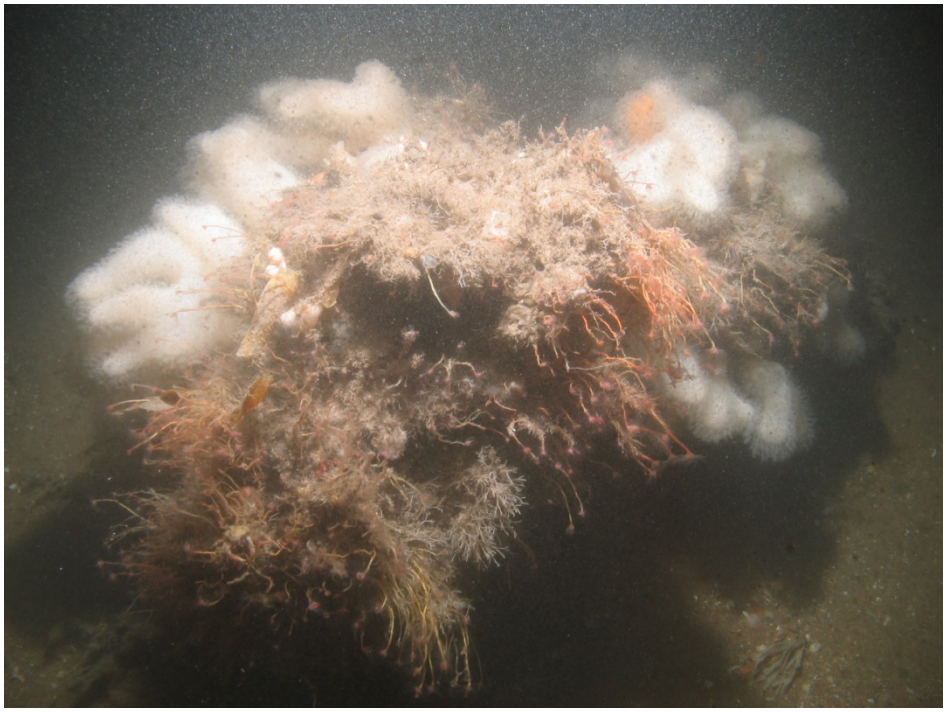
Offshore Special Area of Conservation:
Croker Carbonate Slabs

Conservation Objectives and Advice on Operations



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Version 5.0 (December 2012)

[1] Cover photo illustrates soft corals (*Alcyonium digitatum*) and dense *Tubularia indivisa* hydroids on a methane derived authigenic carbonate structure in the Croker Carbonate Slabs site.

Document version control

Version and date	Amendments made	Issued to and date
Croker Carbonate Slabs Draft Conservation Objectives & Advice on Operations Version 5.0 (December 2012)	Amendments to text in light of consultation feedback and internal review	Defra (18/12/12)
Croker Carbonate Slabs Draft Conservation Objectives & Advice on Operations Version 4.0 (23rd March 2011)	Amendment to wording in light of comments received from Joint Committee. Amendment to objective in light of review of sensitivity assessment.	Defra, Devolved Administrations and other Govt. Departments (23/3/11)
Croker Carbonate Slabs Draft Conservation Objectives & Advice on Operations Version 3.0 (31st January 2011)	Reviewed by JNCC Committee	JNCC Joint Committee (23/02/11)
Croker Carbonate Slabs Draft Conservation Objectives & Advice on Operations Version 2.0 (10.12.10)	Reviewed by JNCC Committee MPA sub-group	MPA Sub-Group (17/12/10)

Further information

This document is available as a pdf file on JNCC's website for download if required (www.jncc.defra.gov.uk).

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Summary of Draft Advice on Operations for Croker Carbonate Slabs Special Area of Conservation (SAC)

This advice is based on information on the SAC presented in JNCC's 'Croker Carbonate Slabs: SAC Selection Assessment' (version 5.0 September 2012). JNCC's Conservation Objectives and Advice on Operations is site and feature specific, and has been developed using best available scientific information and expert interpretation as at December 2012. The advice is generated through a coarse grading of sensitivity and exposure of site interest features to physical, chemical and biological pressures associated with human activity. Sensitivity and exposure have been combined to give a measure of the vulnerability of an interest feature to operations which may cause damage or deterioration, and which therefore may require management action.

***The Conservation Objective for the Croker Carbonate Slabs' submarine structures made by leaking gases is to maintain in favourable condition*.**

The exact impact of any operation will be dependent upon the nature, scale, location and timing of events. This Advice on Operations for the Croker Carbonate Slabs site will be kept under review and will be periodically updated to reflect new evidence that suggests changes in both sensitivity and exposure. Within the Croker Carbonate Slabs SAC, no offshore activities currently occurring are thought to result in damage to or deterioration of the interest feature. This indicates that no additional form of management measure(s) may be required or further measures where actions are already in force. This advice is indicative and does not remove the need for formal consultation on individual plans and projects.

It is important to note, however, that the feature and its associated biological communities are sensitive to a range of pressures, outlined in Table 1. Therefore to fulfil the conservation objectives for these Annex I features, the Competent Authorities for this area are advised to manage human activities within their remit such that they do not result in increased exposure to these pressures and thereby avoid damage or deterioration of the feature and its associated biological communities.

Management actions should enable the Croker Carbonate Slabs' submarine structures made by leaking gases to maintain Favourable Condition. This will require assessment and management of human activities likely to affect the feature adversely, and of activities likely to impact natural environmental quality and environmental processes upon which the features are dependent.

Note:

The recent Report of the Habitats and Wild Birds Directive Implementation Review (HM Govt, 2012) and the European Commission guidance on Conservation Objectives concludes that all Conservation Objectives should be up-to-date, accessible, allow applicants to assess the impact of their proposed development against them, be clear and straightforward, operational in practice and specified in concrete terms and wherever possible be quantifiable in numbers and/or size. On 29 June 2012, JNCC, with Natural England, published a new approach to the information contained in the Conservation Objectives. This new approach will be consulted upon in winter 2012. It is then intended that all Conservation Objectives will be updated in line with the agreed new approach between April 2013 and March 2015.

Croker Carbonate Slabs SAC: Draft Conservation Objectives and Advice on Operations

1 Introduction

1.1 JNCC's role

The Offshore Marine Conservation (Natural Habitats &c.) Regulations 2007 (as amended), hereafter referred to as the Offshore Regulations, transpose the Habitats Directive into law for UK offshore waters (from 12-200 nautical miles from the coast or the UK Continental Shelf). These Regulations give JNCC a statutory responsibility once a site has been submitted by Government to the European Commission to:

i) establish conservation objectives for SACs and inform Competent Authorities of these; and
ii) advise Competent Authorities of any operations which may adversely affect the integrity of the site.

This document for Croker Carbonate Slabs SAC is therefore prepared by JNCC to fulfil requirements under Regulation 18 of the Offshore Regulations. This advice is also required under the Offshore Petroleum Activities (Conservation of Habitats) Regulations (as amended); and the Marine Works (Environmental Impact Assessment) Regulations 2007 (as amended).

This advice is provided under the Advice on Operations section and summarised in the document 'Croker Carbonate Slabs: SAC Selection Assessment' (5.0), (JNCC, 2012). JNCC's Conservation Objectives and Advice on Operations is a broad-scale assessment applied across the whole site. The assessment has been developed using best available scientific information and expert interpretation as at September 2012. This advice will be updated periodically in the light of surveillance required under Article 17 of the Habitats Directive.

The advice is generated through a broad grading scheme of sensitivity and exposure of the site interest features to physical, chemical and biological pressures associated with human activity. Sensitivity and exposure scores have been combined to give a measure of the vulnerability of an interest feature to pressures associated with operations currently consented or permitted and occurring in or near the SAC, or which may cause damage or deterioration to the feature of the site, and which therefore may require management action. A broad-scale assessment is also made of the risk of damage to the features of the site from activities which do not have a prior environmental assessment or licensing regime and which may result in pressures to which the feature is highly or moderately vulnerable.

JNCC's Advice on Operations outlines current knowledge of the nature and extent of activities taking place within or close to the site which may significantly have an impact on the feature(s) for which a site has been selected. This advice will help focus the attention of the Competent Authorities on those activities that pose the greatest potential threat to the condition of the site and the development of appropriate management measures.

It is important to note that this advice is only a starting point for assessing impacts. Use of this advice does not remove the need for formal consultation on individual plans and projects. JNCC will provide more-detailed advice to Competent Authorities to enable them to assess the implications of any given plan or project at the time it is being considered.

This operations advice is likely to need to be supplemented through further, more-detailed discussions with Competent Authorities.

Conservation objectives are the starting point from which management measures and monitoring programmes may be developed as they provide the basis for determining what currently, or may in the future, result in damage or deterioration to the features of the site and therefore prevent the feature(s) of the site from achieving/maintaining 'Favourable Condition'.

The UK conservation agencies use the term 'Favourable Condition' to represent the concept of 'Favourable Conservation Status' for the interest features of an individual SAC (Davies *et al*., 2001). For an Annex I habitat, 'Favourable Conservation Status' under the Habitats Directive occurs when: i) its natural range and area it covers within that range are stable or increasing; and ii) the specific structure and functions, which are necessary for its long-term maintenance, exist and are likely to continue to exist for the foreseeable future; and iii) the conservation status of its typical species is favourable[2] (Article 1e).

1.2 Offshore (12 – 200 nautical miles): The role of competent authorities

Regulations 22, 23, 25 and 27 of the Offshore Regulations outline the responsibilities of Competent Authorities to ensure compliance with the Habitats Directive with regard to European Offshore Marine Sites. The main requirements are summarised below. These Conservation Objectives and Advice on Operations are provided to assist Competent Authorities in the execution of these responsibilities.

Regulation 22 of the Offshore Regulations requires Competent Authorities to consider appropriate conservation measures for Annex I habitats and Annex II species present within the SAC. Regulation 23 requires Competent Authorities to take appropriate steps to avoid the deterioration or disturbance of interest features for which the Offshore SAC is designated. The Advice on Operations set out in section 2 provides the basis for discussion about the nature and extent of the operations taking place within or close to the site and which may have an impact on its features.

Regulation 25 requires Competent Authorities to consider if a plan or project could be likely to have a significant effect on a European Offshore Marine Site and, if necessary, undertake an appropriate assessment for the plan or project that:

- either alone or in-combination with other plans or projects would be likely to have a ***significant effect*** on a European Site; and
- is not directly connected with the management of the site for nature conservation.

Through an Appropriate Assessment, Competent Authorities are required to ascertain the impact on the integrity of the site in view of the site's conservation objectives (Article 6.3 of the Habitats Directive). The integrity of the site is defined as 'the coherence of its ecological structure and function, across its whole area, that enables it to sustain the habitat, complex of habitats and/or the levels of populations of the species for which it was classified'[3].

Although closely linked, the judgement of impact upon site integrity is subtly different to determination of favourable condition of a specific feature. An assessment of favourable condition determines the current status of a feature. Any evaluation of effects on site integrity needs to consider whether the plan or project in question is compatible with the long-term natural recovery of the site's features. For example, adverse effects upon integrity may not become apparent until some time after a plan or project has been initiated. In such cases, a plan or project may have an adverse effect upon long-term site integrity even though the features remain in favourable condition in the short term.

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[2] The term Favourable Conservation Status relates to the individual habitats and species over their natural range within the European Union. However, because the selection of the European network of SACs is seen as fundamental to achieving Favourable Conservation Status, the European Commission considers that the concept should also be applied at the site level.

[3] Institute of Ecology and Environmental Management (2010). Guidelines for Ecological Impact Assessment in Britain and Ireland.

Regulation 27 of the Offshore Regulations requires Competent Authorities to review existing consents, permissions or authorisations and if necessary, affirm, modify or revoke them, undertaking an appropriate assessment where necessary.

The scope and content of any appropriate assessment will depend on the size, location and significance of the proposed project and is informed by the conservation objectives and advice on operations provided herein. In addition to the advice provided in this document, JNCC will also advise on a case-by-case basis.

1.3 Croker Carbonate Slabs SAC conservation objectives

The conservation objectives for the Croker Carbonate Slabs SAC interest features are provided below. These are high level objectives for the site features, and JNCC may refine them in future as our understanding of the features improves. They should be read in the context of (and in conjunction with) other advice given, particularly the SAC Selection Assessment Document which provides more detailed information about the site and evaluates its interest features according to the Habitats Directive selection criteria and guiding principles.

Within the objectives below superscript letters refer to explanatory text provided subsequently in section 1.4.

The Conservation Objectives for the Croker Carbonate Slabs' submarine structures made by leaking gases are:

Subject to natural change, maintain[a] the submarine structures made by leaking gases in favourable condition, such that:

The natural environmental quality[b] is maintained

The natural environmental processes[c] are maintained

The extent[d], physical structure[e], diversity[f], community structure[g] and typical species[h] representative of **submarine structures made by leaking gases** in the Irish Sea are maintained.

At the Croker Carbonate Slabs SAC, there is no direct evidence that the reef feature or associated community are in a damaged or deteriorated state. The feature is also not currently thought to be exposed to pressures associated with ongoing activities which may cause damage or deterioration. Best available evidence therefore indicates the feature is likely to be in a favourable condition and so a maintain objective is appropriate. The conservation objective for the site may be revised at a later date if new information indicates this assessment is not correct.

The feature's vulnerability to human pressure is further documented in section 2.5. However there is a lack of detailed information on levels of exposure to human activities and their ecological impact on the feature at this site. As outlined in section 1.5 below, further information will be required to assess and monitor favourable condition of the submarine structures made by leaking gases at this offshore SAC.

1.4 Explanation of terms used in the Conservation Objectives

a) **Maintain or restore**

Maintain implies that, based on our existing understanding, the feature is regarded as being in **favourable condition** and will, subject to natural change, remain at its condition at designation.
Restore implies that the feature is likely to have been degraded to some degree and be in unfavourable condition and that activities may have to be managed to reduce or eliminate potential negative impact(s). Restoration in the marine environment generally refers to natural recovery to favourable condition through the reduction or removal of impacts.
JNCC consider that maintenance or restoration of the following parameters (b - h) meets the requirements of the Habitats Directive to achieve favourable conservation status of the natural habitat through favourable "distribution, structure and functions".

b) **Natural environmental quality** e.g. chemical quality parameters of water, suspended sediment levels, radionuclide levels etc should not deviate from baseline at designation (if available) or reference conditions.
c) **Natural environmental processes** e.g. circulation, sediment deposition and erosion etc. should not deviate from baseline at designation (if available) or reference conditions.
d) **Extent** - the area covered by the habitat and communities
e) **Physical structure** - the shape, form and composition of the habitat and its substrata.
f) **Diversity** - the number of different biological communities or number of species within a given community**.**
g) **Community structure** e.g. age classes, sex ratios, distribution of species, abundance, biomass, reproductive capacity, recruitment, range and mobility.
h) **Typical species** – see Appendix III for criteria for identifying typical species.

1.5 Favourable condition

Conservation objectives for inshore English SACs have been provided in association with a 'favourable condition' table, which outlines how to recognise favourable condition for the interest features in question. However, understanding the functioning and condition of complex and dynamic offshore marine sites, which experience a variety of pressures resulting from historic and current activities, is difficult. For offshore sites, there is presently insufficiently detailed information on i) the existing condition of qualifying interest features and ii) the preferred or target condition of interest features. This currently limits the identification of measures and associated targets for condition monitoring. It is anticipated that further information on the condition of interest features will be obtained through baseline surveys and monitoring.

2 Advice on operations

2.1 Purpose of advice

The aim of this advice is to enable all competent authorities to prioritise management of activities that pose a threat to the interest features of the Croker Carbonate Slabs site. The advice is linked to the conservation objectives outlined in the section above, and will help provide the basis for detailed discussions on management of activities that may affect the features of the site.

2.2 Methods for assessment of vulnerability to pressures

Six broad Pressure Categories which may cause i) deterioration of natural habitats or the habitats of species, or ii) disturbance of species, (either alone or in combination), are considered in JNCC's Advice on Operations:

- Physical loss
- Physical damage
- Non-physical disturbance
- Toxic contamination
- Non-toxic contamination
- Biological disturbance

Example sources of pressures are provided (See Table 1), although these examples are not inclusive of all potentially detrimental activities and may not occur in or near the site.

A three-step process is used to assess the vulnerability of the site's features (**submarine structures made by leaking gases**) to the above pressures (see flow diagram in Appendix I):

1. An assessment of the **sensitivity** of the interest feature to the listed pressures (section 2.3);

2. An assessment of the current **exposure** of the interest feature to the pressures (section 2.4); and

3. An assessment of the **vulnerability** of the interest feature to the pressures (section 2.5). Vulnerability occurs where sensitivity to a given pressure is combined with exposure to that pressure.

This approach is sufficiently robust to take into account the effects of new activities or changes in patterns of usage. In presenting sensitivity, exposure and vulnerability assessments step-by-step, the reasoning behind current (and any future) advice is made clear. If an interest feature is known or thought to be sensitive to a particular pressure category, new activities or changes in patterns of activities which result in that pressure are likely to cause deterioration or disturbance.

All the scores of relative **sensitivity**, **exposure** and **vulnerability** are derived using best available scientific data and expert judgement. This method uses a coarse categorisation system, reflecting the current state of our understanding of the marine environment. It should be recognised that data for offshore habitats are sparse and assessments are likely to need revision in light of new research.

2.3 Sensitivity assessment

This assessment evaluates the relative sensitivity of the features of the Croker Carbonate Slabs SAC to the effects of physical, chemical and biological pressures. Sensitivity is defined here as 'intolerance of a habitat, community or individual (or individual colony) of a species to damage, or death, from an external factor and the time taken for its subsequent recovery' (MarLIN, 2006). For example, a very sensitive species or habitat is one that is very adversely affected by an external factor arising from human activities or natural events (killed/destroyed, high intolerance) and is expected to recover over a very long period of time, i.e. >10 or up to 25 years ('low' recoverability) (MarLIN, 2006). The sensitivity of interest features (and scientific understanding of sensitivity) may change over time. Hence, an operation which is not currently deemed to have a negative effect may do so in the future.

Table 1 (column 3) presents the sensitivity scores for the features of the Croker Carbonate Slabs SAC. They are drawn principally from MarLIN's 2008 (Hill, 2008) evaluation of the sensitivity of the following biotope (which is the closest biotope from the Marine Habitat Classification of Britain and Ireland (Connor *et al*., 2004). They are not identical to that present within the SAC but are the closest match for which MarLIN sensitivity assessments are available and are comparable in terms of functionality:

- **Piddocks with a sparse associated fauna in upward-facing circalittoral very soft chalk or clay (CR.MCR.SfR.Pid)**

The applicability of the MarLIN assessments of sensitivity is dependent on the quality of available scientific information on these biotopes and their characterising species. In addition, both the biotope classification system and the MarLIN sensitivity assessments primarily rely on inshore biological data, so although they are applicable to habitats in offshore waters, confidence in these assessments in an offshore context is necessarily lower. Therefore JNCC has, in some cases, adjusted the MarLIN sensitivity scores to pressures to take account of site-specific, prevailing conditions, where information is available to do so. This is a justifiable approach but does involve an element of expert judgement.

The interest features and associated biological communities of the Croker Carbonate Slabs site are sensitive to: **physical loss**, **physical damage**, **toxic** and **non-toxic contamination**, and **biological disturbance**. Further detail on sensitivities of the Croker Carbonate Slabs submarine structures made by leaking gases is given below and summarised in column 3 of Table 1.

2.3.1. Sensitivity to physical loss

Many of the species within the biotope are attached to the substratum.or are slow-moving. Areas of 'high relief' methane-derived authigenic carbonate (MDAC) support a diverse range of soft corals, erect filter feeders, sponges, tube worms and anemones whilst the 'low relief' MDAC is colonised with scour-resistant hydroids and bryozoans (Whomersley *et al.,* 2010). Therefore substratum removal would result in loss of most faunal populations. With the loss of adult populations, recovery depends upon recolonisation by larvae during the breeding season. For species representative of the CR.MCR.SfR biotope, recovery by recolonisation is likely to be good because most component species have pelagic larvae or can migrate into the area; therefore sensitivity to **removal** is assessed as moderate.

Any construction or permanent deposition over the feature would lead to, within the immediate vicinity, obstruction of the feature and its associated biological communities. There would therefore be no chance of recovery to a natural state within the immediate vicinity, while the structure or deposition remains *in-situ*. Sensitivity to **obstruction** is therefore assessed as high.

Fauna on low relief MDAC e.g. bryozoans *Flustra foliacea* and *Vesicularia spinosa* and robust hydroids *Tubularia indivisa*, *Nemertesia spp*. and *Diphasia pinaster*, is scour resistant & there are species present which suggest a high energy environment prevails (JNCC 2012). This indicates that sediment is less likely to settle and instead remain in suspension. However, areas of 'high relief' MDAC support a diverse range of soft corals, erect filter feeders, sponges, tube worms and anemones, all of which are either sessile or permanently attached and therefore unable to actively avoid smothering and they rely on particulates in the water column as a food source. To varying degrees they can withstand some smothering e.g. *Alcyonium digitatum* & anemones can slough off sediment by overproducing mucous. However, the low sensitivity score given by MarLIN (Hill, 2008) is based on the tolerance of *Pholas dactylus* & *Polydora ciliata*, two species which have not been recorded in the site. The MarLIN sensitivity assessment highlights that "*many of the other species associated with this biotope, such as Urticina felina and the many sessile suspension feeders like the sponge Halichondria panicea, though tolerant of turbid waters, are likely to be killed by a 5cm deep layer of silt*". Given the feature, in particular the high relief MDAC, is characterised by the dominance of sessile suspension feeders, it is considered appropriate to raise sensitivity to smothering to moderate, in light of relative intolerance of species to smothering combined with expected good recovery due to their having pelagic larval stages.

2.3.2. Sensitivity to physical damage

Erect epifaunal species, such as anemones, the bryozoan *Pentapora fascialis* and hydroids e.g. *Nemertesia antennina* are vulnerable to physical disturbance. The majority of the characterising species in this biotope are erect, sessile or permanently attached to the substratum and unable to move away.

They are therefore likely to be physically removed or damaged by physical disturbance and abrasion such as that which might be experienced by a passing trawl or anchors dragging. Veale *et al*. (2000) reported that the abundance, biomass and production of epifaunal assemblages decreased with increasing fishing effort. Hydroid and bryozoan matrices were reported to be greatly reduced in fished areas (Jennings & Kaiser, 1998 and references therein). However, recovery of many of the species is considered to be relatively good because they have pelagic larval stages. Therefore, given the evidence above, an overall sensitivity to **physical disturbance or abrasion** of moderate has been recorded.

Low relief MDAC is colonised by more scour resistant species such as the bryozoans *Flustra foliacea* and *Vesicularia spinosa*. The robust hydroids *Tubularia indivisa* and occasionally *Nemertesia spp*. and *Diphasia pinaster*, were also associated with this substratum (JNCC 2012). Notably the tubeworm *Sabellaria spinulosa* which is tolerant of some siltation, was often found to entirely cover the exposed MDAC in large numbers. Other species, such as the sponge *Cliona celata* (Snowden 2007) and the anemone *Urticina felina* are tolerant of some siltation. A significant decrease in siltation levels may reduce food input to the feature's associated biological community, resulting in reduced growth and fecundity of suspension feeding animals. Conversely, increases in suspended sediment may benefit these species if availability of organic particles increases. However, very high levels of silt may clog respiratory and feeding organs of some suspension feeders and may result in a minor decline in faunal species diversity. Sensitivity to **changes in suspended sediment** is therefore assessed as low to reflect the relative tolerance and good recoverability of many of the species present.

2.3.3. Sensitivity to non-physical disturbance

The feature and its associated biological communities are not considered sensitive to non-physical disturbance through **noise or visual presence**.

2.3.4. Sensitivity to toxic contamination

The feature and associated communities may be sensitive to various types of chemical contamination. However, assessing the effects of contamination on biotopes is extremely difficult because varying quantities of different contaminants can have very different effects (including antagonistic and synergistic effects) on marine organisms. There is insufficient information to be able to assess whether the feature is sensitive or robust to toxic contamination through the **introduction of non/synthetic compounds or radionuclides**.

2.3.5 Sensitivity to non toxic contamination

There is also insufficient information to be able to assess whether the feature is sensitive or robust to **changes in nutrient loading.**

Many of the species in the biotope are found in the intertidal where some reduced salinity must be experienced from precipitation run-off. However, all species are fully marine species and a long term change in salinity is likely to be detrimental to most species. *Urticina felina*, a characterizing species in the biotope (and recorded as present on the feature) is likely to be highly tolerant of reductions in salinity. The feature is therefore regarded as having low sensitivity to **changes in salinity**.

Many of the species characterising the feature, extend into much cooler and warmer waters than found in Britain so are likely to be tolerant of long term changes in temperature, therefore sensitivity is considered to be low to **changes in thermal regime**.

Water column depth is typically 100m within the site, there are no photosynthesising species recorded (JNCC 2012). The feature and its associated biological communities are therefore assessed as not sensitive to **changes in turbidity**.

2.3.6 Sensitivity to biological disturbance

The effects of removing species from the feature can lead to shifts in population dynamics and species interactions (e.g. if predators are removed from the system) which may then lead to cascading effects on the assemblage as a whole. In addition, many of the species targeted by fisheries in deep water areas are especially vulnerable to the effects of over fishing due to their long life histories (Pauly *et al*., 2002; Sewell and Hiscock, 2005).

While the species characterising the biotope are themselves, considered unlikely to be extracted, other species associated with the feature e.g. crustacean may be targeted so this pressure is relevant to this feature. Sensitivity of the feature and associated biological communities to biological disturbance through **selective extraction of species** are considered to be moderate.

There is insufficient evidence available to determine whether the interest feature and its associated biological communities are sensitive to biological disturbance through the **introduction of microbial pathogens or non-native species**.

2.4 Exposure assessment

Table 1 (column 4) shows the relative exposure of the Croker Carbonate Slabs' interest features to physical, chemical and biological pressures. This assessment is based on known human activities operating in or adjacent to the site, and the anticipated pressures associated with these activities.

As offshore sites cover a relatively large geographical area and precise information on operations within SAC boundaries is not yet available, assigning scores for exposure carries certain assumptions about the spatial extent, frequency and intensity of the pressures associated with offshore activities. Expert judgement was used to determine where onsite activities are likely to affect interest features physically, chemically and/or biologically.

Spatial data on offshore industry activities has been provided by the Crown Estate for aggregate extraction and windfarm development, UK Deal for oil and gas industry activities and the United Kingdom Cable Protection Committee (now Subsea UK) for submarine cable distribution. UK-wide fisheries data for offshore waters are not yet available to JNCC at sufficient resolution to enable a full assessment of exposure to different types of fishing activities. Availability of Vessel Monitoring System (VMS) combined with logbook and/or vessel registration data for all European vessels across UK waters on an annual basis would allow the spatial extent and intensity of physical and biological pressures associated with demersal fishing to be evaluated more thoroughly. We are not aware of an adequate methodology to assess the distribution of static/set demersal gear use provided via VMS, or the intensity of its physical and biological impacts. Interest feature exposure and vulnerability to pressures associated with static/set demersal gears have therefore not been assessed using VMS data. However, site-specific information e.g. survey data, may be used where it is available to do so.

The Marine Management Organisation's Fisheries Activity Database compiles various data at the level of ICES rectangle[4], which includes species landings from vessels when they land their catch, this provides an indication of the species which may be targeted within the vicinity of the site.

[4] ICES (International Council for the Exploration of the Sea) are approximately 30nm x 30nm depending on where they are.

Fishing exposure was derived from work on a Defra marine biodiversity research programme (MB106)[5] where the method to describe how VMS data was processed is provided in detail. Briefly, estimations of fishing activity were derived using Vessel Monitoring System (VMS) data available for 2006-9. The derived surfaces represent activity from all vessels (both UK and non-UK registered vessels) of at least 15m length. VMS data for UK vessels were linked to skipper logbook information in order to determine the fishing gear being employed. For non-UK registered vessels where logbook information is not available information on fishing gear employed has been obtained from 'primary gear' listed on the EU vessel register. Unprocessed VMS data have been filtered using a simple speed rule of between 1 and 6 knots to indicate fishing activity for all gear types. Date and time information attached to unprocessed VMS data were used to determine elapsed time between consecutive VMS locations for each vessel (usually 2 hours) and summarised at a resolution of 0.05 decimal degrees. The same programme recorded distribution of trapping/potting activity, though it should be noted that many vessels undertaking potting/trapping may be less than 15m in length and as such not recorded in this dataset.

The exposure assessment is based on best available information on the levels of pressures associated with activities at the Croker Carbonate Slabs site. If new information becomes available this may lead to modification of the advice on operations presented herein. In addition, an activity may not currently be occurring on the site but may do in future. As such, competent authorities will need to take into account both the sensitivity of the feature and the conservation objectives outlined in section 1.4 whenever a new activity is proposed.

In summary, based on best available information the interest features and associated biological communities of the Croker Carbonate Slabs site are assessed as exposed to the following pressures:

- **Physical loss** due to **obstruction** (cable and wreck) at a low level
- **Physical damage** through **physical disturbance and abrasion** (demersal fishing) at low levels

The detail of the exposure assessments to the pressures listed in section 2.2 (and sub-pressures) are provided below and presented in column 4 of table 1.

2.4.1 Exposure to physical loss

The site is exposed to low levels of obstruction. An inactive *in-situ* BT telecoms submarine cable lies across the site, running approximately east to west. A wreck is located within the site boundary and another located on the western edge of the boundary. However, the wreck's contribution to the exposure of the feature to obstruction would be considered relatively insignificant. Potentially, a small proportion of the feature has been physically lost and so the exposure level to **obstruction** has been assessed to be low.

The removal of rocks or boulders to which species are attached by the passage of mobile fishing gears (Jennings & Kaiser, 1998) may result in substratum loss (or removal). No other activities are thought to occur which would possibly result in the removal of the feature. Therefore the feature is not thought to currently be exposed to **removal**.

Although some suspension of sediments would be expected to accompany mobile trawling activity occurring in the softer sediments within the site, the associated smothering effects would be expected to be limited to the immediate vicinity and relatively short-lived and therefore not expected to exceed the MarLIN sensitivity benchmark of "*sediment to a depth of 5 cm above the substratum for one month*". In addition, this site is thought to lie within an area of relatively high energy (Whomersley *et al*., 2010), so it

[5] Cefas (2010) Report no. 1: Objective 1 – Provision of geo-database containing standardised layers showing the distribution of specified activities, sites and resources with associated metadata and comments. Project MB106: Further development of marine pressure data layers and ensuring the socio-economic data and data layers are developed for use in the planning of marine protected area networks

is unlikely that the suspension of sediment which could accompany trawling activity on nearby sediment would exceed ambient conditions. There are no areas of active dredging occurring in or near the site and so no other activities are thought to occur currently which would contribute to this pressure. The feature is therefore not thought to be exposed to physical loss through **smothering**.

2.4.2. Exposure to physical damage

Although VMS data indicates beam trawling, otter trawling and dredging occurring in proximity to the site, the data is at too low a spatial resolution to confirm that mobile demersal gear activities overlap with the site/ features within the site or whether they fish around it in an effort to avoid it.
As indicated during the verification survey of this site (Whomersley *et al*., 2008), the MDAC feature presents a considerable snagging obstacle to mobile towed gear. It is therefore likely that trawlers would avoid fishing on the feature to prevent damage to their fishing gear. However, static fishing gear (mainly crab pots) was found throughout the site, coincident with the MDAC (Whomersley *et al*., 2008). Static gear can cause, albeit to a lesser extent than towed gears, **physical disturbance and abrasion** of the feature and its associated biological communities. There is no VMS evidence of static demersal fishing activity from vessels over 15 metres, however it is likely that some is undertaken by vessels of less than 15 metres as pots were observed (Whomersley et al. 2008).. The actual activity level and exposure is therefore assessed as unknown.. There are no anchorages in or near the site and so no other activities currently occurring are thought to expose the feature to physical disturbance and abrasion.

The feature and its associated biological communities are unlikely to be exposed to increases in suspended sediment associated with mobile trawling activity occurring on nearby sediment because the site lies in an area subject to relatively high energy, characterised by scour-tolerant species (JNCC 2012). Therefore any **change in suspended sediment** is unlikely to exceed ambient conditions and exposure is therefore assessed as none.

2.4.3. Exposure to non-physical disturbance

The site lies in an area of busy shipping activity between Holyhead and Dublin and other routes running north-south through the Irish Sea. The feature and associated biological communities are likely to be exposed to noise associated with shipping and fishing activities, however, it is not possible to quantify the exposure to **noise.** The feature is unlikely to be exposed to **visual disturbance** associated with shipping and fishing because of the relative depth of the site.

2.4.4. Exposure to toxic and non-toxic contamination

According to best available evidence there are no activities currently occurring in or near the Croker Carbonate Slabs site which are thought to expose the feature to the **introduction of synthetic or non-synthetic compounds**, **changes in nutrient loading, thermal regime, turbidity or salinity**. Whilst the relatively high level of shipping is a potential source of some of these (e.g. synthetic and non-synthetic contaminants, freshwater, nutrients), the amounts are considered to be minimal in comparison to other industries. Also, the site lies at depth (approximately 100m) in an area of relatively high energy and represents an open receiving environment. Therefore, should contaminants be released through ballast water it is expected that they would be quickly diluted and dispersed and so it is unlikely the feature would be exposed.

Levels of the radioactive isotope Technecium-99 in the Irish Sea in the past, increased as a result of authorised discharge from the British Nuclear Fuels plc (BNFL, 1991–1998) reprocessing plant at Sellafield (e.g. Smith *et al*., 2001b). However, a more recent report (Cefas, 2011) indicates a general trend of decreasing radionuclides in the Irish Sea reflecting reduced emissions. Artificial radionuclides, including Caesium (^{137}Cs), Plutonium ($^{239/240}$Pu), Technetium-99, and Americium ^{241}Am have all been recorded in marine organisms and sediments in the region around the Pisces Reef SAC to the north of

Croker Carbonate Slabs SAC and in the wider Irish Sea. However this is insufficient information to be able to quantify exposure to the **introduction of radionuclides** within the site.

2.4.5. Exposure to biological disturbance

According to fish landings data collated by ICES, there is an abundance of mobile species fished in the wider area, A number of other species are harvested on a modest scale, including haddock, cod, sole, monkfish, skates and rays, turbot, and plaice[6]. However it is not possible to assess the exposure of the feature to selective extraction of species associated with bottom trawling because there is insufficient information on species bycatch and mortality. Additionally, while the landings data may be useful in providing an indication of what species are being taken from the general area, the spatial resolution is too coarse to be able to determine which species are being removed at a site level and to what degree.

Except for lobsters, none of the other species recorded as present within the feature are thought to be targeted for extraction. During the survey of this site, static fishing gear was recorded as coinciding with the presence of significant amounts of MDAC. It is likely that the rocky terrain formed by MDAC provided suitable habitat for crabs and lobsters. A lobster was seen on a video tow over MDAC and strings of crab pots were observed across the area (Whomersley *et al*., 2008).

While fixed gears are more selective than mobile and so we would expect mortality of non-target species to be relatively much lower, removal of predators like lobster and crabs from the feature may alter the prey-predator dynamic within the associated biological community, especially given lobster preys on a wide range of benthic invertebrates (Smith *et al*., 2001a). Exposure to **selective extraction of species** is assessed as low, however low confidence accompanies this assessment.

The feature and its associated biological communities may be exposed to the **introduction of microbial pathogens and non-native species and translocation** through the release of ballast water associated with shipping. However, this is an open, energetic receiving environment and the feature is located at depth (approximately 100m), additionally it is becoming less common practice to dispose of ballast at sea. Taking all into consideration the feature is assessed as not exposed to these pressures.

[6] MMO landings data 2010 for ICES rectangle 36E4 and 35E4 over the period 2006-2009.

2.5 Vulnerability assessment

The vulnerability of the interest feature to external pressures is determined by integrating the sensitivity evaluation with that of exposure. Only if a feature is both sensitive *and* exposed to a human activity is it considered vulnerable. In this context, therefore, **vulnerability** has been defined as the **exposure** of the habitat, community or individual (or individual colony) of a species to an external factor to which it is **sensitive** (Hiscock, 1996). An assessment of interest features' vulnerability (Table 1) helps to guide site management decisions by highlighting potentially detrimental activities that may need to be managed (or continue to be managed) by the Competent Authorities.

The **Croker Carbonate Slabs submarine structures made by leaking gases** and associated biological communities are assessed as vulnerable to:

- **Physical damage** through **physical disturbance or abrasion** (static demersal fishing) and **physical loss** through **obstruction**[7] (*in-situ* inactive submarine telecoms cable) at a low level;

2.6 Assessment of risk of damage or disturbance

JNCC considers 'risk' to be the likelihood of deterioration of the feature due to an activity. It is the vulnerability of the feature to an activity, assessed against the current level of management of that activity.

High risk activities will be those to which the feature is highly or moderately vulnerable, and for which current management may not be adequate. For example, industries which are not location specific and not subject to prior consent procedures or reliable enforcement are more likely to cause damage/disturbance to the interest feature. These industries include fishing and shipping. However, not all activities associated with these industries are detrimental to interest features.

Low risk activities will be those where there is no feature vulnerability (i.e. the activity does not interact with the feature) or where the high vulnerability is mitigated for by effective management. For example, for industries which are location specific, are always subject to prior consent requiring consideration of effects on the integrity of the site and have clear reliable methods of enforcement, there is generally a lower likelihood of causing damage or disturbance to interest features. This includes the activities of the oil and gas, aggregates and renewable energy industry sectors. Competent Authorities are advised to consider management actions that might need to be taken to reduce the risk of damage associated with these activities to the SAC feature.

[7] A combination of high sensitivity to obstruction and low exposure should result in an assessment of moderate vulnerability, following the vulnerability matrix provided in Appendix II. However, given the area of obstruction is relatively insignificant in relation to the size of the overall feature is it unlikely that the feature's structure and function would be impaired. It is therefore considered appropriate to lower vulnerability from moderate to low in this instance.

Only high or medium-high risk activities are noted here:

- Within the Croker Carbonate Slabs site, no offshore activity is considered to pose a current moderate to high risk of damage to the interest features.

The vulnerability of the SAC to climate change is not considered in the tables below, given the uncertainties surrounding the effects of global change on the ocean

Table 1: Sensitivity, exposure and vulnerability of the Croker Carbonate Slabs submarine structures made by leaking gases to physical, chemical and biological pressures[8]

Sensitivity key: ••• = High sensitivity •• = Moderate sensitivity • = Low sensitivity, ○ = No known sensitivity and **?** = Insufficient information to make assessment
Exposure key: High = High exposure, Medium = Medium exposure, Low = Low exposure, None = No known exposure, Unknown level = Exposure of an unknown level and **?** = Insufficient information to make assessment.

List of pressures which may cause deterioration or disturbance (with example activities)		**Croker Carbonate Structures: submarine structures made by leaking gases**		
		Sensitivity	**Exposure**	**Vulnerability**
Physical Loss	**Removal** (e.g. aggregate dredging, isolated rock dump, infrastructure development)	••	**None**	**No known vulnerability**
	Obstruction (e.g Permanent constructions [oil & gas infrastructure, windfarms, cables] & wrecks)	••	**Low**	**Low vulnerability (caveat[9])**
	Smothering (e.g. drill cuttings)	••	**None**	**No known vulnerability**
Physical Damage	**Changes in suspended sediment** (e.g. screening plumes from aggregate dredging)	•	**None**	**No known vulnerability**

[8] The vulnerability of the SAC to climate change is not considered in the tables below, given the uncertainties surrounding the effects of global change on the ocean.

[9] A combination of high sensitivity to obstruction and low exposure should result in moderate vulnerability when following the vulnerability matrix provided in Appendix II. However, given the area of obstruction is relatively insignificant in relation to the size of the overall feature is it unlikely that the feature's overall structure and function would be impaired. It is therefore considered appropriate to lower vulnerability form moderate to low in this instance.

	Physical disturbance or abrasion (e.g. mobile benthic fishing, anchoring, windfarm scour pits, pipeline burial, potting)	••	**Unknown**	**vulnerability** Identified but unquantifiable
Non-physical disturbance	**Noise** (e.g. boat activity, seismic)	○	**?**	**No known vulnerability**
	Visual presence (e.g. recreational activity)	○	**None**	**No known vulnerability**
Toxic contamination	**Introduction of synthetic compounds** (e.g. TBT, PCBs, industrial chemical discharge, produced water, fuel oils)	**?**	**None**	**No known vulnerability**
	Introduction of non-synthetic compounds (e.g. heavy metals, crude oil spills)	**?**	**None**	**No known vulnerability**
	Introduction of radionuclides (e.g. nuclear energy industry)	**?**	**Unknown**	**Insufficient information**
Non-toxic contamination	**Changes in nutrient loading** (e.g. outfalls)	**?**	**None**	**No known vulnerability**
	Changes in thermal regime (e.g. cooling water discharges)	•	**None**	**No known vulnerability**
	Changes in turbidity (e.g. laying of pipelines, aggregate dredging)	○	**None**	**No known vulnerability**
	Changes in salinity (e.g. outfalls from rigs, ships)	•	**None**	**No known vulnerability**
Biological disturbance	**Introduction of microbial pathogens** (e.g. outfalls)	**?**	**None**	**No known vulnerability**
	Introduction of non-native species and translocation (e.g. ballast water, hull fouling)	**?**	**None**	**No known vulnerability**

	Selective extraction of species (e.g. bioprospecting, scientific research, demersal fishing)	••	**Low**	**Low vulnerability**

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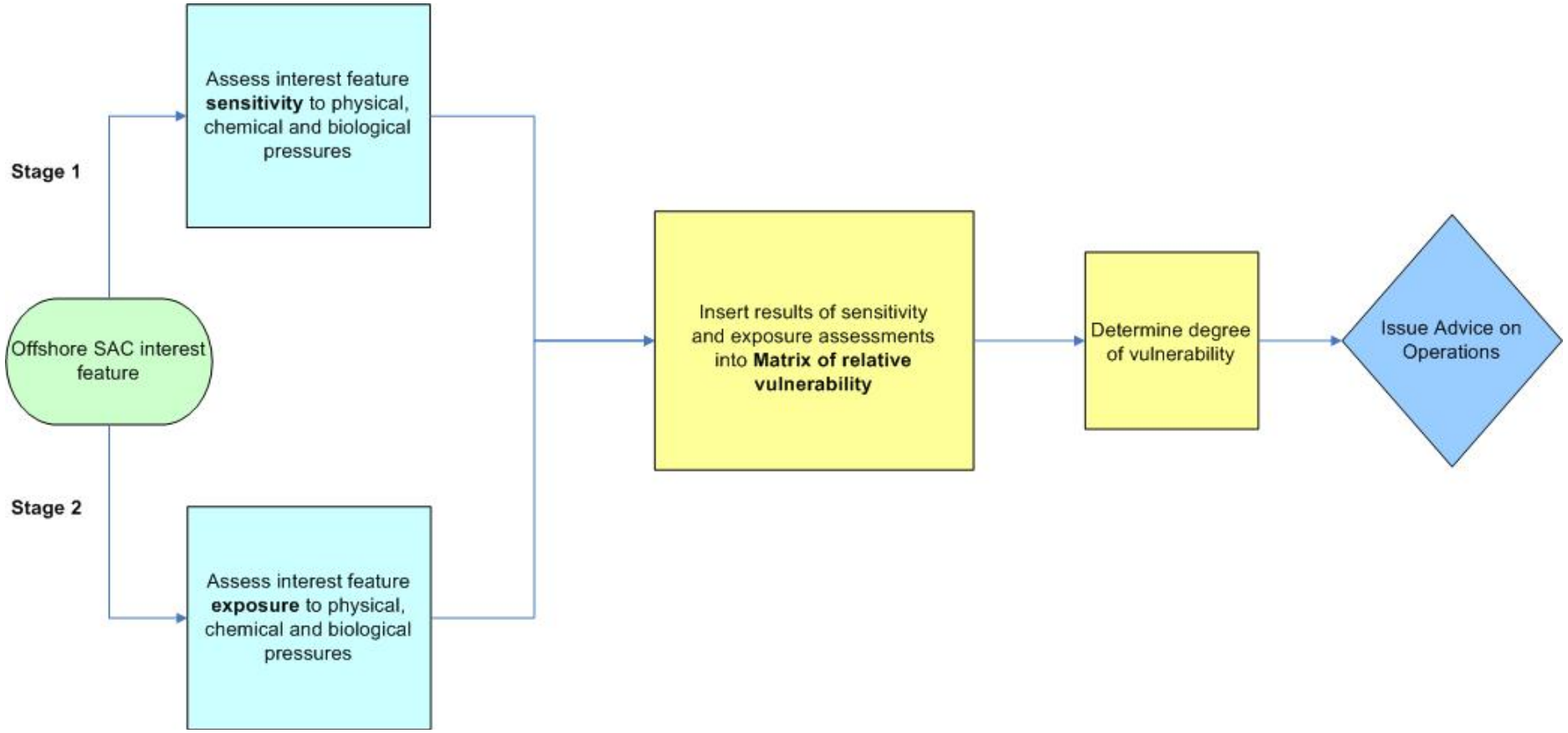
Appendix I: Flow diagram illustrating process of determining vulnerability of interest features



Appendix II: Matrix of relative vulnerability

The relative vulnerability of an interest feature is determined by combining the sensitivity and exposure assessments according to the table below.

		Relative sensitivity of the interest feature			
		High ●●●	Moderate ●●	Low ●	None ○
Relative exposure of the interest feature	High (3)	9	6	3	0
	Medium (2)	6	4	2	0
	Low (1)	3	2	1	0
	Unknown				0
	None (0)	0	0	0	0

Note: if there is insufficient information to assess either exposure **or** sensitivity of a given interest feature, vulnerability will always be categorised 'insufficient information to make any assessment'.

Categories of relative vulnerability

High vulnerability	6 to 9
Moderate vulnerability	3 to 5
Low vulnerability	1 to 2
Vulnerability identified, but not quantified as level of exposure unknown	
No known vulnerability	0
Insufficient information to make any assessment	

Appendix III: Typical species criteria

Identification of a species as typical is not in itself sufficient to indicate the importance of the species or any need for management. The importance of the species should be judged on the contribution made by the species to ecological integrity of the feature. These criteria are intended to help identify or classify typical species and are not limited to the benthos. They are relevant to the Annex I habitat feature and its component parts at the *site* level.

A typical species should meet one or more of the following criteria a – e below:

a) Consistently associated with, but not necessarily restricted to, the feature
   For example:
   - Can be predicted to occur at certain seasons/times (e.g. seasonal & temporal)
   - Stages of life cycle associated with the feature (e.g. spawning)
   - Species is dependent upon feature (for food, shelter, nest)

b) A species on which identification of the habitat is founded
   This criterion is unlikely to apply to complex physiographic features which may be composed include other Annex 1 features (e.g. H1130 Estuaries, H1160 Large Shallow Inlets and Bays which may include H1170 Reefs, H1110 Sandbanks which are slightly covered by seawater all the time etc.)

c) Characteristic of the habitat
   For example:
   Ammodytes tobianus, Zostera marina for 'H1110 Sandbanks which are slightly covered by seawater all the time'

d) An integral part of the structure of the habitat
   For example:
   - Any species that gives the habitat structural complexity (e.g. kelp)
   - Any species that forms the habitat (e.g. biogenic reef species, maerl)

e) A species which influences the habitat's structure and function
   For example:
   - Bioturbators
   - Grazers
   - Animals which bore into the substratum
   - Predators
   - Keystone species (i.e. A species that influences the ecological composition, structure, or functioning of its community far more than its abundance would suggest (EEA, 2008)

Note: above criteria should not be used to describe non-natives as typical; these are marine species and plants and algae transported from their native range to 'new' areas. Introductions and transfer of non-native marine species to their non-native environment mainly occurs by the transport and discharge of ballast water, and to a lesser extent by transport of fouling organisms on hulls or through aquaculture (JNCC, 2008b).