mats (for example, a simple C:N ratio of the algal material) to define the eutrophication status (Janet Khan SNH, *pers comm*.). The growth of algal mats tends to be governed by distinct temperature and light intensity ranges (Khan, 1998). Algae bloom in response to light and temperature, but in optimum environmental conditions if there is a high input to the system then this is reflected in an extensive growth of green algal mats. Conversely, low or no inputs to the system generally results in no, or restricted growth of green algal mats (Schramm & Nienhuis, 1996). The nutrient content of the algae at the beginning of the mat formation (April/May) may be used to indicate whether the nutrients are being recycled within the system, based on a *sediment-algal mat-sediment cycle* system, or whether the nutrients are being derived from an external input (Jeffrey *et al*., 1995). Given the complexities of using algal mats as indicators of nutrient pollution, other early warning indicators include increased frequency or duration of phytoplankton blooms and an increase in the chlorophyll-a concentration in the water column. The assessment of nutrient status should include consideration of all primary and secondary ecological impacts.

There may be other indicators that are more appropriate to an inlet and bay, particularly where the necessary data are collected by other monitoring or surveillance programmes. For instance, fish assemblages/migratory fish/invertebrate populations may be indicators of nutrient status. Research by Dr Peter Henderson on the observed changes in fish and invertebrate populations retained on cooling water intake screens for power stations in the Severn Estuary indicated that such changes are linked to changes in nutrient inputs to the river (Gabrielle Wyn, CCW, pers. comm.).

Where the field assessment judges nutrient status to be unfavourable, further investigation will be necessary to identify the cause and then expert judgement will be required to determine the reported condition of the feature. Where there is a change outside the expected variation or a loss of the conservation interest of the site, (e.g. nutrient levels increase due to anthropogenic factors such as changing agricultural practices or increased effluent discharge) then condition should be considered unfavourable. It should be noted that the source of undesirable inputs may be in the local catchment area a considerable distance from the estuarine site itself. Staff should refer to the flow diagrams in the introductory text to the marine features for more information on these issues.

3.4.1.3 Toxic contamination

Shallow inlets and bays are vulnerable to toxic contamination, which is largely associated with land-based sources including point-sources of effluents and diffuse run-off. Many species and communities are highly sensitive to toxic contamination through the introduction of metals or synthetic compounds such as pesticides, PCBs and biocides such as TBT. Metals such as copper, lead and aluminium can be particularly toxic to invertebrates and fish under acid conditions either from naturally acid riverine inputs or from atmospheric pollution. Many synthetic compounds such as PCBs are known to have toxic effects, even in low concentrations, and high levels of bioaccumulation can occur. Many benthic organisms such as molluscs are poor at regulating their uptake of contaminants. The potential effects of toxic pollutants vary according to the state and availability of the compound and the characteristics of the receiving environment. Where the effects are lethal and result in the removal of individual species, key grazers or predators may be lost and a dominance of pollution-tolerant organisms may result. In sheltered, low energy environments such as estuaries, muddy sediments can act as a contaminant sink. Hydrophobic contaminants bind to fine sediments and may then be remobilised if the sediment is disturbed (e.g. by dredging) making them available once more as potential pollutants. Toxic contamination can reach the feature from point and diffuse sources, such as land-based discharges, run-off from roads, water-based discharges (e.g. from ships or anti-fouling paints) and atmospheric deposition.

Where toxic contamination through adverse impacts causes a loss or shift in community structure such that the nature conservation interests of the site are affected, then condition should be judged as unfavourable. The review of consents process by the Environment Agency is taking steps to address these issues in SACs. Environmental Quality Standards (EQS) have been established for some toxic compounds although their use in assessing ecosystem health is subject to some debate. The Review of Consent process would assume that a failure in EQS amounts to an ‘adverse effect on site integrity’. It will be necessary to seek expert judgement to assess whether available EQS are relevant to the conservation interest of the feature and therefore whether an EQS failure will influence the assessment of condition.

3.4.2 Setting a target

3.4.2.1 Physico-chemical parameters

Salinity, temperature and turbidity should not deviate from baseline. Standards associated with salinity, temperature and turbidity are discussed in the Environment Agency/English Nature joint guidance (Environment Agency, 2001).

3.4.2.2 Non-toxic contamination

The specific representation of this attribute will depend on the perceived threat to the conservation interest of the feature. For many marine communities, the precise water quality requirements are unknown and therefore the actual attribute selected, and its target condition will require specialist input and should be subject to regular review. Staff in the environmental protection agencies[10] have significant expertise on this topic and should be consulted wherever possible. It will be necessary to relate any local measurements of physical parameters to contextual information for a wider geographical area when interpreting the data. Local changes may reflect a regional trend rather than any site-based anthropogenic activity. Furthermore, targets must be set within the wider context of the status of the whole estuary rather than simply considering any local ‘problem areas’. Whether the long-term trend in water quality is improving, static or deteriorating will need to be ascertained and taken into account.

Water quality is an integral part of the Environment Agency’s Review of Consents under the Habitats Regulations, in addition to other European Directives (Water Framework Directive, Urban Waste Water Treatment Directive) and International Conventions (OSPAR Convention). These legislative drivers are deriving international and/or nationally agreed standards in relation to eutrophication and hazardous substances. Comprehensive research programmes are or being established to fill gaps in our knowledge of the effects of these compounds on marine systems. It is vital that common standards monitoring of protected sites links with, and uses the outputs from, these initiatives.

It will often be impossible to set a target value representing the baseline condition for water quality attributes because their status at the point of designation may not be known. Under such circumstances, the target condition should where appropriate default to the international or national standards described above until sufficient local data are available to set site-specific targets. Common standards monitoring will then take the form of measurements to assess compliance with the standard, rather than a comparison with a baseline.

The following text provides guidance on setting site-specific targets where sufficient local data are available. It focuses on nutrient status in recognition of its perceived importance in assessing status of estuaries, although similar principles will apply to other water quality measures.

Nutrient concentrations could be measured directly in water or in appropriate biota (for example green algae), or assessed indirectly using one or more of the indicators mentioned in the previous section (for example phytoplankton populations, chlorophyll-a concentrations, or the presence/thickness of green algal mats). Selecting an appropriate measure will require some knowledge of the likely effect of changing nutrient concentrations on the conservation interest of the feature. For example, benthic communities in littoral sediment will be adversely affected from smothering by dense green algal

[10] Environment Agency, Scottish Environmental Protection Agency, Environment and Heritage Service, Northern Ireland, CEFAS, Fisheries Research Services and Department for Agriculture and Rural Development (Northern Ireland) have considerable expertise in the effect of chemical inputs and the disposal of spoil waste to marine systems.

mats; seagrass beds or algal communities would be affected by reduced turbidity caused by phytoplankton blooms.

Setting a target for phytoplankton abundance and/or species composition will require access to a long term dataset and an understanding of how this links to the conservation interests of the feature. Where such datasets are available it is often possible to identify regular patterns which are site or region specific. If suitable baseline data are unavailable it is unlikely that meaningful abundance targets can be established for phytoplankton, however targets derived for species composition or biomass may still be of use. A surrogate for phytoplankton abundance could be chlorophyll levels as setting targets for phytoplankton abundance may only be appropriate if the residence time of water and other factors such as light levels allows primary productivity to respond to the nutrient status within the estuary. CEFAS and the Environment Agency are establishing phytoplankton baseline levels as part of the implementation of the Water Framework Directive.

Setting a target for changes in extent of algal mats will rely on baseline data derived from mapping surveys and/or aerial photography, plus data on the concentration of nutrients in algae. In most cases the conservation agencies will have no baseline data and may rely on targets derived from other organisations. If baseline data represent only a single time point it will be difficult to establish a target range for extent that encompasses seasonal and inter-annual variability. It is probable that the target will require revision as further data are accumulated during the monitoring process. If an increase in extent is identified this should trigger a more intensive investigation to assess whether the increased coverage is really indicative of eutrophication. The C:N ratio of the algal mat should be assessed at the beginning of the next growing season (April/May), but in the first instance the algal mat biomass should be assessed and levels above 100g per m^2 would be regarded as evidence of eutrophication. The Environment Agency has provided guidance for the Review of Consents process on a procedure for assessing whether the presence of algal mats is a risk to the features of the site (WQTAG087c Guidance for Sites Potentially Impacted By Algal Mats (Green Seaweed) produced Sept 03).

This guidance indicates what amount of algal mats would be problematic. The EA considered the following criteria should be used:

- reference level for mass of weed = 100gm/m2 wet wt.
- up to 500 gm/m2 wet wt. is not a problem
- 1 000 gm/m2 wet wt. is a problem

It is stressed that the above should not be used in isolation. Consideration needs to be focussed on the consequences of the excess algal coverage for the functioning of the ecosystem and the consequent effects on the interest features. It may also be necessary to set a minimum extent for algal mats to represent an adverse reduction in the available nutrients within the estuary system. Such targets would require a detailed understanding of the nutrient budget for the estuary, and a clear understanding of the link between nutrient concentrations and algal biomass.

An example of how a target for water quality in the form of nutrient status might be expressed is shown in

Box 4.

Box 4 A site-specific target for the attribute' Nutrient status/Organic Carbon budget'

Target	Comments
Extent of algal mats should not deviate significantly from baseline levels recorded in 2000.	Significant changes in algal mat extent should trigger a more intensive investigation. This could involve assessing algal mat biomass (100g/m2 might be considered a reference level, up to 500 gm/m2 wet wt. is not a problem 1 000 gm/m2 wet wt. is a problem)or direct measurements of phytoplankton biomass or nutrients, to compare to an established baseline. Algal mat C:N ratio could be assessed at the beginning of the next growth season to establish if nutrients are internally cycled or derived from external sources. Eutrophication due to effluent discharge or agricultural run-off will result in the attribute being designated as unfavourable. Significant changes from baseline will trigger site visit to ascertain algal mat biomass. Reference to aerial photographs and baseline data from Bunker, Moore & Perrins (2001).

3.4.2.3 Toxic contamination

Some toxic compounds will accumulate in sediments and be readily bioaccumulated. It is important therefore to consider the levels of contaminant in water, sediment, and biota.

Environmental Quality Standards (EQSs) for the protection of saltwater life are available for many toxic substances in the water column. EQSs have been derived under the requirements of the Dangerous Substances Directive which classified substances as List I and List II. In addition to these statutory standards, The Environment Agency has also developed non-statutory standards for additional or newly emerging substances. If it considered that failure of an EQS has a consequence on an interest feature, the site should be considered as unfavourable.

The Water Framework Directive introduces an updated list of hazardous substances known as priority substances, in addition to “specific pollutants”. These substances will have revised EQSs to inform “good ecological status”.

There are no EQSs for sediments, although there are ‘guideline’ targets available. The Review of Consents has adopted the use of Canadian derived ‘threshold effects limits’, and ‘probable effects limits’ (TELs/PELs) to assess contamination of sediment. (These are detailed in Cole *et al.*, 1999). It should be noted that these are “trigger” values, failure of which would constitute further investigation such as evidence of biological impact.

3.4.3 Suggested techniques

Water quality monitoring is an integral part of both existing and emerging statutory monitoring programmes undertaken by the environmental protection agencies[10]. For example, nutrients and hazardous substances are measured annually by the National Marine Monitoring Programme (NMMP) at coastal and estuarine stations to provide data for the UK to comply with the OSPAR requirements. .Information on the sampling and analytical procedures is available in the Green Book, which is available from the NMMP web site[11]. Similarly, the Water Framework Directive classification of status will require measures of nutrient status, hydromorphological parameters, macroalgae, phytoplankton and hazardous substances.

Wherever possible, common standards monitoring of protected sites should use the data and assessments of water quality undertaken by these other statutory programmes. Any deviation from the reference conditions/standards within these programmes could provide a trigger for more intensive biological monitoring under the Common Standards Programme.

Biomarkers are emerging and potentially important tools to assess sub-lethal effects from toxic contaminants. They are currently mostly used as a "weight of evidence" tool, for instance where there is a contaminant "hot spot", biomarkers could validate biological effects and act as an early warning indicator of harm - potentially at the population level. They have been deployed by organisations such as Plymouth Marine Laboratory and CEFAS to look at the effects of specific chemical exposure and general health. To date biomarkers have had little use in the "regulatory" sense as there are no robust stand-alone tools yet available. Consequently their use in condition assessment at the present time should be non-prescriptive. Information on biomarkers could be used as supporting evidence depending on interest features and hazards etc. English Nature have recently undertaken a project and held a workshop on the use of biomarkers, and they are considering their potential use in the Fal estuary SAC (Michael Coyle, English Nature, pers. comm).

If existing programmes cannot deliver appropriate monitoring data, conservation agency staff will require specialist advice before embarking on a new monitoring programme. The conservation agencies should establish close links with other agencies to participate in any review of the coverage and location of existing monitoring stations and to encourage new or re-located stations to be positioned within marine SAC.

4 Recommended visiting period and frequency of visits

4.1 Seasonal effects

Marine communities show seasonal patterns. Many marine organisms have seasonal reproductive patterns that can significantly alter the number of individuals present at different times of the year. Further information on seasonal effects is covered in the separate guidance on littoral sediment, littoral rock and inshore sublittoral rock, and sublittoral sediments.

Some of the more obvious visual changes occur in algal assemblages and following massive settlements of juvenile animals such as mussels and barnacles. In Loch Maddy cSAC, the largest changes observed in shallow communities between autumn 1998 and summer 1999 were an increase in diversity and abundance of algae (Howson &Davison, 2000). Banks of loose stones and gravel are often sufficiently seasonally stable to support dense assemblages of ephemeral algae. Littoral sediments often support dense green algal mats during the summer months. Rapid growth of microscopic algae, and diatoms in particular, can change the appearance (colour) of littoral sediments (Patterson *et al*.,. 1998). Maerl beds support rich algal assemblages with distinct seasonal variation.

Seasonal effects are also prevalent in eelgrass communities. The blade density of the eelgrass itself will increase during the summer and then the decrease during the autumn and winter – a process known as die-back (Short *et al*., 2000). Eelgrass blades may support dense assemblages of epiphytic algae during the summer months, which then decline during the winter.

4.2 Time of assessment

It is important to consider seasonal patterns when planning timing of a condition assessment. Sampling should always be undertaken at the same time of year if seasonal variation is likely to affect an attribute. Seasonal changes in seagrass have important consequences for the timing of remote sensing campaigns because the spectral signature of the seagrass will change between summer and winter (Pooley & Bamber, 2000).

It is important to synchronise timings with previous data collected at the site, taking into account the aforementioned seasonal effects. See also guidance on littoral sediment, littoral rock and inshore sublittoral rock, inshore sublittoral sediment and saltmarsh for timings of assessment.

4.3 Meteorological changes

Prevailing weather conditions and tidal state will affect any monitoring study. Sites open to the prevailing wind and swell will require calm conditions for effective field survey. Periods of calm conditions will improve underwater visibility and improve sampling efficiency and reliability. For sediment habitats and adjacent areas, excessive water movement will mobilise fine sediment into the water column, thereby reducing underwater visibility. Conversely, calm conditions will cause suspended sediment to deposit out of the water column, and visibility will improve, but reef assemblages may then become smothered with sediment, obscuring some species from view. For any areas subject to strong tidal streams (for instance, the tidal rapids in Loch Maddy cSAC), sampling must take place at slack water, avoiding the equinoctial tides when the duration of slack water will be at its shortest.

Freshwater input to inlets and bays is less than estuaries, although it may be locally important in parts of these systems. In such circumstances, monitoring events should avoid periods of heavy rainfall if changes in ambient salinity are likely to influence the results.

Ambient atmospheric pressure affects the height and time of low and high tide: high pressure decreases the height of high and low tide, and the time of the highest and lowest water is later than predicted. Low pressure has the opposite effect. Weather cycles can result in changes in the biotic assemblages. Changes in perennial algae on Loch Maddy maerl beds were possibly due to an unusually warm preceding summer (Howson & Davison, 2000). Periods of extreme cold coinciding with low water can result in mass mortality of kelp plants (Todd & Lewis, 1984). Storm events can result in the mass displacement of sediment communities – for example, populations of the long-armed brittlestar *Amphiura filiformis* in Galway Bay, Ireland (O'Connor *et al*., 1983).

When establishing a monitoring strategy, meteorological effects must be integrated with seasonal effects to ensure that sites can be monitored reliably through time.

5 Additional information

5.1 Planning a sampling programme

The whole feature must be considered when planning a sampling programme. Clearly, this poses considerable logistical problems when dealing with very extensive sites such as the Wash and Morecambe Bay. A monitoring strategy will need to encompass techniques to consider broad-scale, whole feature attributes and some detailed sampling to assess the biological quality (Wyn & Kay, 2000). Broad-scale maps can provide both data for the whole feature (extent, biotope distribution) and the necessary information for applying a stratified sampling programme to select locations to monitor sub-features. Further information on this can be found in Sanderson *et al.* (2001), *Section 1.3: Providing a background for planning monitoring trials.*

A bay may contain other marine Annex I features (e.g. mudflats and sandflats, subtidal sandbanks and reefs). Advice on the monitoring of saltmarsh habitats is provided by Scottish Natural Heritage (Ecoscope, 2000). Each attribute will have its own inherent source of variability that must be addressed during data collection and subsequent interpretation of the results. A monitoring programme must consider the whole bay, even where it may contain other Annex 1 features. These should have their own dedicated monitoring programme. A bay's monitoring programme may therefore be an aggregation of both the sampling programmes for a range of Annex 1 features in their own right, and a dedicated sampling programme for additional features of the whole bay.

To gain access to the site, the surveyor must consider the issues of permission (intertidal sites), tidal state (high or low water/slack water), prevailing wind/wave/swell conditions and underwater visibility. Access to intertidal habitats would be gained from the land, except for islands and offshore banks or remote sites, where boat access will be necessary. It will be necessary to use a boat to gain access to many subtidal habitats and therefore the availability of harbours and/or launching facilities is a consideration. Land access would be possible for those subtidal habitats immediately adjacent to the shore.

DGPS should be used for recording position on extensive intertidal or subtidal habitats. Photographs and/or diagrams of characteristic topographical features to find the precise location of a site marker should supplement maps. For subtidal sites, the approximate position can be located using conspicuous land features, preferably lined up to create transits. Photographs and/or diagrams should be used underwater to find the precise sample location although poor visibility creates severe problems.

5.2 Health and safety

All fieldwork must follow approved codes of practice to ensure the health and safety of all staff. Risks specific to working on bays are similar to those on littoral sediments, sublittoral sediments, littoral and inshore sublittoral rock habitats and are detailed in the Marine Monitoring Handbook (Davies *et al.*, 2001), the NMMP's Green Book[11] and references therein.

Some subtidal sampling will involve SCUBA diving techniques. All diving operations are subject to the procedures described in the Diving at Work Regulations 1997[12] (see: **http://www.hse.gov.uk/lau/lacs/47-11.htm**) and must follow the Scientific and Archaeological Approved Code of Practice[13] (see **http://www.hse.gov.uk/diving/osd/part.htm#Scientific**).

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[11] See **http://www.cefas.co.uk/monitoring/page-b3.asp** for information on the NMMP and for the NMMP Green book **http://www.marlab.ac.uk/FRS.Web/Uploads/Documents/GBMain%20Text%201103.pdf**.

[12] The Diving at Work Regulations 1997 SI 1997/2776. The Stationery Office 1997, ISBN 0 11 065170 7.

[13] Scientific and Archaeological diving projects: The Diving at Work Regulations 1997. Approved Code of Practice and Guidance – L107. HSE Books 1998, ISBN 0 7176 1498 0.

6 Generic attributes table

The following table lists the generic attributes that should be used in conjunction with those attributes highlighted from sub-feature guidance to define the condition of the entire feature.

For details of assessment techniques see Section 2 and Davies *et al*. (2001).

Table 1. UK GUIDANCE ON CONSERVATION OBJECTIVES FOR MONITORING DESIGNATED SITES

Interest feature: Inlets and Bays

Equivalent Phase 1 category: H1 intertidal, and H2 saltmarsh, K marine

Includes the following NVC types: various SM, MG and S types

Includes the Habitats Directive Annex I habitat types: Large shallow inlets and bays

Reporting category: Inshore sublittoral sediment, Inshore sublittoral rock, Littoral sediment and Littoral rock

NOTE: The attributes apply to all sites with inlet and bay features except those with asterisks which may not be applicable to all sites, and should be selected only where they reflect the conservation interest of the individual site.

It is essential that the section in the marine introductory text entitled *Setting objectives and judging favourable condition* is read in conjunction with this table when selecting the attributes to judge the condition of the feature.

Attributes	Target	Method of assessment	Comments
Extent of entire feature	No change in extent of whole feature	Assessment of extent should be measured periodically against a baseline map/aerial image or through the review of any known activities that may have caused an alteration in extent. Possible sources of baseline data are archive remote sensing, aerial photographs and intertidal resource mapping.	Where changes in extent are known to occur as a result of cyclical natural processes, then the target value should accommodate this variability. If required a declining value may be established where sufficient information is available to predict a trend. Where the field assessment judges the extent to be unfavourable, and subsequent

Attributes	Target	Method of assessment	Comments
		For details of assessment techniques see Section 3 and Davies *et al*. (2001).	investigation reveals the cause is clearly attributable to cyclical natural processes, the final assessment will require expert judgement to determine the reported condition of the feature. The feature's condition could be declared favourable where the officer is certain that the conservation interest of the feature is not compromised by the failure of this attribute to meet its target condition. Where there is a change outside the expected variation or a loss of the conservation interest of the site, (e.g. due to anthropogenic activities which interrupt natural coastal processes such as hard sea defences, land reclamation, etc. or unrecoverable natural losses) then condition should be considered unfavourable. Staff should refer to the flow diagrams in the introductory text to the marine features for more information on these issues.
Diversity of component habitats	Maintain the variety of habitats identified for the site, allowing for natural succession/known cyclical change.	Repeated assessment of overall habitat composition or a subset of specified habitats identified for the site. For details of assessment techniques see Section 3 and Davies *et al*.,(2001).	Where changes in habitat composition are known to be attributable to natural processes then the target value should accommodate this variability. Where there is a change in habitat composition outside the expected variation or a loss of the conservation interest of the site, then condition should be considered unfavourable.

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Attributes	**Target**	**Method of assessment**	**Comments**
Distribution/spatial pattern of habitats	Maintain the pattern of distribution of predominant habitats throughout the feature.	Assessment of the distribution of habitats identified for the site. Confirm the presence of named habitats at selected locations in the inlet or bay. The habitats will be representative of the inlet and bay. For details of assessment techniques see Section 3 and Davies *et al*. (2001).	Where changes in distribution/spatial pattern are clearly attributable to cyclical succession or expected shifts in distribution, or they occur as a consequence of natural geomorphological changes in the estuary (e.g. change in the position of the low water channel) then the target value should accommodate this variability. Where there is a change outside the expected variation or a loss of the conservation interest of the site, possibly as a consequence of anthropogenic developments, then condition should be considered unfavourable.
Water Quality ***The specific representation of this attribute will depend on the local conservation interest of the feature and take into account any perceived threat to the system.***	Target values should default to appropriate national or international standards where appropriate. If sufficient local data are available to establish the baseline condition, site-specific targets can be set.	Water quality parameters could be assessed directly using in water measurements or in appropriate biota, or using one or more indicators (for example, indicators of nutrient status are phytoplankton levels, chlorophyll-a concentrations or through the presence/thickness of green algal mats) For details of assessment techniques see Section 3.	Water quality standards are currently being established by the environmental protection agencies[10] for European Directives (Water Framework Directive, Urban Waste Water Treatment Directive) and the OSPAR Convention. Monitoring data are or will be available from these agencies to support feature assessment under common standards monitoring. In all cases, local measurements should be compared with regional or national assessments to establish whether any local changes are part of a wider trend. Eutrophication due to effluent discharge or agricultural run-off will result in condition of the attribute being designated as unfavourable.

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