Advice from the Joint Nature Conservation Committee and Natural England with regard to fisheries impacts on Marine Conservation Zone habitat features.

FINAL VERSION (28 April 2011)

In fulfilling our obligations under the Marine and Coastal Access Act 2009 to support the Regional MCZ projects, Natural England and JNCC have produced this package of advice on the impacts of fishing activities on broad scale habitats and habitat Features of Conservation Importance (FOCI). We have also highlighted the possible high level management options that are available to address impacts (where they occur) and the compatibility of these options with the conservation objective of the feature.

Whilst we have endeavoured to make these assessments as evidence-based and fit for purpose as possible, due to the high degree of variability within some habitat categories, the large numbers of fishing gears under consideration and local variation in fishing practices, it is inevitable that the advice is somewhat generalised. It will however, provide a scientifically-robust starting point for discussions about the specific management requirements of features. For individual MCZs the advice should be used alongside site specific information, local knowledge (including that from fishermen) and with the support from the relevant statutory conservation adviser.

Please note - The introductory section of this document contains some important definitions relevant to the interpretation and application of the assessments. Users should read this section before proceeding to the habitat assessments and subsequent advice.

Written by JNCC and Natural England

The Joint Nature Conservation Committee and Natural England

Advice on the impacts of fishing activities on broad scale habitats and habitat Features of Conservation Importance (FOCI), possible management options and their compatibility with conservation objectives.

Marine Conservation Zones and fisheries **Document version control**	
Version 1 (compiled from individual feature assessments)	Date prepared 26/1/2011 Prepared by – T. Blasdale, M. Duffy, R, Enever, R. Fisher, F. A. Lannin, F. Marubini, H. Stevens and M. Tasker. Quality Assured by – J Ashworth and E Mayhew. Reviewed by – CEFAS (Simon Jennings) and MMO (Neil Wellum).
Version 2 *part 2* (incorporating reviewer comments for feature assessments ONLY)	Date prepared 14/3/2011 Prepared by – F. Marubini Reviewed by H. Stevens
Version 3 (merged edits from H. Stevens, T. Blasdale and F. Marubini)	Date prepared 16/3/2011 Prepared by – T. Blasdale and F. Marubini Reviewed by H. Stevens Quality Assured by M. Duffy and M. Tasker (18 & 19/3/2011)
Working Draft (v4) Approved by:	MCZ Project Board (C. Cotterell and J. Goold) Date Approved 14th April
Final Version (v5)	21st April 2011
Final Version – Issued	28th April 2011

1 INTRODUCTION

The Statutory Nature Conservation Agencies (Natural England and the Joint Nature Conservation Committee [JNCC]) have a duty under the Marine and Coastal Access Act 2009 to provide advice and guidance to stakeholders and public authorities on the following (but not restricted to):

1) The matters which are capable of damaging or otherwise affecting any protected feature (within a Marine Conservation Zone – MCZ);

2) How any conservation objective may be furthered or least hindered and how the effect of any activity or activities on a MCZ may be mitigated.

The relevant fisheries management bodies (IFCAs, MMO and Defra) are responsible for the design, implementation and enforcement of fisheries management measures (where they are required) to ensure that the conservation objectives for MCZ features are met. The regional projects will include in their draft MCZ recommendations an indication of the possible management options that they consider necessary to achieve their conservation objectives. In addition they will produce an Impact Assessment that identifies the implications of these management options. The draft MCZ recommendations, associated conservation objectives and the Impact Assessments will be reviewed by JNCC and Natural England before submission to Government.

This document is intended to provide the regional projects with advice on:

1) the impact that various fishing activities may have upon most MCZ broad scale and FOCI habitat features (some habitats are so heterogeneous that such advice is not possible, see notes in Section 3);

2) the likelihood of potential management options to appropriately mitigate fisheries impacts and help the conservation objective be delivered.

It is intended that this advice will be useful to stakeholders and public authorities:

1) to help to inform the discussions of the regional project stakeholder groups;

2) to support the public authorities in considering the feasibility and effectiveness of management options put forward by the stakeholder groups;

3) to provide the fishing industry representatives with a better understanding of whether and how their activities might be affected by management to achieve conservation objectives;

4) to inform the Impact Assessments and the assumptions made within them;

5) to provide the SNCB's current understanding of the impacts of fishing activities on MCZ habitat features and on the options available to help ensure that the feature can achieve its conservation objective(s).

Whilst we have endeavoured to make these assessments as evidence-based and fit for purpose as possible, due to the high degree of variability within some habitat categories, the large numbers of fishing gears under consideration and local variation in fishing practices, it is inevitable that the advice is somewhat generalised. Where possible the review has been based on evidence from peer-reviewed scientific journals. However, it should be noted that gear impact studies for many species and habitats are not covered in the primary literature.

In such instances grey literature (such as Government agency reports), expert judgement and the use of proxies for habitats, species and gears were applied to inform our assessments.

These assessments have also been through a peer review process involving internal SNCB specialists, fisheries scientists and marine ecologists at Cefas and the MMO. We acknowledge that whilst this advice is (deliberately) not an exhaustive review of all the available evidence, it should provide a scientifically-robust starting point for discussions about the specific management requirements of individual MCZs and must be used alongside site specific information and local knowledge. It is however inevitable that further evidence will become available and it is possible that as a consequence this advice might change – we would be interested to hear of new evidence and of any errors within the text.

1.1 Conservation objectives

A conservation objective is a statement describing the desired ecological/geological state of a feature for which an MCZ is designated. Within the MCZ project, draft conservation objectives are to be recommended by the regional stakeholder groups (RSG).

The conservation objectives will be collectively reviewed by the MCZ Science Advisory Panel and Natural England /JNCC to assess whether they are sufficient to meet the overall aims of the MCZ network.

The target condition for all MCZ features is known as ‘favourable condition’. An explanation of favourable condition is provided in the Ecological Network Guidance (ENG) and the Conservation Objectives Guidance (COG).

As stated within the Ecological Network Guidance, at least one viable reference area should be identified for each broad scale habitat and Feature of Conservation Interest (FOCI) present in each regional project area. Reference areas aim to achieve reference condition through the removal or prevention of extractive, depositional and human-derived disturbing or damaging activities. **This present advice therefore does not apply to reference areas.**

For interest features the conservation objectives will be either to **maintain** the feature in favourable condition (applicable to features that are currently considered to be in favourable condition) or to provide conditions in which it can **recover** to favourable condition (applicable to features that are not currently considered to be in favourable condition). Management measures will be guided by the requirement to meet these objectives.

2 Explanation of the Advice

This advice is organised by feature (Feature Of Conservation Importance or broad scale habitat) and gear type. Fishing gears or activities are grouped to combine those with broadly similar impacts, but where there is likely to be variation within a group (e.g. for high and low energy sands), this has been taken into account. Currently, the available evidence base does not permit us to divide the impacts and advice into anything other than broad categories; we appreciate that this may prove unsatisfactory to some stakeholders. This issue may be resolved at individual site level with more detailed site-specific information to hand (on both the habitat and the fishing activities taking place). If a gear is unlikely to be used in a particular habitat no advice is provided.

Pelagic gears do not generally have direct impact on any of the benthic features considered here and so have been considered separately. Our advice on possible management options for these gears is presented in section 2.

For each habitat and gear category, a brief summary of knowledge of the likely impacts is provided, in conjunction with supporting evidence.

2.1 Impacts

Each feature will display a range of sensitivities to fishing activities. The sensitivity at the site level may depend on the specific benthic community characterising the feature at the site or local natural environmental conditions, but will also reflect differing impacts of different gears. Where relevant, the advice elaborates the conditions under which a feature may be more or less sensitive, so that regional projects and fisheries managers can take this into consideration.

This advice does not consider the impacts of fishing activities on target and non-target mobile species and impacts occurring through potential changes to food webs, for example the effects on prey species by removing their predators and the subsequent changes in the food chain. These effects are considered too complex to provide generic advice for i.e., they should be ascertained on a site-by-site basis where appropriate. Where there is evidence of such a link (and that it is having an adverse effect on feature condition at the site level), this should be taken into account when setting conservation objectives and when considering management options.

2.2 Evidence

This is a summary of the evidence used to describe the impacts and support the advice. All literature used is cited (full references are provided in section 31) along with a brief description of its relevance to the specific feature in the MCZ project area, any assumptions made and an indication of the quality of the evidence used as follows:

- Directly relevant peer-reviewed studies;
- Directly relevant ‘grey literature’ studies;
- Inference from peer-reviewed or grey literature relating to a comparable feature, gear or geographical area;

- Expert judgement[8].

2.3 JNCC/Natural England advice tables

The advice given in these tables reflects the best judgement of the SNCBs on the likely outcomes of a number of management options. It is derived from our understanding of the expected impacts of fisheries presented in the *impacts* and *evidence* sections together with a pragmatic assessment of the likely outcomes of management.

2.4 Cumulative effects

Users of this advice should be mindful that a feature may be prevented from achieving its target condition by multiple pressures resulting from more than one human activity (also known as cumulative effects). In these situations it is likely that a combination of more than one management measure may be required to ensure the feature meets its target condition. The advice in this document is presented without the consideration of cumulative effects. However, when proposing management options for MCZs or complexes of sites, stakeholders should be mindful to the potential for cumulative effects of activities. For more locally specific information please seek further clarification from your relevant SNCB adviser.

2.5 Possible management options

Three possible management options are suggested for stakeholders and public authorities to consider:

- **Unrestricted access**; fisheries are allowed access to the feature with no restrictions other than general fisheries regulations (quotas, technical measures etc) that are not site specific.

- **Managed access**; fisheries are allowed access to the feature subject to certain additional management measures (e.g. effort limitation, technical gear modification). **These may include measures that are already in place** e.g. those that manage effort, gear restrictions etc., as well as additional measures that could be introduced through voluntary or regulatory mechanisms.

- **No access**; the specified gears are not permitted within the feature. This may be introduced through voluntary or regulatory mechanisms. Existing regulations or agreements that exclude certain gears are included under this option.

The intention of our advice is to present a broad range of options for the Regional Projects to consider. Some of these options will be not be possible in every case. In particular, the differing legal regimes in the 0-6nm, 6-12nm and 12nm-median line or 200nm zones may restrict the use of the second option (managed access).

2.6 Consequences to feature

An assessment is made of the likely changes to the feature (positive or negative) that will occur if a particular management measure is applied.

[8] "expert judgement" *can* still lead to high certainty (explained later in Section 2.8)

There are numerous habitats where knowledge of impacts, recovery potential and therefore appropriate conservation objectives is limited or scant (and therefore confidence in the effects of possible management measures is *low*). Developing conservation objectives and assessment of feature condition are continuous processes that will be revised and assessed when new information becomes available.

2.7 Will the option help to meet the conservation objective?

Here an assessment is made of whether the proposed management measure is likely to meet the objectives of recover or maintain.

2.8 Notes on the advice

Certainty

The degree and type of uncertainty in each of the assessments has been stipulated, based on the sources of evidence used. These were accordingly classified as high, medium and low uncertainty, with appropriate sub-divisions. This was necessary to make clear to the end-user the strength of evidence used but also that expert judgment can still lead to a high degree of certainty in an assessment. The categories are described below.

<u>Low certainty</u>

- There is no direct evidence (peer-reviewed scientific, grey literature or non-scientific). It has been necessary to rely on analogy with other habitats for which evidence does exist. Evidence to support this assumption may be limited (i.e. the relative sensitivity of the habitats is not clear)

- The feature may encompass a number of sub-types which vary in their sensitivity to fishing pressure. There is no direct evidence for any of the subtypes so it has been necessary to rely on analogy with several other habitats for which evidence does exist.

- Conclusions have been based on sensitivity assessments which may rely on significant assumptions or generalisations. It has not been possible to validate these assumptions.

- The evidence base is conflicting, as a result it is not possible to reach accurate conclusions on the effect of activities on features and consequently provide direct and clear advice.

<u>Medium certainty</u>

- There is no direct evidence. It has been necessary to make an analogy with other habitats for which evidence exists. There is good reason to believe that the analogy is justified (e.g. occurrence of species with similar characteristics).

- The feature may encompass a number of sub-types which vary in their sensitivity to fishing pressure. The available evidence does not cover the full range of the variation so some cases may not be well supported by evidence.

- There is directly relevant scientific information to support the conclusion but it comes from 'grey literature' sources.

- There is relevant non-scientific information that directly support the conclusion on impacts and advice on management options.

High certainty

- There is good quality, highly relevant scientific information to directly support the conclusion.

- There is good quality, highly relevant non-scientific information that directly support the conclusion.

- There may not be direct evidence to support the conclusions, but they are inevitable conclusions based on the application of common sense.

Broad-scale habitats

Some broad scale habitat categories (e.g. deep-sea bed; sub-tidal mixed sediments) can include a range of component features. Each of these component habitats may vary in their sensitivity to the same fishing activities. It is therefore difficult to provide relatively uniform advice on such habitats. An additional problem is that the variance in these habitats' sensitivities may be at a spatial scale less than the minimum area of some fisheries management options. This will need to be taken into account when considering such habitats at the site level.

Co-occurring habitats

In some MCZs, a specific proposed feature may occur spatially *within* a designated broad scale habitat (see Annex 3 in the Ecological Network Guidance, where for example mud habitats in deep water occur within subtidal mud). According to their relative sensitivities, they may have different management needs for the same activities (derived from their conservation objectives). In these cases, *if* it is not possible to apply separate management measures for the individual components, the most appropriate choice for a management option would be to manage the site for the most sensitive feature.

Glossary of terms

Damage, degrade or deteriorate: a change inconsistent with a conservation objective of maintain or restore.

Fragile: synonymous with sensitive, but used specifically to highlight those species which are brittle and highly susceptible to breakage.

Fishing activity/effort: the amount of fishing taking place irrespective of any potential damage.

Modification: an anthropogenic change in a habitat or feature. Whether this change is compatible with a conservation objective of maintain or restore, **will be dependent on the determination of favourable condition.**

Natural: an unimpacted state (the community may not be stable, as it may be changing but will not be changing as a consequence of *fishing* activity).

Natural pace: rate of change from an impacted state to an unimpacted state in the absence of pressure to which the species/habitat is sensitive[9].

Sensitive: species/habitats which have a low resilience to damage

[9] There will be some variability in response rates between different sites following removal of a pressure due to local biological and physical factors. As a result of interdependencies, response rates of biological communities may therefore not always be the same even where the feature and the pressure is the same.

3 PELAGIC GEARS IN ALL BROAD SCALE HABITATS AND FOCI

This advice applies to all broad scale habitats and FOCI covered in this guidance.

3.1 All pelagic gears (including pelagic trawl, purse seine, pelagic longline)

Impacts

Pelagic gears are defined as those with no physical contact with the benthos and therefore no direct impact on benthic communities may be expected

Directly relevant peer reviewed literature		Directly relevant grey literature		Inference from peer reviewed or grey literature relating to a comparable habitat, gear or geographical area.		Expert judgement	✔

Possible management options (see introduction section 2.5)	**Consequences for habitats/features**	**Will the option help to meet the conservation objective?**		**Certainty**
		Maintain	**Recover**	
Unrestricted access	It is not expected that there would be any impact on the habitat/feature.	This option will help to achieve the conservation objective.	This option will help to achieve the conservation objective.	High certainty: There may not be direct evidence to support the conclusions, but they are inevitable conclusions based on the application of common sense.

4 INTERTIDAL SAND AND MUDDY SAND

4.1 Dredging (including hydraulic and tractor dredge)

Impacts

Dredging removes sediments and re-suspends them[1] as well as damaging non-target animals[2]. The impact of this loss/change in habitat varies according to natural disturbance levels – for sand habitats dominated by physical processes, recovery may occur within days[2] to months, depending on fishing intensity[3], however for sand habitats with a higher mud fraction, recovery may be >2 years[4]. Impacts may vary regionally[5].

Evidence

[1]Hiddink (2003); [2]Hall and Harding (1997); [3]Dernie *et al.* (2003); [4]Kaiser *et al* (2006); [5]Bell and Walker. (2007)							
Abundant evidence from UK waters which is considered to be directly applicable to this habitat							
Directly relevant peer reviewed literature	✔	Directly relevant grey literature		Inference from peer reviewed or grey literature relating to a comparable habitat, gear or geographical area.		Expert judgement	

Possible management options (see introduction section 2.5)	**Consequences for habitats/features**	**Will the option help to meet the conservation objective?**		**Certainty**
		Maintain	**Recover**	
Unrestricted access	The habitat may be maintained in a modified state with reduced abundance of associated species. There is risk that cumulative effects from ongoing fishing may result in increasing levels of modification. If fishing effort increases or expands to new areas, further modification may occur. The degree of modification is likely to be greater in lower energy sand/mud habitats	This option may help to achieve the conservation objective but with a significant risk of deterioration.	The conservation objective could not be achieved under this option.	High certainty. The conclusions are supported by good quality, directly relevant scientific information.

Managed access	If fishing effort is limited, the habitat may be maintained in a modified state with reduced abundance of associated species. If effort is reduced (eg through technical gear modifications) then some recovery may be expected.	If appropriate management is applied, this option may help to achieve the conservation objective.	If appropriate management is applied, this option may help to achieve the conservation objective.	Medium certainty. The conclusions are supported by good quality, directly relevant scientific information. Some assumptions have been made regarding recovery potential.
No access	The habitat will not be subject to further modification. If there are no other unregulated pressures, recovery would be expected to take place at a natural pace.	This option will help to achieve the conservation objective.	This option will help to achieve the conservation objective.	High certainty. Inevitable conclusions based on the application of common sense.

4.2 All other towed demersal gears (including otter trawl, shrimp trawl, seine & beam trawl)

Impacts

The large scale structure of the feature would remain intact but increased mortality of fragile and long lived species would result in a degraded benthic community relative to the un-impacted state[1,2]. In areas with high wave energy, most of the natural fauna will be well adapted to recover from disturbance and so the impacted state may be more similar to the natural community[3]. In lower energy areas such as muddy sands, the alteration from the natural state will be greater[3]. The advice therefore is given in two tables covering high and low energy intertidal sands respectively.

Evidence

[1]Bergman and Van Santbrink (2000); [2]Kaiser *et al.*. (2006); [3]Dernie *et al*. (2003)							
No direct evidence has been found for the effects of trawling on intertidal sands, probably partly because this is a rare activity. In common with Hall *et al*, the assessment is based on the assumption of similar effect to those observed in subtidal sands.							
Directly relevant peer reviewed literature		Directly relevant grey literature		Inference from peer reviewed or grey literature relating to a comparable habitat, gear or geographical area.	✔	Expert judgement	✔

JNCC/Natural England advice: High energy intertidal sands

Possible management options (see introduction section 2.5)	Consequences for habitats/features	Will the option help to meet the conservation objective?		Certainty
		Maintain	Recover	
Unrestricted access	The habitat may be maintained in a modified state however the modification is likely to be low relative to natural variation.	This option may help to achieve the conservation objective.	This option may help to achieve the conservation objective but with a potential risk of deterioration.	Medium certainty. There is no direct evidence and it has been necessary to make assumptions based on knowledge of similar habitats or comparable pressures. There is good reason to believe that the assumptions are justified (eg. occurrence of species with similar characteristics).
Managed access	Reduction of fishing activity would be expected to result in a benthic community more similar to the natural state. Measures to restrict more penetrating gears (dredges, beam trawl) may result in a benthic community more similar to the natural state.	If appropriate management is applied, this option would be likely to help to achieve the conservation objective.	If appropriate management is applied, this option would be likely to help to achieve the conservation objective.	Medium certainty. There is no direct evidence and it has been necessary to make assumptions based on knowledge of similar habitats or comparable pressures. There is good reason to believe that the assumptions are justified (eg. occurrence of species with similar characteristics).
No access	The habitat will not be subject to further modification. If there are no other unregulated pressures, recovery would be expected to take place at a natural pace.	This option will help to achieve the conservation objective.	This option will help to achieve the conservation objective.	High certainty. Inevitable conclusions based on the application of common sense.

JNCC/Natural England advice: Low energy intertidal sands (including muddy sands)

Possible management options (see introduction section 2.5)	Consequences for habitats/features	Will the option help to meet the conservation objective?		Certainty
		Maintain	Recover	
Unrestricted access	The habitat may be maintained in a modified state with reduced abundance of fragile and long lived species. There is risk that cumulative effects from ongoing fishing may result in increasing levels of modification. If fishing effort increases or expands to new areas, further modification may occur.	This option may help to achieve the conservation objective but with a significant risk of deterioration.	The conservation objective will not be achieved under this option.	Medium certainty. There is no direct evidence and it has been necessary to make assumptions based on knowledge of similar habitats or comparable pressures. There is good reason to believe that the assumptions are justified (eg. occurrence of species with similar characteristics).
Managed access	If fishing activity does not increase, the habitat may be maintained in a modified state with reduced abundance of fragile and long lived species. There is risk that cumulative effects from ongoing fishing may result in increasing levels of modification. If fishing is reduced then some recovery may be expected. If more impacting gears (eg. dredges, beam trawls and heavier otter trawls) are prohibited and lighter gears (eg. lighter trawls and seine) allowed, it is likely that some degree of recovery may occur.	If appropriate management is applied, this option may help to achieve the conservation objective.	If appropriate management is applied, this option may help to achieve the conservation objective.	Medium certainty. There is no direct evidence and it has been necessary to make assumptions based on knowledge of similar habitats or comparable pressures. There is good reason to believe that the assumptions are justified (eg. occurrence of species with similar characteristics).
No access	The habitat will not be subject to further modification. If there are no other unregulated pressures, recovery would be expected to take place at a natural pace.	This option will help to achieve the conservation objective.	This option will help to achieve the conservation objective.	High certainty. Inevitable conclusions based on the application of common sense.

4.3 Hand raking, and bait collection

Impacts

Bait digging can affect faunal communities and sediment structure[1,2]. Trampling and the action of vehicles compact sediments[1]. The impact is considered to be proportional to intensity of activity with high intensity commercial gathering having a greater impact than low level or casual gathering[1].

Evidence

[1]Hall *et al.* (2008); [2]Brown and Wilson (1997)							
There is abundant evidence for the effects of bait collection on intertidal sands, some of which relates directly to UK waters. No direct evidence could be found for the impacts of hand raking, however, some aspects of the impacts of this gear (trampling, vehicles etc.) are considered to be sufficiently similar to bait collection to allow comparison.							
Directly relevant peer reviewed literature **Only applicable to bait collection**	✔	Directly relevant grey literature		Inference from studies on comparable habitats, gears or geographical areas.	✔	Expert judgement	✔

JNCC/Natural England advice

Possible management options (see introduction section 2.5)	**Consequences for habitats/features**	**Will the option help to meet the conservation objective?**		**Certainty**
		Maintain	**Recover**	
Unrestricted access	The habitat may be maintained in a modified state with altered animal community and sediment structure. The degree of modification will be dependent on intensity of fishing. At low activity levels, modification may be negligible.	This option may help to achieve the conservation objective but with a risk of deterioration.	The conservation objective is unlikely to be achieved under this option.	Medium certainty. There is some direct evidence but it has been necessary to make assumptions based on knowledge of similar habitats or comparable pressures. There is good reason to believe that the assumptions are justified (eg. occurrence of species with similar characteristics).

Managed access	If collection effort does not increase, the habitat may be maintained in a modified state with altered animal community and sediment structure. If collection effort increases or expands to new areas, further modification may occur. If effort is reduced then some recovery may be expected. Restriction of access by vehicles may prevent damage and assist recovery.	If appropriate management is applied, this option may help to achieve the conservation objective.	If appropriate management is applied, this option may help to achieve the conservation objective.	Medium certainty. There is some direct evidence but it has been necessary to make assumptions based on knowledge of similar habitats or comparable pressures. There is good reason to believe that the assumptions are justified (eg. occurrence of species with similar characteristics).
No access	The habitat will not be subject to further modification. If there are no other unregulated pressures, recovery would be expected to take place at a natural pace.	This option will help to achieve the conservation objective.	This option will help to achieve the conservation objective.	High certainty. Inevitable conclusions based on the application of common sense.

4.4 All demersal static gears (including gillnets, trammel nets, longlines, pots and traps)

Impacts

This habitat is not considered to be sensitive to the type of impacts caused by static demersal gears (surface abrasion)[1,2].

Evidence

[1]Tillin *et al.* (2010); [2]Hall *et al.*(2008)							
No study has been found that directly addresses the impact of demersal static gears on intertidal sand and muddy sand . The advice is therefore based on interpretation of sensitivity assessments.							
Directly relevant peer reviewed literature		Directly relevant grey literature		Inference from studies on comparable habitats, gears or geographical areas.		Expert judgement	✔

JNCC/Natural England Advice

Possible management options (see introduction section 2.5)	Consequences for habitats/features	Will the option help to meet the conservation objective?		Certainty
		Maintain	Recover	
Unrestricted access	Direct impact on community will be minimal and seabed structure will be maintained	This option may help to achieve the conservation objective.	n/a	Low certainty. Conclusions have been based on sensitivity assessments which may rely on significant assumptions or generalisations. It has not been possible to validate these assumptions.
Managed access	No potential access management options were considered as impacts of these gears are minimal on this habitat	n/a	n/a	
No access	The habitat will not be subject to further modification. If there are no other unregulated pressures, recovery would be expected to take place at a natural pace.	This option will help to achieve the conservation objective.	This option will help to achieve the conservation objective.	High certainty. Inevitable conclusions based on the application of common sense.

5 INTERTIDAL COARSE SEDIMENT

5.1 All demersal towed gear (including dredges, beam trawls and otter trawls)

Impacts

Coarse sand and gravel sediments occurring in shallow water, wave exposed and tide-swept coasts are highly mobile, and subject to high levels of natural disturbance. Relatively few animals are able to live in this type of habitat and those which do are adapted to living in such a highly disturbed environment. Fishing impacts are therefore likely to be minimal[1,2,3].

Evidence

[1]Hall *et al.* (2008); [2]Collie *et al.* (2005); [3]Foden *et al.* (2010).							
No evidence could be found relating to the impacts of towed gears on this habitat. The assessment is based on the assumption of similar effects to those observed in unstable subtidal coarse sediments.							
Directly relevant peer reviewed literature		Directly relevant grey literature		Inference from studies on comparable habitats, gears or geographical areas.	✔	Expert judgement	✔

JNCC/Natural England Advice

Possible management options (see introduction section 2.5)	**Consequences for habitats/features**	**Will the option help to meet the conservation objective?**		**Certainty**
		Maintain	**Recover**	
Unrestricted access	The habitat may be maintained in a modified state however the modification is likely to be low relative to natural variation. There is risk that cumulative effects from ongoing fishing may result in increasing levels of modification. If fishing activity increases or expands to new areas, further modification may occur.	This option may help to achieve the conservation objective.	This option may help to achieve the conservation objective.	Medium certainty. There is no direct evidence and it has been necessary to make assumptions based on knowledge of similar habitats or comparable pressures. There is good reason to believe that the assumptions are justified (eg. occurrence of species with similar characteristics).

Managed access	If fishing effort does not increase, the habitat will not be subject to further modification. Recovery would be expected to take place at a natural pace. There is risk that cumulative effects from ongoing fishing may result in increasing levels of modification. If fishing effort increases or expands to new areas, further modification may occur – although this is considered to be unlikely.	This option will help to achieve the conservation objective.	This option will help to achieve the conservation objective.	Medium certainty. There is no direct evidence and it has been necessary to make assumptions based on knowledge of similar habitats or comparable pressures. There is good reason to believe that the assumptions are justified (eg. occurrence of species with similar characteristics).
No access	The habitat will not be subject to further modification. If there are no other unregulated pressures, recovery would be expected to take place at a natural pace.	This option will help to achieve the conservation objective.	This option will help to achieve the conservation objective.	High certainty. Inevitable conclusions based on the application of common sense.

5.2 All demersal static gears (including pots, traps, lines and nets)

Impacts

Coarse sand and gravel sediments occurring in shallow water, wave exposed and tide-swept coasts are highly mobile, and subject to high levels of natural disturbance. Relatively few animals are able to live in this type of habitat and those which do are adapted to living in such a highly disturbed environment. Fishing impacts are therefore likely to be minimal[1,2,3]. This habitat is not considered to be sensitive to the type of impacts caused by static demersal gears (surface abrasion)[1,4].

Evidence

[1]Hall *et al.* (2008); [2]Collie *et al.* (2004); [3]Foden *et al.* (2010); [4]Tillin *et al.* (2010).							
No evidence could be found relating to the impacts of static gears on this habitat. The assessment is based on the assumption of similar effects to those observed in unstable subtidal coarse sediments.							
Directly relevant peer reviewed literature		Directly relevant grey literature		Inference from studies on comparable habitats, gears or geographical areas.	✔	Expert judgement	✔

JNCC/Natural England advice

Possible management options (see introduction section 2.5)	Consequences for habitats/features	Will the option help to meet the conservation objective?		Certainty
		Maintain	Recover	
Unrestricted access	Some impact will occur if target species are removed but direct impact on community will be minimal and seabed structure will be maintained.	This option may help to achieve the conservation objective.	This option may help to achieve the conservation objective.	Medium certainty. There is no direct evidence and it has been necessary to make assumptions based on knowledge of similar habitats or comparable pressures. There is good reason to believe that the assumptions are justified (eg. occurrence of species with similar characteristics).
Managed access	None considered to be useful as impacts of these gears are minimal on this habitat	n/a	n/a	Medium certainty. There is no direct evidence and it has been necessary to make assumptions based on knowledge of similar habitats or comparable pressures. There is good reason to believe that the assumptions are justified (eg. occurrence of species with similar characteristics).
No access	The habitat will not be subject to further modification. If there are no other unregulated pressures, recovery would be expected to take place at a natural pace.	This option will help to achieve the conservation objective.	This option will help to achieve the conservation objective.	High certainty. Inevitable conclusions based on the application of common sense.

6 INTERTIDAL MIXED SEDIMENTS

May contain the FOCI:

Sheltered muddy gravels
Estuarine rocky habitats

For areas that support these habitats please refer to the relevant FOCI habitat

6.1 All demersal towed gears (including dredges, beam trawls and otter trawls)

Impacts

This habitat is considered to have medium sensitivity to the types of impact caused by this gear (shallow abrasion, surface abrasion and penetration of the seabed). The exposure of this habitat to these gear types is likely to be low.

Evidence

[1]Tillin *et al.* (2010)							
There is no direct evidence relating to impacts of demersal towed gears on this habitat. Advice is therefore provided on the basis of our interpretation of sensitivity assessments[1].							
Directly relevant peer reviewed literature		Directly relevant grey literature		Inference from studies on comparable habitats, gears or geographical areas.		Expert judgement	✔

Possible management options (see introduction section 2.5)	Consequences for habitats/features	Will the option help to meet the conservation objective?		Certainty
		Maintain	Recover	
Unrestricted access	The habitat may be maintained in a modified state with reduced abundance of fragile long lived species(e.g. infaunal bivalve species). There is risk that cumulative effects from ongoing fishing may result in increasing levels of modification.If fishing activity increases or expands to new areas, further modification may occur.	This option may help to achieve the conservation objective but with a significant risk of deterioration.	The conservation objective will not be achieved under this option.	Low certainty. Conclusions have been based on sensitivity assessments which may rely on significant assumptions or generalisations. It has not been possible to validate these assumptions.
Managed access	If fishing activity does not increase, the habitat may be maintained in a modified state with reduced abundance of fragile long lived species. There is risk that cumulative effects from ongoing fishing may result in increasing levels of modification. If effort is reduced to low levels then some recovery may be expected.If more impacting gears (eg. dredges, beam trawls and heavier otter trawls) are prohibited and lighter gears (eg. shrimp trawls, light otter trawls) allowed, it is likely that some degree of recovery may occur.	If appropriate management is applied, this option may help to achieve the conservation objective.	If appropriate management is applied, this option may help to achieve the conservation objective.	Low certainty. Conclusions have been based on sensitivity assessments which may rely on significant assumptions or generalisations. It has not been possible to validate these assumptions. Some assumptions have been made regarding recovery potential.
No access	The habitat will not be subject to further modification. If there are no other unregulated pressures, recovery would be expected to take place at a natural pace.	This option will help to achieve the conservation objective.	This option will help to achieve the conservation objective.	High certainty. Inevitable conclusions based on the application of common sense.

6.2 All demersal static gears (including pots, traps and set nets)

Impacts

This habitat is considered to have medium sensitivity to the types of impact caused by demersal static gears[1]. The exposure of this habitat to these gear types is likely to be low.

Evidence

[1]Tillin *et al.* (2010)							
There is no direct evidence relating to impacts of demersal static gear on this habitat. Advice is therefore provided on the basis of our interpretation of sensitivity assessments[1].							
Directly relevant peer reviewed literature		Directly relevant grey literature		Inference from studies on comparable habitats, gears or geographical areas.		Expert judgement	✔

JNCC/Natural England Advice

Possible management options (see introduction section 2.5)	**Consequences for habitats/features**	**Will the option help to meet the conservation objective?**		**Certainty**
		Maintain	**Recover**	
Unrestricted access	Some impact will occur if target species are removed but direct impact on community will be minimal. Seabed structure may be altered. There is risk that cumulative effects from ongoing fishing may result in further modification.	This option may help to achieve the conservation objective but with a risk of deterioration.	The conservation objective is unlikely to be achieved under this option.	Low certainty. Conclusions have been based on sensitivity assessments which may rely on significant assumptions or generalisations. It has not been possible to validate these assumptions.

Managed access	If fishing activity does not increase, the habitat may be maintained in a modified state and some recovery may be possible. Some impact will occur if target species are removed but direct impact on community will be minimal. Seabed structure may be altered. There is risk that cumulative effects from ongoing fishing may result in further modification. If effort is reduced then some recovery may be expected.	If appropriate management is applied, this option may help to achieve the conservation objective.	If appropriate management is applied, this option may help to achieve the conservation objective.	Low certainty. Conclusions have been based on sensitivity assessments which may rely on significant assumptions or generalisations. It has not been possible to validate these assumptions. Some assumptions have been made regarding recovery potential.
No access	The habitat will not be subject to further modification. If there are no other unregulated pressures, recovery would be expected to take place at a natural pace.	This option will help to achieve the conservation objective.	This option will help to achieve the conservation objective.	High certainty. Inevitable conclusions based on the application of common sense.

6.3 Bait-digging

Impacts

Bait digging affects faunal communities and sediment structure[1,2]. Trampling and the action of vehicles compact sediments[1]. The impact is considered to be proportional to intensity of activity with high intensity commercial gathering having a greater impact than low level or recreational gathering[1].

Evidence

[1]Hall *et al* (2008); [2]Brown and Wilson (1997)							
No direct evidence has been found for the effects of bait digging on this habitat. The advice is based on the assumption of similar effect to those observed in intertidal sands and muddy sands.							
Directly relevant peer reviewed literature		Directly relevant grey literature		Inference from studies on comparable habitats, gears or geographical areas.	✔	Expert judgement	

JNCC/Natural England Advice

Possible management options (see introduction section 2.5)	Consequences for habitats/features	Will the option help to meet the conservation objective?		Certainty
		Maintain	Recover	
Unrestricted access	The habitat may be maintained in a modified state with altered animal community and sediment structure. The degree of modification will be dependent on level of fishing effort. At low effort levels, damage may be negligible.	This option may help to achieve the conservation objective but with a risk of deterioration.	The conservation objective is unlikely to be achieved under this option.	Medium certainty. There is no direct evidence and it has been necessary to make assumptions based on knowledge of similar habitats or comparable pressures. There is good reason to believe that the assumptions are justified (eg. occurrence of species with similar characteristics).
Managed access	If bait digging activity does not increase, the habitat may be maintained in a modified state with altered animal community and sediment structure. If effort is reduced then some recovery may be expected. Restriction of access by vehicles may prevent damage and assist recovery.	If appropriate management is applied, this option may help to achieve the conservation objective.	If appropriate management is applied, this option may help to achieve the conservation objective.	Medium certainty. There is no direct evidence and it has been necessary to make assumptions based on knowledge of similar habitats or comparable pressures. There is good reason to believe that the assumptions are justified (eg. occurrence of species with similar characteristics).
No access	The habitat will not be subject to further modification. If there are no other unregulated pressures, recovery would be expected to take place at a natural pace.	This option will help to achieve the conservation objective.	This option will help to achieve the conservation objective.	High certainty. Inevitable conclusions based on the application of common sense.

7 SUBTIDAL SAND

May contain the FOCI:

Subtidal sands and gravels
Saline lagoons.

For areas that support these habitats please refer to the relevant FOCI habitat

7.1 All demersal towed gears (including dredges, beam trawl, otter trawl and seine net)

Impacts

The large scale structure of the feature would remain intact but increased mortality of fragile and long lived species would result in a degraded benthic community relative to the un-impacted state[1,2]. Some particularly vulnerable species may disappear entirely[1]. In shallow sands with high wave energy, most of the natural fauna will be well adapted to recover from disturbance and so the impacted state may be more similar to the natural community[3]. In lower energy areas such as muddy sands and sand in deeper water, the alteration from the natural state will be greater[3].

The advice therefore is given in two tables covering high and low energy sands respectively.

Evidence

[1]Bergman and Van Santbrink (2000); [2]Kaiser *et al*. (2006); [3]Dernie *et al*. (2003)							
There is abundant evidence for the impacts of trawling and dredging on subtidal sand. Much of this evidence comes from the UK and northern Europe so can be regarded as directly applicable to the MCZ project area.							
Directly relevant peer reviewed literature	✔	Directly relevant grey literature		Inference from studies on comparable habitats, gears or geographical areas.		Expert judgement	

JNCC/Natural England Advice: High energy subtidal sands

Possible management options (see introduction section 2.5)	Consequences for habitats/features	Will the option help to meet the conservation objective?		Certainty
		Maintain	Recover	
Unrestricted access	The habitat may be maintained in a modified state however the modification is likely to be low relative to natural variation.	This option may help to achieve the conservation objective.	This option may help to achieve the conservation objective.	High certainty. The conclusions are supported by good quality, directly relevant scientific information.
Managed access	None considered to be useful as impacts of these gears are minimal on this habitat	n/a	n/a	
No access	The habitat will not be subject to further modification. If there are no other unregulated pressures, recovery would be expected to take place at a natural pace.	This option will help to achieve the conservation objective.	This option will help to achieve the conservation objective.	High certainty. Inevitable conclusions based on the application of common sense.

JNCC/Natural England Advice: Low energy subtidal sands (including muddy sands)

Possible management options (see introduction section 2.5)	Consequences for habitats/features	Will the option help to meet the conservation objective?		
		Maintain	Recover	
Unrestricted access	The habitat may be maintained in a modified state with reduced abundance of fragile long lived species. There is risk that cumulative effects from ongoing fishing may result in increasing levels of modification. If fishing pressure increases or expands to new areas, the degree of modification will be expected to increase.	This option may help to achieve the conservation objective but with a significant risk of deterioration	The conservation objective will not be achieved under this option.	High certainty. The conclusions are supported by good quality, directly relevant scientific information.

Managed access	If fishing activity does not increase, the habitat may be maintained in a modified state with reduced abundance of fragile, long lived species. There is risk that cumulative effects of ongoing fishing may result in further modification. If effort is reduced then some recovery may be expected. If more impacting gears (eg. dredges, beam trawls and heavier otter trawls) are prohibited and lighter gears (eg. lighter trawls and seine) allowed, it is likely that some degree of recovery may occur.	If appropriate management is applied, this option may help to achieve the conservation objective.	If appropriate management is applied, this option may help to achieve the conservation objective.	Medium certainty. The conclusions are supported by good quality, directly relevant scientific information. Some assumptions have been made regarding recovery potential.
No access	The habitat will not be subject to further modification. If there are no other unregulated pressures, recovery would be expected to take place at a natural pace	This option will help to achieve the conservation objective.	This option will help to achieve the conservation objective.	High certainty. Inevitable conclusions based on the application of common sense.

7.2 All demersal static gears (including gillnets, trammel nets, longlines, pots and traps)

Impacts

There is potential for damage from dragged anchors but, assuming they are set correctly, demersal static gears are not considered to have a significant impact[1].

Evidence

[1]Hall *et al*. (2008)							
No study has been found that directly addresses the impact of demersal static gears on subtidal sands. Our advice is therefore based on our interpretation of sensitivity assessments.							
Directly relevant peer reviewed literature		Directly relevant grey literature		Inference from studies on comparable habitats, gears or geographical areas.		Expert judgement	✔

JNCC/Natural England Advice

Possible management options (see introduction section 2.5)	Consequences for habitats/features	Will the option help to meet the conservation objective?		Certainty
		Maintain	Recover	
Unrestricted access	Some impact will occur but direct impact on community will be minimal and seabed structure will be maintained.	This option may help to achieve the conservation objective.	This option may help to achieve the conservation objective.	Low certainty. Conclusions have been based on sensitivity assessments which may rely on significant assumptions or generalisations. It has not been possible to validate these assumptions.
Managed access	None considered to be useful as impacts of these gears are minimal on this habitat.	n/a	n/a	
No access	The habitat will not be subject to further modification. If there are no other unregulated pressures, recovery would be expected to take place at a natural pace	This option will help to achieve the conservation objective.	This option will help to achieve the conservation objective.	High certainty. Inevitable conclusions based on the application of common sense.

8 SUBTIDAL COARSE SEDIMENT

May contain the FOCI:

Sublittoral sands and gravels

For areas that support these habitats please refer to the relevant FOCI habitat

8.1 All demersal towed gears (including dredges, beam trawl, otter trawl and seine net)

Impacts

This broad scale habitat includes sub-habitats with a wide range of sensitivities to trawling. The heterogeneous nature of this habitat means that a case-by-case approach to management is particularly required. Communities on unstable coarse sediments are considered to contain relatively robust fauna which are not believed to be greatly impacted by surface abrasion[1]. More stable gravels may support a 'turf' of fragile species which are easily damaged by trawling and recover slowly [2,3.] Trawling may result in a degraded benthic community with reduced abundance of fragile long lived species. Recovery time from dredging is longer than from trawling[3].

Because of the wide variation in impacts of fishing, advice is given in two tables covering stable and unstable coarse sediments respectively.

Evidence

[1]Hall *et al*. (2008); [2]Collie *et al*. (2004); [3]Foden *et al* (2010)							
There is abundant evidence for the effects of trawling and dredging on subtidal coarse sediment. Some of the evidence used is derived from similar habitats in North America (Gulf of Maine and Alaska) but is considered sufficiently similar to be applicable to habitats in the MCZ area. Other evidence is derived from the UK and is directly applicable.							
Directly relevant peer reviewed literature	✔	Directly relevant grey literature		Inference from studies on comparable habitats, gears or geographical areas.	✔	Expert judgement or anecdotal evidence	

JNCC/Natural England Advice: Unstable subtidal coarse sediments

Possible management options (see introduction section 2.5)	Consequences for habitats/features	Will the option help to meet the conservation objective?		Certainty
		Maintain	Recover	
Unrestricted access	The habitat may be maintained in a modified state however the modification is likely to be low relative to natural variation.	This option may help to achieve the conservation objective.	This option may help to achieve the conservation objective.	High certainty. The conclusions are supported by good quality, directly relevant scientific information.
Managed access	Non considered to be useful as impacts of these gears are minimal on this habitat	n/a	n/a	
No access	The habitat will not be subject to further modification. If there are no other unregulated pressures, recovery would be expected to take place at a natural pace.	This option will help to achieve the conservation objective.	This option will help to achieve the conservation objective.	High certainty. Inevitable conclusions based on the application of common sense.

JNCC/Natural England Advice: Stable subtidal coarse sediments

Possible management options (see introduction section 2.5)	Consequences for habitats/features	Will the option help to meet the conservation objective?		
		Maintain	Recover	
Unrestricted access	The habitat may be maintained in a modified state with reduced abundance of fragile, long lived species. There is risk that cumulative effects from ongoing fishing may result in increasing levels of modification. If fishing activity increases or expands to new areas, the degree of modification will be expected to increase.	This option may help to achieve the conservation objective but with a significant risk of deterioration.	The conservation objective will not be achieved under this option.	High certainty. The conclusions are supported by good quality, directly relevant scientific information.

Managed access	If fishing effort does not increase, the habitat may be maintained in a modified state with reduced abundance of sensitive, long lived species. If effort is very low then some recovery may be expected. If 'heavier' gears (eg. dredges, beam trawls and heavier otter trawls) are prohibited and lighter gears (eg. lighter trawls and seine) allowed, it is likely that some degree of recovery may occur.	If appropriate management is applied, this option may help to achieve the conservation objective.	If appropriate management is applied, this option may help to achieve the conservation objective.	Medium certainty. The conclusions are supported by good quality, directly relevant scientific information. Some assumptions have been made regarding recovery potential.
No access	The habitat will not be subject to further modification. If there are no other unregulated pressures, recovery would be expected to take place at a natural pace.	This option will help to achieve the conservation objective.	This option will help to achieve the conservation objective.	High certainty. Inevitable conclusions based on the application of common sense.

8.2 All demersal static gears (including gillnets, trammel nets, longlines, pots and traps)

Impacts

This habitat is not considered to be sensitive to the type of impacts caused by static demersal gears (surface abrasion)[1,2].

Evidence

[1]Tillin *et al.* (2010); [2]Hall *et al.* (2008)

No study has been found that directly addresses the impact of demersal static gears on subtidal coarse sediments. The advice is therefore based on interpretation of sensitivity assessments.

Directly relevant peer reviewed literature		Directly relevant grey literature		Inference from studies on comparable habitats, gears or geographical areas.		Expert judgement	✔

JNCC/Natural England Advice

Possible management options (see introduction section 2.5)	Consequences for habitats/features	Will the option help to meet the conservation objective?		Certainty
		Maintain	Recover	
Unrestricted access	Direct impact on community will be minimal and seabed structure will be maintained	This option may help to achieve the conservation objective.	This option may help to achieve the conservation objective.	Low certainty. Conclusions have been based on sensitivity assessments which may rely on significant assumptions or generalisations. It has not been possible to validate these assumptions.
Managed access	None considered to be useful as impacts of these gears are minimal on this habitat	n/a	n/a	
No access	The habitat will not be subject to further modification. If there are no other unregulated pressures, recovery will be expected to take place at a natural pace.	This option will help to achieve the conservation objective.	This option will help to achieve the conservation objective.	High certainty. Inevitable conclusions based on the application of common sense.

9 SUBTIDAL MIXED SEDIMENTS

May contain the FOCI:

Sheltered muddy gravels
File shell beds
Native oyster beds.

For areas that support these habitats please refer to the relevant FOCI habitat

9.1 All gears

Impacts

This broad scale habitat covers a wide range of different types of sediment from muddy, gravely sands to mosaics of cobbles and pebbles in or on a sand, gravel or mud seabed. Areas of mixed sediments may also include seabeds where waves or ribbons of sand form on the surface of a gravel bed[1]. These different habitats can be expected to vary greatly in their sensitivity to fishing impacts[2] however, there are very few studies that directly evaluate fishing impacts on subtidal mixed sediments.

It is therefore not possible to give general advice for this broad scale habitat. In the absence of specific advice, a reasonable proxy may be to consider the advice given for other, similar habitats, e.g. for muddy seabed with cobbles, sensitivity may be similar to mud habitats in deep water.

Where possible, well designed scientific studies (which may include experimental fishery closures) should be carried out in order to determine appropriate management.

Evidence

[1]Anon (2010); [2]Roberts *et al.* (2010)							
Directly relevant peer reviewed literature		Directly relevant grey literature		Inference from studies on comparable habitats, gears or geographical areas.		Expert judgement	✔

Possible management options (see introduction section 2.5)	**Consequences for habitats/features**	**Will the option help to meet the conservation objective?**		**Certainty**
		Maintain	**Recover**	
All management options	Will be heavily dependent on the specific nature of the habitat. This can only be judged at the level of individual sites.	This can only be judged at the level of individual sites.	This can only be judged at the level of individual sites.	High certainty. Inevitable conclusions based on the application of common sense.

10 SHELTERED MUDDY GRAVELS

10.1 All gears

Impacts

Sheltered muddy gravel habitats occur in areas protected from wave action and strong tidal currents, principally in estuaries, rias and sea lochs; good quality examples of this habitat are thought to be very scarce[1]. Information on this habitat is very limited and generic advice is not considered appropriate; thus it is recommended that management be determined at the level of individual sites. In the absence of specific advice, a reasonable proxy may be to consider the advice given for 'intertidal mixed sediments' and 'subtidal mixed sediments' as this FOCI is contained within those two broadscale habitats.

Evidence

[1]BRIG (2008)							
Directly relevant peer reviewed literature		Directly relevant grey literature		Inference from studies on comparable habitats, gears or geographical areas.		Expert judgement	✔

JNCC/Natural England Advice

Possible management options (see introduction section 2.5)	**Consequences for habitats/features**	**Will the option help to meet the conservation objective?**		**Certainty**
		Maintain	**Recover**	
All management options	Will be heavily dependent on the specific nature of the habitat. This can only be judged at the level of individual sites.	This can only be judged at the level of individual sites.	This can only be judged at the level of individual sites.	High certainty. Inevitable conclusions based on the application of common sense.

11 SEA-PEN AND BURROWING MEGAFAUNA COMMUNITIES

11.1 All demersal towed gears (including beam trawl, demersal otter trawl, seine net and scallop dredge)

Impacts

Fishing with towed gears can be a significant physical intervention in an otherwise stable, low-energy environment - sediment complexity is reduced, habitat becomes more homogeneous and species diversity is decreased[1,2]. There is evidence that severity of impact is cumulative[2] so may be less severe where fishing pressure is low [3]. *Nephrops* may be an important component of the benthic community so fisheries that greatly reduce its abundance may be seen to have a negative impact.

Evidence

[1]Greathead *et al.,* (2007); [2]Hinz *et al.* (2009); [3]Ball *et al.* (2000); OSPAR (2010a)							
There is abundant evidence for the effects of trawling on muddy habitats including seapen and burrowing megafauna. The evidence is from UK waters and so is considered to be directly applicable.							
Directly relevant peer reviewed literature	✔	Directly relevant grey literature		Inference from studies on comparable habitats, gears or geographical areas.		Expert judgement	

JNCC/Natural England Advice

Possible management options(see introduction section 2.5)	**Consequences to habitat/feature**	**Will the option help to meet the conservation objective?**		**Certainty**
		Maintain	**Recover**	
Unrestricted access	The habitat may be maintained in a modified state with altered sedimentary characteristics and reduced abundance of sea pens and burrowing species. There is risk that cumulative effects from ongoing fishing may result in increasing levels of modification. If fishing activity increases or expands to new areas, the degree of modification will	This option may help to achieve the conservation objective but with a significant risk of deterioration.	The conservation objective will not be achieved under this option.	High certainty. The conclusions are supported by good quality, directly relevant scientific information.

	be expected to increase.			
Managed access	If fishing activity does not increase, the habitat may be maintained in a modified state with altered sedimentary characteristics and reduced abundance of sea pens and burrowing species. There is risk that cumulative effects from ongoing fishing may result in increasing levels of modification. If effort is reduced, some recovery may occur. It is not known if this will be sufficient to achieve favourable condition.	If appropriate management is applied, this option may help to achieve the conservation objective.	If appropriate management is applied, this option may help to achieve the conservation objective.	Medium certainty. The conclusions are supported by good quality, directly relevant scientific information. Some assumptions have been made regarding recovery potential.
No access	The habitat will not be subject to further modification. If there are no other unregulated pressures, recovery would be expected to take place at a natural pace.	This option will help to achieve the conservation objective.	This option will help to achieve the conservation objective.	High certainty. Inevitable conclusions based on the application of common sense.

11.2 All demersal static gears (including pots, traps, lines and nets)

Impacts

Studies on the impacts of pots on seapens have shown little or no adverse effect on seapens from a *single* fishing operation[1,2,3]. However, the impacts of repeated exposure to these types of fishing gear at high levels of fishing activity are unknown[2]. Fishing may be expected to result in a reduction in *Nephrops* and hence their burrows. *Nephrops* may be an important component of the benthic community so fisheries that greatly reduce its abundance may be seen to have a negative impact.

Evidence

[1] Eno *et al.* (1996); [2]Eno *et al.* (2001); [3]Kinnear *et al.* (1996); OSPAR (2008)							
There is some evidence for the impacts of potting on this habitat. The evidence is from UK waters so can be regarded as directly applicable to the MCZ area. There is no direct evidence for the impacts of netting or longlining so the assessment is based on the assumption of similar effects to potting.							
Directly relevant peer reviewed literature	✔	Directly relevant grey literature		Inference from peer reviewed or grey literature relating to a comparable habitat, gear or geographical area.		Expert judgement	✔

JNCC/Natural England Advice

Possible management options (see introduction section 2.5)	**Consequences for habitats/features**	**Will the option help to meet the conservation objective?**		**Certainty**
		Maintain	**Recover**	
Unrestricted access	If fishing activity is low, direct impact on habitat will be minimal and seabed structure will be maintained. Impacts of high levels of activity on benthic species are unknown. At *high* activity levels, nephrops burrow density may be reduced.	This option may help to achieve the conservation objective but with a potential risk of deterioration if fishing activity is high	This option may help to achieve the conservation objective but with a potential risk of deterioration.	Medium certainty. There is some direct evidence but it has been necessary to make assumptions based on knowledge of similar habitats or comparable pressures. There is good reason to believe that the assumptions are justified (eg. occurrence of species with similar characteristics).
Managed access	If fishing activity is at low levels, the habitat may be maintained in a state as described above and some recovery may be possible, i.e. increases in density of *Nephrops* and their burrows may occur. There is risk that cumulative effects of ongoing fishing may result in increasing degrees of modification.	If appropriate management is applied, this option may help to achieve the conservation objective.	If appropriate management is applied, this option may help to achieve the conservation objective.	Medium certainty. There is some direct evidence but it has been necessary to make assumptions based on knowledge of similar habitats or comparable pressures. There is good reason to believe that the assumptions are justified (eg. occurrence of species with similar characteristics).

No access	The habitat will not be subject to further modification. If there are no other unregulated pressures, recovery would be expected to take place at a natural pace.	This option will help to achieve the conservation objective.	This option will help to achieve the conservation objective.	High certainty. Inevitable conclusions based on the application of common sense.

12 MUD HABITATS IN DEEP WATER

May contain the FOCI:

Sea-pen and burrowing megafauna communities

For areas that support these habitats please refer to the relevant FOCI habitat

12.1 All gears

Impacts

This habitat feature is characterised by fairly stable fine sediments with potentially rich burrowing fauna; susceptibility to disturbance by demersal towed fishing gear is considered likely. This feature might contain biotopes rich in burrowing brittlestars and bivalves as well as the feature of conservation importance 'sea-pen and burrowing megafauna'. As no further direct experimental evidence has been found that specifically addresses the long-term impact of fishing gears on bivalves and brittlestars, we propose that the advice provided for the feature of conservation importance "sea-pen and burrowing megafauna communities" (Section 11) is adequate for this feature too.

13 SUBTIDAL MUD

May contain the FOCI:

sea-pen and burrowing megafauna communities
mud-habitats in deep water

For areas that support these habitats please refer to the relevant FOCI habitat

13.1 All gears

Impacts: This broad scale habitat covers a range of habitats and biological communities on muds and sandy muds. While some variability in sensitivity is to be expected at this broad-scale, the great majority of cases occur in extremely sheltered areas (sealochs, sheltered estuaries and harbours and at depth) characterised by undisturbed muddy sediments with a rich and diverse fauna. The stable nature of the sediments makes them generally susceptible to disturbance from demersal towed fishing gear but much less so to static gear. While it is recommended that management be determined at the level of individual sites as in all other broad-scale habitats, the advice provided for the feature of conservation importance “sea-pen and burrowing megafauna communities” (section 11) is considered to be adequate at this broad-scale too.

14 DEEP-SEA BED

May contain FOCI:

Cold-water coral reef
Deep sea sponge aggregations (assumed not present in MCZ area)

For areas that support these habitats please refer to the relevant FOCI habitat

14.1 All demersal towed gears (including otter trawl, beam trawl, etc)

Impacts

This broad scale habitat within the MCZ project area includes deep-sea mixed substrata, deep-sea sand, deep-sea mud, deep-sea bedrock and deep-sea biogenic gravel. As with stable sand, burrowed mud, and gravel habitats at shallower depths it is likely that demersal towed gears will cause the abundance of fragile, long lived species to be reduced while abundance of robust scavenging species will increase. The degree of modification would depend on the recovery rate of impacted organisms (which in this case is largely unknown) and levels of fishing activity.

Evidence

There is no direct evidence relating to the impacts of towed gears on any of these habitats. In the absence of direct evidence, this assessment is based on consideration of similar habitats occurring in shallower water. Confidence in this assessment is therefore low. See references for subtidal sand and seapen and burrowing megafauna.							
Directly relevant peer reviewed literature		Directly relevant grey literature		Inference from studies on comparable habitats, gears or geographical areas.	✔	Expert judgement	✔

Possible management options (see introduction section 2.5)	Consequences for habitats/features	Will the option help to meet the conservation objective?		Certainty
		Maintain	Recover	
Unrestricted access	The habitat may be maintained in a modified state with altered sedimentary characteristics and reduced abundance of fragile species. There is risk that cumulative effects from ongoing fishing may result in increasing levels of modification. If fishing activity increases or expands to new areas, the degree of modification will be expected to increase.	This option may help to achieve the conservation objective but with a significant risk of deterioration.	The conservation objective could not be achieved under this option.	Low certainty. There is no direct evidence and it has been necessary to make assumptions based on knowledge of similar habitats or comparable pressures. These assumptions may not be well founded (i.e. the relative sensitivity of the habitats is not clear)
Managed access	If fishing activity does not increase, the habitat may be maintained in a modified state with altered sedimentary characteristics and reduced abundance of some species. There is risk that cumulative effects from ongoing fishing may result in increasing levels of modification. If effort is reduced, limited recovery may occur. It is not known if this will be sufficient to achieve favourable condition.	If appropriate management is applied, this option may help to achieve the conservation objective.	If appropriate management is applied, this option may help to achieve the conservation objective.	Low certainty. There is no direct evidence and it has been necessary to make assumptions based on knowledge of similar habitats or comparable pressures. These assumptions may not be well founded (ie. the relative sensitivity of the habitats is not clear)
No access	The habitat will not be subject to further modification. If there are no other unregulated pressures, recovery would be expected to take place at a natural pace.	This option will help to achieve the conservation objective.	This option will help to achieve the conservation objective.	High certainty. Inevitable conclusions based on the application of common sense.

14.2 All demersal static gears (including gillnets, trammel nets, longlines, pots and traps)

Impacts: Evidence from burrowed mud and rocky habitats in shallower water suggests that some species (e.g. seapens, sea fans) may be resilient to impacts from pots, ropes etc. while other species could suffer damage or detachment from the substrate[1,2,3]. While the impact of individual fishing events may be small, cumulative effects may be significant. It is not possible to quantify the level of fishing activity that would result in significant damage. Impacts on sediment structure are likely to be minimal.

Evidence

[1]Eno *et al.* (1996); [2]Eno *et al*. (2001); [3]Kinnear *et al*. (1996)							
There is no direct evidence relating to the impacts of static gears on any of the other habitat sub-types occurring within this broad-scale habitat. The assessment is therefore based on consideration of impacts of static gear on similar habitats in shallower water. Confidence in this assessment is low.							
Directly relevant peer reviewed literature		Directly relevant grey literature		Inference from studies on comparable habitats, gears or geographical areas.	✔	Expert judgement or anecdotal evidence	

JNCC/Natural England Advice

Possible management options (see introduction section 2.5)	**Consequences for habitats/features**	**Will the option help to meet the conservation objective?**		
		Maintain	**Recover**	
Unrestricted access	The habitat may be maintained in a modified state. The degree of modification will be related to fishing effort and may be minor if activity is low. There is risk that cumulative effects from ongoing fishing may result in increasing levels of modification. If fishing activity increases or expands to new areas, the degree of modification will be expected to increase.	This option may help to achieve the conservation objective but with a significant risk of deterioration.	The conservation objective could not be achieved under this option.	Low certainty. There is no direct evidence and it has been necessary to make assumptions based on knowledge of similar habitats or comparable pressures. These assumptions may not be well founded (ie. the relative sensitivity of the habitats is not clear)
Managed access	If fishing does not increase, the habitat may be maintained in a modified state. There is risk that cumulative effects from ongoing fishing may result in increasing levels of	If appropriate management is applied, this option may help to achieve the	If appropriate management is applied, this option may help to achieve the	Low certainty. There is no direct evidence and it has been necessary to make assumptions based on knowledge of similar habitats or comparable pressures.

	modification. If activity is reduced, limited recovery may occur. It is not known if this will be sufficient to achieve favourable condition.	conservation objective.	conservation objective.	These assumptions may not be well founded (ie. the relative sensitivity of the habitats is not clear)
No access	The habitat will not be subject to further modification. If there are no other unregulated pressures, recovery would be expected to take place at a natural pace.	This option will help to achieve the conservation objective.	This option will help to achieve the conservation objective.	High certainty. Inevitable conclusions based on the application of common sense.

15 COLD-WATER CORAL REEFS

15.1 All demersal towed gears (including otter trawl, beam trawl)

Impacts

Fishing gear breaks up living and dead corals resulting in the loss of the physical structure of the reef[1,2,3]. Biomass and diversity are reduced in areas impacted by trawling[1,3]. Reefs may take centuries to recover[2,3] from damage, if at all.

Evidence

[1]Fosså *et al*. (2000 & 2002); [2]Hall-Spencer *et al*. (2002); [3]ICES advice, 2005 – 2010							
There is abundant evidence for the effects of trawling on cold water coral reefs. The evidence relates mainly to Norwegian and Irish waters but this is considered to be sufficiently similar to UK waters for the quality of the evidence to be considered high.							
Directly relevant peer reviewed literature	✔	Directly relevant grey literature	✔	Inference from studies on comparable habitats, gears or geographical areas.		Expert judgement	

JNCC/Natural England Advice

Possible management options (see introduction section 2.5)	**Consequences for habitats/features**	**Will the option help to meet the conservation objective?**		**Certainty**
		Maintain	**Recover**	
Unrestricted access	If trawling occurs, it is highly likely that there will be direct loss of the habitat.	The conservation objective will not be met under this management option	The conservation objective will not be met under this management option	High certainty. The conclusions are supported by good quality, directly relevant scientific information.
Managed access	No suitable management options could be identified that would mitigate the effects of fishing on this feature.	n/a	n/a	
No access	The habitat will not be subject to further modification. If there are no other unregulated pressures, recovery would be expected to take place at a natural pace.	This is the only mngt option that would help to meet the conservation objective	This is the only mngt option that would help to meet the conservation objective	High certainty. Inevitable conclusions based on the application of common sense.

15.2 All demersal static gears (including gillnets, trammel nets, longlines, pots and traps)

Impacts: Hooks, lines, nets and ropes entangle corals and 'pluck' them during hauling[1,2]. Physical damage to the seabed has been observed which may be caused by dragged anchors[1,2]. The individual impact of a single fishing operation may be slight but cumulative damage can be significant[2]. Given the slow growth rate of the reefs, they may take centuries to recover from damage, if at all.

Evidence

[1]Grehan *et al.* (2004); [2]ICES Advice 2005 - 2010.
There is direct evidence of the effects of gill nets and longlines on cold water coral reefs. The evidence relates to UK and Irish waters and can be regarded as directly applicable to the MCZ project area. There is no direct evidence of impacts from pots on this habitat.

Directly relevant peer reviewed literature	✔	Directly relevant grey literature	✔	Inference from studies on comparable habitats, gears or geographical areas.		Expert judgement	

JNCC/Natural England Advice

Possible management options (see introduction section 2.5)	Consequences for habitats/features	Will the option help to meet the conservation objective?		Certainty
		Maintain	Recover	
Unrestricted access	If fishing gear has direct contact, living corals will be killed and dead coral broken up (resulting in loss of habitat).	The conservation objective will not be met under this management option	The conservation objective will not be met under this management option	High certainty. The conclusions are supported by good quality, directly relevant scientific information.
Managed access	No suitable management options could be identified that would mitigate the effects of fishing on this feature.	n/a	n/a	
No access	The habitat will not be subject to further modification. If there are no other unregulated pressures, recovery would be expected to take place at a natural pace.	This is the only management option that would help to meet the conservation objective	This is the only management option that would help to meet the conservation objective	High certainty. Inevitable conclusions based on the application of common sense.

16 MAËRL BEDS

16.1 All demersal towed gears (including scallop dredge, hydraulic dredge, beam trawl, otter trawl etc).

Impacts

Maërl beds are built by coralline seaweeds, mainly *Lithothamnion coralloides* and *Phymatolithon calcareum* in British waters. They are vulnerable to physical damage from towed demersal gears with recovery taking as long as 10 - 25 years[1]. Evidence of the impacts of scallop dredges comes directly from UK sites. Maërl is crushed and buried (up to 8cm) with one pass of a scallop dredge, whilst the impacts from smothering have been also experimentally demonstrated [2]. Associated species, including file shell *Limaria hians* 'nests' within the dredge track were destroyed and after 5 months 70% of maërl was dead and there was no evidence of recovery 4 years later [3]. Experimental hydraulic dredging reduced (dead) maërl cover from 83% to 16% [4]. The BIOMAËRL EU project proposed prohibitions on the use of towed gear on maërl grounds [5].

Evidence

[1]OSPAR (2006); [2]Wilson *et al.* (2004); [3]Hall-Spencer and Moore (2000); [4]Hauton *et al.* (2003); [5]Bordehore *et al.* (2003); [6]Bárbara *et al.* (2003)							
There is evidence of the effects of scallop dredging on muddy maërl beds with evidence from UK waters. Evidence on the effects of otter trawls comes from the Mediterranean[6].							
Directly relevant peer reviewed literature	✔	Directly relevant grey literature		Inference from studies on comparable habitats, gears or geographical areas.	✔	Expert judgement	

JNCC / Natural England advice

Possible management options(see introduction section 2.5)	**Consequences to habitat/feature**	**Will the option help to meet the conservation objective?**		**Certainty**
		Maintain	**Recover**	
Unrestricted access	If dredging or trawling occurs, maërl beds will be damaged /destroyed	The conservation objective will not be met under this management option	The conservation objective will not be met under this management option	High certainty. The conclusions are supported by good quality, directly relevant scientific information.
Managed access	No suitable management options could be identified that would mitigate the effects of fishing on this feature	N/A	N/A	

No access	The habitat will not be subject to further modification. If there are no other unregulated pressures, recovery would be expected to take place at a natural pace.	This is the only management option that would help to meet the conservation objective	This is the only management option that would help to meet the conservation objective	High certainty. Inevitable conclusions based on the application of common sense.

16.2 All demersal static gears (including pots, traps, lines and nets)

Impacts

Maërl is fragile and recovery is extremely long; anything which disrupts or penetrates the surface and/or drags on the seabed is likely to cause the maërl to be broken up or buried, silted over etc. As such, demersal static gears may have a negative impact on maërl beds but the severity of the impact in terms of achieving conservation objectives would depend on fishing intensity as well as type of gear.

Evidence

No study has been found that addresses directly the impact of static gears on maërl beds. Our advice is therefore based on expert knowledge.							
Directly relevant peer reviewed literature		Directly relevant grey literature		Inference from peer reviewed or grey literature relating to a comparable habitat, gear or geographical area.		Expert judgement	✔

JNCC/Natural England advice

Possible management options (see introduction section 2.5)	**Consequences for habitats/features**	**Will the option help to meet the conservation objective?**		**Certainty**
		Maintain	**Recover**	
Unrestricted access	Some damage will occur but its severity will depend on site conditions and level of effort.	This option may help to achieve the conservation objective but with a significant risk of deterioration	The conservation objective will not be achieved under this option	Medium certainty. Based on expert knowledge.

Managed access	If fishing does not increase, the habitat may be maintained in a modified state and some recovery may be possible. There is risk that cumulative effects from ongoing fishing may result in increasing levels of modification. Appropriate measures will have to be decided at the site level so that some localised impact might occur but the habitat overall will not be degraded.	If appropriate management is applied, this option will help to achieve the conservation objective.	If appropriate management is applied, this option will help to achieve the conservation objective.	Medium certainty. Based on expert knowledge.
No access	The habitat will not be subject to further modification. If there are no other unregulated pressures, recovery would be expected to take place at a natural pace.	This option will help to meet the conservation objective	This option will help meet the conservation objective	High certainty. Inevitable conclusions based on the application of common sense.

17 BLUE MUSSEL BEDS (including intertidal beds on mixed and sandy sediments)

[*please use in conjunction with supplementary advice*]

This advice covers mussel beds in both intertidal and subtidal environments. Mussel beds can be of two distinct types; ephemeral beds consisting of only young mussels which persist only for short periods, and persistent beds containing old mussels which persist for many years[3]. This advice assumes that any mussel beds identified as MCZs will only be of the latter type.

17.1 Mussel dredging

Impacts

Direct removal of mussels results in loss of biogenic reef habitat[1], with local adverse effects on dependent animals and plants[2]. Dredging may increase the vulnerability of mussel beds to storm damage resulting in reduction in extent or even complete loss of beds[3]. Over-exploitation may reduce subsequent recruitment[4] (although this relationship is poorly understood[5,6]). Recovery potential will therefore be variable.

Evidence

[1]Dolmer *et al.* (1999); [2]Buschbaum *et al.* (2009); [3]Anon (2010); [4]Herlyn & Millat (2000); [5]Holt *et al.* (1998); [6]Tyler-Walters (2008)							
There is abundant evidence for the impacts of dredging on intertidal and subtidal blue mussel beds although much of this evidence is from other areas (Denmark, Germany). *Some* of the evidence refers to *ephemeral* mussel beds so *may* not be directly applicable to the type of beds likely to be designated as MCZs.							
Directly relevant peer reviewed literature		Directly relevant grey literature		Inference from studies on comparable habitats, gears or geographical areas.	✔	Expert judgement	✔

Possible management options (see introduction section 2.5)	Consequences for habitats/features	Will the option help to meet the conservation objective?		Certainty
		Maintain	Recover	
Unrestricted access	Reduction in mussel cover and abundance of associated species. Reef structure is damaged, resulting in loss of beds. Increased risk of storm damage leading to loss of reef.	The conservation objective is unlikely to be met under this management option.	The conservation objective is unlikely to be met under this management option.	Medium certainty. There is no direct evidence and it has been necessary to make assumptions based on knowledge of similar habitats or comparable pressures. There is good reason to believe that the assumptions are justified (eg. occurrence of species with similar characteristics).
Managed access	Some levels or methods of fishing will reduce impact to mussel beds. Extraction could be limited to levels which allow beds to persist over the long-term and maintain associated biodiversity	If appropriate management is applied, this option may help to achieve the conservation objective.	The conservation objective is unlikely to be met under this management option.	Medium certainty. There is no direct evidence and it has been necessary to make assumptions based on knowledge of similar habitats or comparable pressures. There is good reason to believe that the assumptions are justified (eg. occurrence of species with similar characteristics).
No access	The habitat will not be subject to further modification. If there are no other unregulated pressures, reefs would be expected to become more stable and persistent. In time, recruitment may promote growth of damaged beds	This option will help to achieve the conservation objective.	This option will help to achieve the conservation objective.	High certainty. Inevitable conclusions based on the application of common sense.

17.2 All other demersal towed gears (including Beam trawl, demersal otter trawl, seine net, scallop dredge, suction dredge etc.)

Impacts

Mussel beds are assessed as moderately sensitive to the effects of towed gears (surface and shallow abrasion)[1]. It is likely that a proportion of mussel patches and their associate species will be removed. Recoverability is likely to be high[1].

Evidence

[1]Tillin *et al.* (2010); [2]Hall *et al.* (2008)							
No study has been found that directly addresses the impact of demersal towed gears other than mussel dredges on blue mussel beds. Our advice is therefore based on our interpretation of sensitivity assessments[1,2]							
Directly relevant peer reviewed literature		Directly relevant grey literature		Inference from studies on comparable habitats, gears or geographical areas.		Expert judgement or anecdotal evidence	✔

JNCC/Natural England advice

Possible management options (see introduction section 2.5)	**Consequences for habitats/features**	**Will the option help to meet the conservation objective?**		**Certainty**
		Maintain	**Recover**	
unrestricted access	Reduced mussel cover and abundance of associated species. If fishing effort is very low, this option may allow favourable condition to be maintained but there is risk that cumulative effects from ongoing fishing may result in modification. If fishing pressure increases further modification will be expected to occur.	This option may help to achieve the conservation objective but with a significant risk of deterioration.	The conservation objective will notbe met under this management option.	Low certainty. Conclusions have been based on sensitivity assessments which may rely on significant assumptions or generalisations. It has not been possible to validate these assumptions.

Managed access	If fishing effort does not increase, the habitat may be maintained in a modified state and some recovery may be possible. There is risk that cumulative effects from ongoing fishing may result in increasing levels of modification. Measures that prevent the use of highly impacting gears (eg. suction dredge) but allow les impacting gears (eg. light trawls, shrimp trawl) may allow some recovery	If appropriate management is applied, this option may help to achieve the conservation objective.	If appropriate management is applied, this option may help to achieve the conservation objective.	Low certainty. Conclusions have been based on sensitivity assessments which may rely on significant assumptions or generalisations. It has not been possible to validate these assumptions.
no access	The habitat will not be subject to further modification. If there are no other unregulated pressures, recovery would be expected to take place at a natural pace.	This option will help to achieve the conservation objective.	This option will help to achieve the conservation objective.	High certainty. Inevitable conclusions based on the application of common sense.

17.3 All demersal static gears (including pots, traps, lines and nets)

Impacts

Mussel beds are assessed as moderately sensitive to the effects of demersal static gears (surface abrasion)[1]. It is possible that a proportion of mussel patches and their associate species will be removed. Recoverability is likely to be high[1].

Evidence

[1]Tillin *et al*. (2010); [2]Hall *et al*. (2008)							
No study has been found that directly addresses the impact of demersal static gears on blue mussel beds. Our advice is therefore based on our interpretation of sensitivity assessments[1,2]							
Directly relevant peer reviewed literature		Directly relevant grey literature		Inference from studies on comparable habitats, gears or geographical areas.		Expert judgement	✔

JNCC/Natural England advice

Possible management options (see introduction section 2.5)		Will the option help to meet the conservation objective?		Certainty
		Maintain	Recover	
Unrestricted access	Some damage may occur but its severity will depend on site conditions and level of effort.	This option may help to achieve the conservation objective but with a potential risk of deterioration if fishing pressure is very high	This option may help to achieve the conservation objective but with a potential risk of deterioration.	Low certainty. Conclusions have been based on sensitivity assessments which may rely on significant assumptions or generalisations. It has not been possible to validate these assumptions.
Managed access	If effort is limited to low or moderate levels, the habitat may be maintained in a modified state and some recovery may be possible. There is risk that cumulative effects from ongoing fishing may result in increasing levels of modification.	If appropriate management is applied, this option may help to achieve the conservation objective.	If appropriate management is applied, this option may help to achieve the conservation objective.	Low certainty. Conclusions have been based on sensitivity assessments which may rely on significant assumptions or generalisations. It has not been possible to validate these assumptions.
No access	The habitat will not be subject to further modification. If there are no other unregulated pressures, recovery would be expected to take place at a natural pace.	This option will help to achieve the conservation objective.	This option will help to achieve the conservation objective.	High certainty. Inevitable conclusions based on the application of common sense.

17.4 Hand collection and raking

Impacts

When fished by hand at moderate levels using traditional methods the biogenic reefs will probably retain most of their intrinsic biodiversity, however, natural mussel beds are vulnerable to over-exploitation[1,2,3]

Evidence

[1]Roberts *et al*. (2010); [2]Holt *et al*. (1998); [3]Tyler-Walters (2008)							
No empirical study has been found that directly addresses the impact of demersal hand dredging or raking on blue mussel beds. Our advice is therefore based on our interpretation of sensitivity assessments and assertions from grey literature.[1,2,3]							
Directly relevant peer reviewed literature		Directly relevant grey literature	✔	Inference from studies on comparable habitats, gears or geographical areas.		Expert judgement	✔

JNCC/Natural England advice

Possible management options (see introduction section 2.5)	**Consequences for habitats/features**	**Will the option help to meet the conservation objective?**		**Certainty**
		Maintain	**Recover**	
Unrestricted access	Reefs may retain their structure and diversity but beds are vulnerable to over-exploitation.	This option may help to achieve the conservation objective but with a potential risk of deterioration if fishing pressure is very high	This option may help to achieve the conservation objective but with a potential risk of deterioration.	Low certainty. Conclusions have been based on sensitivity assessments which may rely on significant assumptions or generalisations. It has not been possible to validate these assumptions.
Managed access	If fishing is limited to low or moderate levels the habitat may be maintained in a modified state and some recovery may be possible. There is risk that cumulative effects of ongoing fishing may result in increasing levels of modification. The feature is more likely to achieve favourable condition if under-size shellfish are returned to the beds (and are undisturbed long enough to reattach).	If appropriate management is applied, this option may help to achieve the conservation objective.	If appropriate management is applied, this option may help to achieve the conservation objective.	Low certainty. Conclusions have been based on sensitivity assessments which may rely on significant assumptions or generalisations. It has not been possible to validate these assumptions.

No access	The habitat will not be subject to further modification. If there are no other unregulated pressures, recovery would be expected to take place at a natural pace.	This option will help to achieve the conservation objective.	This option will help to achieve the conservation objective.	High certainty. Inevitable conclusions based on the application of common sense.

17.5 Bait collection

Impacts

Trampling may cause a reduction in the extent of mussel patches with recovery taking years[1,2]. There is anecdotal evidence of very high levels of bait collection (either for mussel or digging over gravel for ragworm) resulting in complete loss of mussel beds[3,4].

Evidence

[1]Smith & Murray (2005); [2]Brosnan & Crumrine (1994); [3]Holt *et al.*, (1998); [4]Tyler-Walters (2008)							
No study has been found that directly addresses the impact of bait collection on blue mussel beds in the UK. There is experimental evidence of the effects of trampling on a related species on rocky substrate in Australia and anecdotal evidence of complete loss of beds in Wales through over-exploitation.							
Directly relevant peer reviewed literature		Directly relevant grey literature		Inference from studies on comparable habitats, gears or geographical areas.	✔	Expert judgement or anecdotal evidence	✔

Possible management options (see introduction section 2.5)	Consequences for habitats/features	Will the option help to meet the conservation objective?		Certainty
		Maintain	Recover	
Unrestricted access	Trampling may reduce mussel cover. High levels of activity may result in loss or significant damage to beds.	This option may help to achieve the conservation objective but with a significant risk of deterioration if fishing pressure is high	This option may help to achieve the conservation objective but with a significant risk of deterioration.	Medium certainty. There is no direct evidence and it has been necessary to make assumptions based on knowledge of similar habitats or comparable pressures. There is good reason to believe that the assumptions are justified (eg. occurrence of species with similar characteristics).
Managed access	If activity is limited to low or moderate levels the habitat may be maintained in a modified state and some recovery may be possible. There is risk that cumulative effects from ongoing fishing may result in increasing levels of modification.	If appropriate management is applied, this option may help to achieve the conservation objective.	If appropriate management is applied, this option may help to achieve the conservation objective.	Medium certainty. There is no direct evidence and it has been necessary to make assumptions based on knowledge of similar habitats or comparable pressures. There is good reason to believe that the assumptions are justified (eg. occurrence of species with similar characteristics).
No access	The habitat will not be subject to further modification. If there are no other unregulated pressures, recovery would be expected to take place at a natural pace.	This option will help to achieve the conservation objective.	This option will help to achieve the conservation objective.	High certainty. Inevitable conclusions based on the application of common sense.

18 HORSE MUSSEL (*Modiolus modiolus*) BEDS

18.1 All demersal towed gear (including scallop dredges and otter trawls)

Impacts

Horse mussels are slow growing and long-lived; recruitment is slow and sporadic;[1] their dense aggregations sustain rich and diverse communities[2]. Widespread damage (to individual mussels, to the structural integrity of the clumps and to epifauna) by demersal fishing has been documented in Strangford Lough[3,4,5] and implicated in loss of beds off the south east of the Isle of Man[6].

Evidence

[1]Holt *et al*. (1998); [2]Jones *et al*. (2000); [3]Magorrian and Service (1998); [4]Roberts *et al*. (2004); [5]Brown (1989); [6]Jones (1951)							
The evidence is from dredging and trawling for scallops in UK waters and Isle of Man and so is considered to be directly applicable.							
Directly relevant peer reviewed literature	✔	Directly relevant grey literature	✔	Inference from studies on comparable habitats, gears or geographical areas.		Expert judgement	

JNCC/Natural England Advice

Possible mitigation options (see introduction section 2.5)	**Ecological consequences of mitigation option**	**Compatibility with conservation objective and level of confidence in this assessment.**		**Certainty**
		Maintain	**Recover**	
Unrestricted access	If demersal towed gears are deployed, habitat loss will occur.	The conservation objective will not be met under this management option	The conservation objective will not be met under this management option	High certainty. The conclusions are supported by good quality, directly relevant scientific information.
Managed access	No suitable management options could be identified that would mitigate the effects of fishing on this feature.	n/a	n/a	

No access	The habitat will not be subject to further modification. If there are no other unregulated pressures, recovery would be expected to take place at a natural pace.	This is the only management option that would help to meet the conservation objective	This is the only management option that would help to meet the conservation objective	High certainty. Inevitable conclusions based on the application of common sense.

18.2 All demersal static gears (including pots, traps, lines and nets)

Impacts

Sensitivity of horse mussel beds to static gears is low but depending on type of epifauna it may increase to medium under high fishing intensity[1,2].

Evidence

[1]Hall *et al.* (1998); [2]Tillin *et al.* (2010)							
No study has been found that addresses directly the impact of static gears on horse mussel beds. Our advice is therefore based on our interpretation of sensitivity assessments.							
Directly relevant peer reviewed literature		Directly relevant grey literature		Inference from peer reviewed or grey literature relating to a comparable habitat, gear or geographical area.		Expert judgement	✔

JNCC/Natural England advice

Possible management options (see introduction section 2.5)	**Consequences for habitats/features**	**Will the option help to meet the conservation objective?**		**Certainty**
		Maintain	**Recover**	
Unrestricted access	Some damage may occur but its severity will depend on site conditions and level of fishing effort.	This option may help to achieve the conservation objective but with a potential risk of deterioration if fishing pressure increases to very high levels	This option may help to achieve the conservation objective but with a potential risk of deterioration if fishing pressure is high	Low certainty. Conclusions have been based on sensitivity assessments which may rely on significant assumptions or generalisations. It has not been possible to validate these assumptions.

Managed access	If fishing effort does not increase, the habitat may be maintained in a modified state and some recovery may be possible.	If appropriate management is applied, this option may help to achieve the conservation objective.	If appropriate management is applied, this option may help to achieve the conservation objective.	Low certainty. Conclusions have been based on sensitivity assessments which may rely on significant assumptions or generalisations. It has not been possible to validate these assumptions. Some assumptions have been made regarding recovery potential.
No access	The habitat will not be subject to further modification. If there are no other unregulated pressures, recovery would be expected to take place at a natural pace.	This option will help to achieve the conservation objective.	This option will help to achieve the conservation objective.	High certainty. Inevitable conclusions based on the application of common sense.

19 NATIVE OYSTER (*Ostrea edulis*) BEDS

[*please use in conjunction with supplementary advice*]

19.1 Oyster dredge

Impacts

Direct mortality of oysters. Fishing has been a significant, if not the primary cause of historical oyster bed declines in England [1]. There are now only two or three self-sustaining oyster populations in England (the Thames, the Fal and the Solent). In addition to the direct effects on the oyster stock, experimental studies have suggested that the top 10-15cm of sediment could be disturbed by the dredge, the gravel component reduced, sediment plumes created and tracks made on the seabed [2], [3, 4]. As oysters require the exposure of a hard substrate to settle on; redistribution of sediment may reduce this available surface [5].

Evidence

[1]Gardner & Elliot (2001); [2]Sewell & Hiscock (2005); [3]Anon (1992); [4]Rothschild *et al.* (1994);[5]Jackson & Wilding (2009); [6]Ismail (1985)							
There is some peer-reviewed evidence for the effects of fisheries on oyster populations from the UK and elsewhere. Other impacts (such as sedimentation) have been indicated, although their role in reducing the native oyster population is not quantified and therefore of lower certainty [5].							
Directly relevant peer reviewed literature	✔	Directly relevant grey literature	✔	Inference from peer reviewed or grey literature relating to a comparable habitat, gear or geographical area.		Expert judgement	

JNCC/Natural England advice

Possible management options (see introduction section 2.5)	**Consequences for habitats/features**	**Will the option help to meet the conservation objective?**		**Certainty**
		Maintain	**Recover**	
Unrestricted access	Oyster beds will remain in a depleted state or continue to decline	This option may help to achieve the conservation objective but with a significant risk of deterioration.	The conservation objective will not be achieved under this option.	Medium certainty. The conclusions are supported by directly relevant scientific information However, this is 'grey' rather than peer reviewed.

Managed access (i) *Managed sustainable use (e.g. significant effort limitation, protected broodstock areas, TAC combined with seeding of grounds and maintenance/ provision of cultch)*	Unless the stock is self-sustaining, this is can be the only way of ensuring this habitat will be maintained.	If appropriate management is applied, this option may help to achieve the conservation objective	If appropriate management is applied, this option may help to achieve the conservation objective.	Low certainty. There is direct evidence but its conclusions are conflicting or unclear.
No Access (in a public fishery[8]).	Prohibition of dredging will reduce the number of oysters extracted and prevent associated impacts to the beds. Natural recovery is not certain as oysters may be too scattered to reproduce successfully and there may be a higher level of predation (American tingle) or competition (*Crepidula*) which may limit recovery.	This option will help to achieve the conservation objective, providing the stock is self-sustaining.	This option may help to achieve the conservation objective.	Low certainty. There is direct evidence but its conclusions are conflicting or unclear.

No access (within a Several Order[10]).	Prohibition of dredging will reduce the number of oysters extracted and prevent any associated impact to the beds. Associated fisheries management of the beds would be unlikely to continue, therefore the potential beneficial contribution of management, particularly seeding of beds and also from the maintenance of appropriate cultch, cleaning of the beds and potential prevention of disease (*Bonamia*) [7] may cease, reducing recoverability potential.	Uncertain. Objective may be achieved or cessation of management could exacerbate decline.	Uncertain. Objective may be achieved or cessation of management could exacerbate decline	High certainty. Inevitable conclusions based on the application of common sense.

19.2 All other demersal gears (including beam trawl, scallop dredge, otter trawl and all static gear)

Impacts will be dependent on the bed type – the advice provided for **subtidal mixed sediments** would be most applicable here and should be used.

[10] Several and Regulating Orders both constitute a variation in the public right to fish for shellfish, which in effect means that the fisheries under Order are restricted and access limited to/by the owner/s of the Order rather than open access to all fishermen.

The purpose of a **Regulating Order** is to improve the management of natural shellfisheries; application is usually made therefore by Inshore Fisheries and Conservation Authority. A Regulating Order provides **i)** licencing rights which allow the Grantee to issue licences for the fishing of shellfish to a particular time, location or manner **ii)** additional enforcement powers relating to the restrictions and regulations relative to that Order. SFC's can therefore control where, when and how much fishing occurs.

The purpose of a **Several Order** is to improve or establish a shellfishery; the Order therefore removes the public right to fish and grantees are usually individuals. In effect, a private fishery is created where fishing effort is entirely managed by the owner. Several Orders are a property right however which may be leased or transferred. Grantees may create and maintain the shellfishery; simply harvesting existing shellfish is usually insufficient to grant a Several Order.

20 HONEYCOMB WORM (*Sabellaria alveolata*) REEFS and ROSS WORM (*Sabellaria spinulosa*) REEFS

Reefs of *Sabellaria alveolata* and *Sabellaria spinulosa* differ in their distribution with depth; reefs of *S. alveolata* are found mainly in the intertidal or shallow subtidal while those of *S. spinulosa* are generally best developed sublittorally (10-50 m)[1]. Overlap with different fishing activities is therefore likely to change between the two species e.g. bait-digging will mainly occur on *S. alveolata*. Considering some overlap might occur, it was considered appropriate to present our advice as one assessment.

20.1 All demersal towed gear (including shrimp trawling)

Impacts

Loss of *Sabellaria* reefs in North East Atlantic have been attributed to the long-term effects of various fishing practices, predominantly that of towed demersal gear as in Morecombe Bay[1,2]. The impact of trawls is to break apart the worm tubes resulting in direct mortality (death) of the worms and in a reduction of the structure and complexity of the habitat which may no longer support the associated animals and plants[3]. A recent study[4] conducted partially off the coast of France and partially in the Wadden Sea challenges the view that all towed gears constitute a great risk to all *Sabellaria* reefs; however, as the gear is likely to differ from that used in UK and reef characteristics are also likely to be different, this study is not considered sufficient to alter previous assessments made for UK waters[5,6,7].

Evidence

[1]Jones *et al.* (2000); [2]Holt *et al.* (1998); [3]UK BAP (2000); [4]Vorberg (2000); [5]OSPAR (2010); [6]Hall *et al.* (1998); [7]Tillin *et al.* (2010)							
Mainly historical evidence of damage in UK waters and habitat sensitivity assessments; there is one empirical study on impacts of shrimp trawling in Wadden Sea and off French coast but is not considered to be directly relevant to UK reefs.							
Directly relevant peer reviewed literature		Directly relevant grey literature	✔	Inference from peer reviewed or grey literature relating to a comparable habitat, gear or geographical area.	✔	Expert judgement	✔

Possible management options (see introduction section 2.5)	Consequences for habitats/features	Will the option help to meet the conservation objective?		Certainty
		Maintain	Recover	
Unrestricted access	If trawling occurs, Sabellaria reefs will be damaged /destroyed.	The conservation objective will not be met under this management option	The conservation objective will not be met under this management option	Medium certainty. The conclusions are supported by directly relevant scientific information. However, this is 'grey' rather than peer reviewed.
Managed access	No suitable management options could be identified that would mitigate the effects of fishing on this feature.	n/a	n/a	
No access	The habitat will not incur direct damage and reef evolution and recovery will be expected to take place at a natural pace, if there are no other unregulated pressures.	This is the only management option that would help to meet the conservation objective	This is the only management option that would help to meet the conservation objective	High certainty. Inevitable conclusions based on the application of common sense.

20.2 All demersal static gears (including pots, traps, lines and nets)

Impacts

Sensitivity of *Sabellaria* reefs to static gears is low to medium depending on fishing intensity[1,2].

Evidence

[1]Hall *et al.*(2008); [2]Tillin *et al.* (2010)							
No study has been found that addresses directly the impact of static gears on *Sabellaria* reefs. Our advice is therefore based on our interpretation of sensitivity assessments.							
Directly relevant peer reviewed literature		Directly relevant grey literature		Inference from peer reviewed or grey literature relating to a comparable habitat, gear or geographical area.		Expert judgement	✔

JNCC/Natural England advice

Possible management options (see introduction section 2.5)	Consequences for habitats/features	Will the option help to meet the conservation objective?		Certainty
		Maintain	Recover	
Unrestricted access	Some damage may occur but its severity will depend on site conditions and level of fishing effort.	This option may help to achieve the conservation objective but with a potential risk of deterioration if fishing increases to very high levels	This option may help to achieve the conservation objective but with a potential risk of deterioration if fishing high	Low certainty. Conclusions have been based on sensitivity assessments which may rely on significant assumptions or generalisations. It has not been possible to validate these assumptions. Some assumptions have been made regarding recovery potential.
Managed access	If effort is restricted to low or moderate intensity, damage will be minimised and some recovery may occur.	If appropriate management is applied, this option may help to achieve the conservation objective.	If appropriate management is applied, this option may help to achieve the conservation objective.	Low certainty. There is no direct evidence and it has been necessary to make assumptions based on knowledge of similar habitats or comparable pressures. These assumptions may not be well founded (ie. the relative sensitivity of the habitats is not clear)
No access	The habitat will not be subject to further modification. If there are no other unregulated pressures, recovery would be expected to take place at a natural pace.	This option will help to achieve the conservation objective.	This option will help to achieve the conservation objective.	High certainty. Inevitable conclusions based on the application of common sense.

20.3 Bait digging

Impact

Trampling and extraction of worms for bait has variable impact according to exposure, with rapid recovery from isolated trampling of light or moderate nature[1].

Evidence

[1]Cunningham *et al.* (1984)							
Directly relevant peer reviewed literature		Directly relevant grey literature	✔	Inference from peer reviewed or grey literature relating to a comparable habitat, gear or geographical area.		Expert judgement	✔

JNCC/Natural England advice

Possible management options (see introduction section 2.5)	**Consequences for habitats/features**	**Will the option help to meet the conservation objective?**		**Certainty**
		Maintain	**Recover**	
Unrestricted access	Some change in the quality of the habitat. In some cases this may be sufficiently minor for the condition to be considered favourable.	This option may help to achieve the conservation objective but with a potential risk of deterioration in condition if fishing activity increases to very high levels.	This option may help to achieve the conservation objective but with a potential risk of deterioration in condition if fishing activity is high.	Medium certainty. The conclusions are supported by directly relevant scientific information However, this is 'grey' rather than peer reviewed.
Managed access	If fishing effort does not increase, the habitat may be maintained in a modified state and some recovery may be possible. There is risk that cumulative effects from ongoing fishing may result in increasing levels of modification.	If appropriate management is applied, this option may help to achieve the conservation objective.	If appropriate management is applied, this option may help to achieve the conservation objective.	Medium certainty. The conclusions are supported by directly relevant scientific information However, this is 'grey' rather than peer reviewed.
No access	The habitat will not be subject to further modification. If there are no other unregulated pressures, recovery would be expected to take place at a natural pace.	This management option will help to achieve the conservation objective	This management option will help to achieve the conservation objective	High certainty. Inevitable conclusions based on the application of common sense.

21 Seagrass beds

21.1 All demersal towed gear (including dredges, beam trawls and otter trawls)

Impacts

All forms of trawling and dredge gears have major direct and indirect impacts on seagrass beds[1]; substrate is lost or destabilised, seagrasses are uprooted and damaged and sediment resuspension reduces light necessary for seagrass photosynthesis [2,3,4]. Recovery may occur over several years[5] and will be dependent on environmental conditions[6] with proximity of healthy seagrass being an important factor[7]

Evidence

[1]Erftemeijer & Lewis (2006); [2]Bishop *et al.* (2005); [3]Tudela (2004); [4]Peterson *et al.* (1987); [5]Neckles *et al.* (2005); [6]Roberts *et al.* (2010); [7]Anon(2010).							
There are many UK and European & American studies into the impacts of towed benthic gear on seagrasses.							
Directly relevant peer reviewed literature	✔	Directly relevant grey literature		Inference from peer reviewed or grey literature relating to a comparable habitat, gear or geographical area.	✔	Expert judgement	

JNCC/Natural England advice

Possible management options (see introduction section 2.5)	**Consequences for habitats/features**	**Will the option help to meet the conservation objective?**		**Certainty**
		Maintain	**Recover**	
Unrestricted access	If dredging or trawling occurs, seagrass beds will be severely damaged	The conservation objective will not be met under this management option.	The conservation objective will not be met under this management option.	High certainty. The conclusions are supported by good quality, directly relevant scientific information.
Managed access	No suitable management options could be identified that would mitigate the effects of fishing on this feature.	N/A	N/A	

No access	The habitat will not be subject to further modification. If there are no other unregulated pressures, recovery would be expected to take place at a natural pace.	This is the only management option that would help to meet the conservation objective	This is the only management option that would help to meet the conservation objective	High certainty. Inevitable conclusions based on the application of common sense.

21.2 All demersal static gears (including pots, traps, lines and nets)

Impact

Pots set and hauled in seagrass beds can cause damage by cutting off leaves, uprooting plants and, if left long enough on the bottom, can cause damage by smothering and blocking light. The extent of damage by pots depends on the number of pots set, soak time and hauling frequency [1].

Evidence

[1]ASMFC. (2000).							
There is evidence of impact from peer-reviewed literature but mostly from the North Eastern states of the USA.							
Directly relevant peer reviewed literature		Directly relevant grey literature	✔	Inference from peer reviewed or grey literature relating to a comparable habitat, gear or geographical area.		Expert judgement	✔

JNCC/Natural England advice

Possible management options (see introduction section 2.5)	**Consequences for habitats/features**	**Will the option help to meet the conservation objective?**		**Certainty**
		Maintain	**Recover**	
Unrestricted access	Some damage will occur but its severity will depend on site conditions and level of activity.	This option may help to achieve the conservation objective but with a significant risk of deterioration	The conservation objective will not be achieved under this option	Medium certainty. The conclusions are supported by 'grey' rather than peer reviewed literature.

Managed access	If fishing effort does not increase, the habitat may be maintained in a modified state and some recovery may be possible. There is risk that cumulative effects from ongoing fishing may result in increasing levels of modification. Appropriate measures such as zoning or effort restriction will have to be decided at the site level so that some localised short-term damage might occur but the habitat overall will not be negatively impacted	If appropriate management is applied, this option will help to achieve the conservation objective	If appropriate management is applied, this option will help to achieve the conservation objective.	Medium certainty. There is some direct evidence but it has been necessary to make assumptions based on knowledge of similar habitats or comparable pressures. There is good reason to believe that the assumptions are justified (eg. occurrence of species with similar characteristics).
No access	The habitat will not be subject to further modification. If there are no other unregulated pressures, recovery would be expected to take place at a natural pace.	This management option will help to meet the conservation objective.	This management option will help to meet the conservation objective.	High certainty. Inevitable conclusions based on the application of common sense.

22 HIGH, MODERATE AND LOW ENERGY CIRCALITTORAL ROCK

May contain FOCI:

Fragile sponge and anthozoan communities on subtidal rocky habitat
Subtidal chalk
Ross worm (*Sabellaria spinulosa*) reefs.

For areas that support these habitats please refer to the relevant FOCI habitat

Communities on low, moderate and high energy circalittoral rock may have a very broad range of sensitivities to fishing. Some high energy environments support robust species and have relatively low sensitivity to fishing activity. However, the relationship between energy exposure and habitat sensitivity is not always consistent and there are examples of rocky habitats in high energy environments that support fragile species (e.g. sponges and sea-firs in strong tidal streams) and may be relatively sensitive to damage from fishing activities, because the fishing activity exerts a different type of pressure from the natural disturbance. Furthermore, the scientific literature on fishing impacts on rocky habitats contains insufficient detail to allow impacts on high, medium and low energy environments to be distinguished. A single piece of advice is therefore given to all three of these broad scale habitats, which will need to be used in conjunction with available site specific evidence and advice.

22.1 All demersal towed gears (including scallop dredges, beam trawls and otter trawl)

Impacts

Towing fishing gear across rocky substrates is likely to cause damage or death of attached species[1,2], and reduce habitat complexity as boulders and cobbles associated with the hard substrate are moved around[3.] Recovery times for impacted habitat are likely to be longer than for soft substrates[4]. The substrate of circalittoral rock habitats can vary in their hardness and therefore resistance to damage from towed demersal gears, with the harder examples of the substrate (e.g. granite) being more resistant to damage than softer examples (e.g. shales and chalk).

Evidence

[1]Løkkeborg, (2005); [2]Engel & Kvitek (1998); [3]Freese *et al.* (1999); [4]Foden *et al.* (2010); [5]MacDonald *et al.* (1996); [6]Hall *et al.* (2008);							
No studies were found relating directly to impacts of towed gears on this habitat. The assessment is therefore based on knowledge of impacts of towed gear on other habitats with similar characteristics (hard substrate and fragile, erect epifauna) in the UK and elsewhere.							
Directly relevant peer reviewed literature		Directly relevant grey literature		Inference from studies on comparable habitats, gears or geographical areas.	✔	Expert judgement	

JNCC/Natural England Advice

Possible management options (see introduction section 2.5)	Consequences for habitats/features	Will the option help to meet the conservation objective?		Certainty
		Maintain	Recover	
Unrestricted access	If fishing occurs, abundance of characteristic fragile epifauna will be reduced resulting in significant damage to the feature and potentially to the underlying substrate.	The conservation objective will not be met under this management option	The conservation objective will not be met under this management option	Medium certainty. There is no direct evidence and it has been necessary to make assumptions based on knowledge of similar habitats or comparable pressures. There is good reason to believe that the assumptions are justified (eg. occurrence of species with similar characteristics).
Managed access	If fishing is maintained at low levels, the habitat may be maintained in a modified state with reduced abundance of fragile species If effort is reduced, limited recovery may occur but it is unlikely that this will be sufficient to achieve favourable condition. Removal of more impacting gears (dredges, heavy trawls) may reduce damage to substrate and improve the potential for recovery.	If appropriate management is applied, this option may help to achieve the conservation objective.	If appropriate management is applied, this option may help to achieve the conservation objective.	Medium certainty. There is no direct evidence and it has been necessary to make assumptions based on knowledge of similar habitats or comparable pressures. There is good reason to believe that the assumptions are justified (eg. occurrence of species with similar characteristics). Some assumptions have been made regarding recovery potential.
No access	The habitat will not be subject to further modification. If there are no other unregulated pressures, recovery would be expected to take place at a natural pace.	This option will help to achieve the conservation objective.	This option will help to achieve the conservation objective.	High certainty. Inevitable conclusions based on the application of common sense.

22.2 All demersal static gears (including gillnets, trammel nets, longlines, pots and traps)

Impacts

Mechanical impacts of static gear (e.g. weights and anchors hitting the seabed, hauling gear over seabed, rubbing / entangling effect of ropes) can damage some species[1]. Other species appear to be resilient to individual fishing operations but the effects of high fishing intensity are unknown[2]. Recovery will be slow[3] resulting in significant reduction or even loss of characteristic species. The individual impact of a single fishing operation may be slight but cumulative damage may be significant[2,3]. Sensitivity to low intensity potting is considered low[4].

Evidence

[1]Eno *et al.* (1996); [2]Eno *et al.* (2001); [3]Foden *et al.*, (2010); [4]Hall *et al.* (2008).							
Evidence directly related to this habitat type in the UK							
Directly relevant peer reviewed literature	✔	Directly relevant grey literature		Inference from studies on comparable habitats, gears or geographical areas.		Expert judgement	✔

JNCC/Natural England Advice

Possible management options (see introduction section 2.5)	Consequences for habitats/features	Will the option help to meet the conservation objective?		Certainty
		Maintain	Recover	
Unrestricted access	Habitat may be maintained in a modified state with reduced abundance of some species. In some cases, the degree of modification may be low. There is risk that cumulative effects from ongoing fishing may result in increasing levels of modification. If fishing pressure increases or expands to new areas, the degree of modification will be expected to increase.	This option may help to achieve the conservation objective but with a risk of deterioration	The conservation objective is unlikely to be met under this management option.	High certainty. The conclusions are supported by good quality, directly relevant scientific information.

Managed access	If fishing effort does not increase, the habitat may be maintained in a modified state and some recovery may be possible. There is risk that cumulative effects from ongoing fishing may result in increasing levels of modification. Zoned closure of specific areas within the feature known to support sensitive species could limit their exposure to fishing and allow recovery.	If appropriate management is applied, this option may help to achieve the conservation objective.	If appropriate management is applied, this option may help to achieve the conservation objective.	Medium certainty. The conclusions are supported by good quality, directly relevant scientific information. Some assumptions have been made regarding recovery potential.
No access	The habitat will not be subject to further modification. If there are no other unregulated pressures, recovery would be expected to take place at a natural pace.	This option will help to achieve the conservation objective.	This option will help to achieve the conservation objective.	High certainty. Inevitable conclusions based on the application of common sense.

23 HIGH, MODERATE AND LOW ENERGY INFRALITTORAL ROCK

May contain the FOCI:

Subtidal chalk
Intertidal underboulder communities

For areas that support these habitats please refer to the relevant FOCI habitat

Where these habitats are known to occur, management should follow the advice given for the specific feature type.

Communities on low, moderate and high energy infralittoral rock may have a very broad range of sensitivities to fishing. Some high energy environments support robust species and have relatively low sensitivity to fishing pressures. However, the relationship between energy exposure and habitat sensitivity is not always consistent and there are examples of rocky habitats in high energy environments that support fragile species and may be relatively sensitive to damage from fishing activities, because the fishing activity exerts a different type of pressure from the natural disturbance. Furthermore, the scientific literature on fishing impacts on rocky habitats contains insufficient detail to allow impacts on high, medium and low energy environments to be distinguished. A single piece of advice is therefore given to all three of these broad scale habitats, which will need to be used in conjunction with site specific evidence and advice.

23.1 All demersal towed gears (including otter trawl, beam trawl dredges)

Impacts

Towing fishing gear across rocky substrates is likely to cause damage or death of attached species[1,2] and reduce habitat complexity as boulders and cobbles associated with the hard substrate are moved around[3] . Recovery times for impacted habitat are likely to be longer than for soft substrates[4]. Sensitive species susceptible to towed gears which attach themselves to infralittoral rock include seaweeds, hydroids, bryozoans, sponges and anemones.[5,6]

Evidence

[1]Løkkeborg, (2005); [2]Engel & Kvitek (1998); [3]Freese *et al.* (1999); [4]Foden *et al.* (2010); [5]MacDonald *et al.* (1996); [6]Hall *et al.* (2008)							
No studies were found relating directly to impacts of towed gears on this habitat. The assessment is therefore based on knowledge of impacts of towed gear on other habitats with similar characteristics (hard substrate and fragile, erect epifauna) in the UK and elsewhere.							
Directly relevant peer reviewed literature		Directly relevant grey literature		Inference from studies on comparable habitats, gears or geographical areas.	✔	Expert judgement	

JNCC/Natural England Advice

Possible management options (see introduction section 2.5)	Consequences for habitats/features	Will the option help to meet the conservation objective?		Certainty
		Maintain	Recover	
Unrestricted access	If fishing occurs, abundance of characteristic fragile epifauna will be reduced resulting in significant damage to the feature and potentially to the underlying substrate.	The conservation objective will not be met under this management option	The conservation objective will not be met under this management option	Medium certainty. There is no direct evidence and it has been necessary to make assumptions based on knowledge of similar habitats or comparable pressures. There is good reason to believe that the assumptions are justified (eg. occurrence of species with similar characteristics).
Managed access	If fishing effort does not increase, the habitat will be maintained in a modified state with reduced abundance of fragile species. If effort is reduced, limited recovery may occur. It is not known if this will be sufficient to achieve favourable condition.	If appropriate management is applied, this option may help to achieve the conservation objective.	If appropriate management is applied, this option may help to achieve the conservation objective.	Medium certainty. There is no direct evidence and it has been necessary to make assumptions based on knowledge of similar habitats or comparable pressures. There is good reason to believe that the assumptions are justified (eg. occurrence of species with similar characteristics).
No access	The habitat will not be subject to further modification. If there are no other unregulated pressures, recovery would be expected to take place at a natural pace.	This option will help to achieve the conservation objective.	This option will help to achieve the conservation objective.	High certainty. Inevitable conclusions based on the application of common sense.

23.2 All demersal static gears (including pots, traps, lines and nets)

Impacts

Mechanical impacts of static gear (e.g. weights and anchors hitting the seabed, hauling gear over seabed, rubbing / entangling effect of ropes) can damage some species[1]. Other species appear to be resilient to individual fishing operations but the effects of high fishing

intensity are unknown[2]. Recovery will be slow[3] resulting in significant reduction or even loss of characteristic species. The individual impact of a single fishing operation may be slight but cumulative damage may be significant[2,3]. Sensitivity to low intensity potting is considered low[4]

Evidence

[1]Eno *et al.* (1996); [2]Eno *et al.* (2001); [3]Foden *et al.*, (2010); [4]Hall *et al.* (2008).							
Evidence directly related to this habitat type in the UK.							
Directly relevant peer reviewed literature	✔	Directly relevant grey literature		Inference from studies on comparable habitats, gears or geographical areas.		Expert judgement	✔

JNCC/Natural England Advice

Possible management options (see introduction section 2.5)	**Consequences for habitats/features**	**Will the option help to meet the conservation objective?**		**Certainty**
		Maintain	**Recover**	
Unrestricted access	Habitat may be maintained in a modified state with reduced abundance of some species.In some cases, the degree of modification may be low. There is risk that cumulative effects from ongoing fishing may result in increasing levels of modification. If fishing pressure increases or expands to new areas, the degree of modification will be expected to increase.	This option may help to achieve the conservation objective but with a potential risk of deterioration.	The conservation objective is unlikely to be met under this management option.	High certainty. The conclusions are supported by good quality, directly relevant scientific information.

Managed access	If fishing effort does not increase, the habitat may be maintained in a modified state and some recovery may be possible. There is risk that cumulative effects from ongoing fishing may result in increasing levels of modification. Recovery may be expected if effort is reduced to low levels.	If appropriate management is applied, this option may help to achieve the conservation objective.	If appropriate management is applied, this option may help to achieve the conservation objective.	Medium certainty. The conclusions are supported by good quality, directly relevant scientific information. Some assumptions have been made regarding recovery potential.
No access	The habitat will not be subject to further modification. If there are no other unregulated pressures, recovery would be expected to take place at a natural pace.	This option will help to achieve the conservation objective.	This option will help to achieve the conservation objective.	High certainty. Inevitable conclusions based on the application of common sense.

24 HIGH, MODERATE AND LOW ENERGY INTERTIDAL ROCK

May contain the FOCI:

Littoral chalk communities
Intertidal underboulder communities
Estuarine rocky habitats

For areas that support these habitats please refer to the relevant FOCI habitat

24.1 All demersal towed gears

The exposure of this broad scale feature to this activity is considered to be very low. Fishermen will generally avoid this feature to limit damage to fishing gears.

24.2 Static gear – pots and traps

The exposure of this broad scale feature to this activity is considered to be very low. Pots and traps are very rarely (if ever) deployed in the intertidal zone.

24.3 Static gear – set nets

Impacts

Assessed as high (low energy rock) to moderate sensitivity (high and moderate energy rock) to abrasion[1], however this activity is generally conducted at low levels and would be expected to affect only limited areas of the feature.

[1]Tillin *et al*. (2010)							
No studies could be found that directly address the impact of mobile gears on this habitat. The assessment is therefore based on sensitivity assessments.							
Directly relevant peer reviewed literature		Directly relevant grey literature		Inference from studies on comparable habitats, gears or geographical areas.		Expert judgement	✔

Possible management options (see introduction section 2.5)	Consequences for habitats/features	Will the option help to meet the conservation objective?		Certainty
		Maintain	Recover	
Unrestricted access	The habitat may be maintained in a modified state. There is risk that cumulative effects from ongoing fishing may result in modification. If fishing pressure increases, further modification will be expected to occur.	This option may help to achieve the conservation objective but with a risk of deterioration.	This option is unlikely to help to achieve the conservation objective.	Low certainty. Conclusions have been based on sensitivity assessments which may rely on significant assumptions or generalisations. It has not been possible to validate these assumptions.
Managed access	If fishing effort does not increase, the habitat may be maintained in a modified state. There is risk that cumulative effects from ongoing fishing may result in increasing levels of modification. If effort is reduced, limited recovery may occur. It is not known if this will be sufficient to achieve favourable condition.	If appropriate management is applied, this option may help to achieve the conservation objective.	If appropriate management is applied, this option may help to achieve the conservation objective.	Low certainty. Conclusions have been based on sensitivity assessments which may rely on significant assumptions or generalisations. It has not been possible to validate these assumptions. Some assumptions have been made regarding recovery potential.
No access	The habitat will not be subject to further modification or degration. If there are no other unregulated pressures, recovery would be expected to take place at a natural pace.	This option will help to achieve the conservation objective.	This option will help to achieve the conservation objective.	High certainty. Inevitable conclusions based on the application of common sense.

24.4 Hand gathering of shellfish, trampling, bait collection

Impacts

Increased levels of trampling result in reduced biodiversity, reduced abundance or biomass of affected species (especially macroalgae) and increased bare space and, in some cases,

clear paths[1]. However results are highly variable but demonstrate that the impacts depend on the nature of the receiving habitat and the intensity of trampling, although knowledge is incomplete, un-managed access has the potential to damage intertidal habitats[1].

Evidence

[1]Tyler-Walters (2008)							
Trampling has been relatively well studied on the intertidal rocky shores. However, there are very few studies of the effects of vehicles in the intertidal, none of which were relevant directly to access to fishing grounds.							
Directly relevant peer reviewed literature	✔	Directly relevant grey literature		Inference from studies on comparable habitats, gears or geographical areas.		Expert judgement	

JNCC/Natural England Advice

Possible management options (see introduction section 2.5)	**Consequences for habitats/features**	**Will the option help to meet the conservation objective?**		**Certainty**
		Maintain	**Recover**	
Unrestricted access	Habitat may be maintained in a modified state with reduced abundance of some species. If fishing effort is low, the degree of modification may be small. Further modification may occur if effort increases and there is risk that cumulative effects of ongoing activities may result in furthermodification.	This option may help to achieve the conservation objective but with a potential risk of deterioration.	This option may help to achieve the conservation objective but with a risk of deterioration.	Medium certainty. There is some direct evidence but it has been necessary to make assumptions based on knowledge of similar habitats or comparable pressures. There is good reason to believe that the assumptions are justified (eg. occurrence of species with similar characteristics).
Managed access	If fishing effort does not increase, the habitat may be maintained in a modified state and some recovery may be possible. There is risk that cumulative effects from ongoing fishing may result in increasing levels of modification	If appropriate management is applied, this option may help to achieve the conservation objective.	If appropriate management is applied, this option may help to achieve the conservation objective.	Medium certainty. There is some direct evidence but it has been necessary to make assumptions based on knowledge of similar habitats or comparable pressures. There is good reason to believe that the assumptions are justified (eg. occurrence of species with similar characteristics).

No access	The habitat will not be subject to further modification. If there are no other unregulated pressures, recovery would be expected to take place at a natural pace.	This option will help to achieve the conservation objective.	This option will help to achieve the conservation objective.	High certainty. Inevitable conclusions based on the application of common sense

25 Fragile sponge and anthozoan communities on subtidal rocky habitats

25.1 All demersal towed gear (including beam trawl, otter trawl, scallop dredge etc)

Impacts

This feature is generally found on steeply sloping bedrock or large boulders in depths from about 50m to just below low tide and is dominated by large, slow growing species such as branching sponges and sea fans. Where mobile demersal fishing gears come into contact with this feature they will damage and destroy the slow-growing fragile epifauna that characterises this habitat and potentially (at higher intensities) the underlying substrate[1]. Destruction of this latter attribute of the feature will have adverse consequences for recovery potential. Recovery will be slow and repeated passes of the gear will result in significant reduction or even loss of characteristic species[2,3].

Evidence

[1]Hall *et al.* (2008); [2]Foden *et al.* (2010); [3]Kaiser *et al.* (2006)							
There is no direct evidence relating to impacts of towed gears on this habitat. The assessment is therefore based on knowledge of impacts of towed gear on other habitats with similar characteristics (Hard substrate and fragile, erect epifauna) in the UK and elsewhere. These are considered to be sufficiently similar for the quality of the evidence to be considered medium.							
Directly relevant peer reviewed literature		Directly relevant grey literature		Inference from studies on comparable habitats, gears or geographical areas.	✔	Expert judgement	

Possible management options(see introduction section 2.5)	Consequences to habitat/feature	Will the option help to meet the conservation objective?		Certainty
		Maintain	Recover	
Unrestricted access	If fishing occurs, abundance of characteristic fragile epifauna will be reduced resulting in significant damage to the feature and potentially to the underlying substrate.	The conservation objective will not be met under this management option	The conservation objective will not be met under this management option	Medium certainty. There is no direct evidence and it has been necessary to make assumptions based on knowledge of similar habitats or comparable pressures. There is good reason to believe that the assumptions are justified (eg. occurrence of species with similar characteristics).
Managed access	No suitable management options could be identified that would mitigate the effects of fishing on this feature.	N/A	N/A	
No access	The habitat will not be subject to further modification. If there are no other unregulated pressures, recovery would be expected to take place at a natural pace.	This is the only management option that would help to meet the conservation objective.	This is the only management option that would help to meet the conservation objective.	High certainty. Inevitable conclusions based on the application of common sense.

25.2 All demersal static gears (including gillnets, trammel nets, longlines, pots and traps)

Impacts

Mechanical impacts of static gear (e.g. weights and anchors hitting the seabed, hauling gear over seabed, rubbing / entangling effect of ropes) can damage these fragile communities[1,2]. Recovery will be slow resulting in significant reduction or even loss of characteristic species[2]. The individual impact of a single fishing operation may be slight but cumulative damage may be significant[2,3]. Sensitivity to low intensity potting is considered low[4].

Evidence

[1]UK BAP, [2]Eno *et al.* (1996); [3]Foden *et al.* (2010); [4]Hall *et al.* 2008							
There is abundant evidence of impacts of static gears in similar habitats (rocky substrate with fragile, erect organisms) in the UK but it is not clear whether it refers to this specific habitat.							
Directly relevant peer reviewed literature		Directly relevant grey literature		Inference from studies on comparable habitats, gears or geographical areas.	✔	Expert judgement	

JNCC/Natural England Advice

Possible management options(see introduction section 2.5)	**Consequences to habitat/feature**	**Will the option help to meet the conservation objective?**		**Certainty**
		Maintain	**Recover**	
Unrestricted access	Areas that have previously been impacted by fisheries will not recover. Unimpacted areas may be fished resulting in further habitat loss.	The conservation objective will not be met under this management option	The conservation objective will not be met under this management option	Medium certainty. There is no direct evidence and it has been necessary to make assumptions based on knowledge of similar habitats or comparable pressures. There is good reason to believe that the assumptions are justified (eg. occurrence of species with similar characteristics).
Managed access	If fishing efort does not increase, the habitat may be maintained in a modified state and some recovery may be possible. There is risk that cumulative effects from ongoing fishing may result in increasing levels of modification. Recovery may be expected only if effort is reduced to low levels.	If appropriate management is applied, this option may help to achieve the conservation objective.	If appropriate management is applied, this option may help to achieve the conservation objective.	Medium certainty. There is no direct evidence and it has been necessary to make assumptions based on knowledge of similar habitats or comparable pressures. There is good reason to believe that the assumptions are justified (eg. occurrence of species with similar characteristics).

No access	The habitat will not be subject to further modification. If there are no other unregulated pressures, recovery would be expected to take place at a natural pace.	This option will help to achieve the conservation objective	This option will help to achieve the conservation objective	High certainty. Inevitable conclusions based on the application of common sense.

26 Chalk communities (includes littoral and subtidal)

26.1 All demersal towed gears (including beam, otter trawling and scallop dredging)

Impacts

Chalk can be soft, friable and easily eroded[1]. As such it has the potential to be damaged by heavy or intrusive mobile fishing gears[1], which could result in the loss of supporting habitat for associated dependent species. In general, fishermen using towed gears will avoid areas where there is a risk of snagging (as this can result in the loss of the gear and place the vessel and crew at risk). This is likely to reduce disturbance from this source in this habitat type[1]. Species that are able to bore into chalk reefs for example, piddocks and the boring sponge *Cliona celata*, are predicted to be relatively unaffected by fishing using towed gears that do not damage the reef[2]. However in general, encrusting, sessile epifauna are known to be vulnerable to removal and damage by towed gears.

Evidence

[1]BRIG (2008); [2]Roberts *et al.* (2010)							
There is no direct evidence relating to impacts of towed gears on this habitat. Roberts *et al.* (2010) concluded that the impacts of fishing activities on chalk reefs habitats are the least well studied of all the habitats examined in their review, This assessment is therefore based on knowledge of impacts of towed gear on other habitats with similar characteristics (low energy infralittoral and circalittoral rock) and habitat groups, particularly faunal turfs and slow growing epifauna							
Directly relevant peer reviewed literature		Directly relevant grey literature		Inference from studies on comparable habitats, gears or geographical areas.	✔	Expert judgement	✔

Possible management options(see introduction section 2.5)	Consequences to habitat/feature	Will the option help to meet the conservation objective?		Certainty
		Maintain	Recover	
Unrestricted access	If fishing occurs, abundance of epifauna may be reduced resulting in damage to the feature and potentially to the underlying substrate.	The conservation objective is unlikely to be met under this management option.	The conservation objective is unlikely to be met under this management option.	Medium certainty. There is no direct evidence and it has been necessary to make assumptions based on knowledge of similar habitats or comparable pressures. There is good reason to believe that the assumptions are justified (eg. occurrence of species with similar characteristics).
Managed access	If fishing effort does not increase, the habitat may be maintained in a modified state. Recovery may also be expected to take place at a natural pace.	If appropriate management is applied, this option may help to achieve the conservation objective.	If appropriate management is applied, this option may help to achieve the conservation objective.	Medium certainty. There is no direct evidence and it has been necessary to make assumptions based on knowledge of similar habitats or comparable pressures. There is good reason to believe that the assumptions are justified (eg. occurrence of species with similar characteristics).
No access	The habitat will not be subject to further modification. If there are no other unregulated pressures, recovery would be expected to take place at a natural pace.	This option will help to achieve the conservation objective	This option will help to achieve the conservation objective	High certainty. Inevitable conclusions based on the application of common sense.

26.2 All demersal static Gears (including pots, nets and lines)

Impacts

OSPAR[1] indicated that there was a low threat of an adverse impact occurring to littoral chalk communities as a result of the removal of species, including over-harvesting from fishing/potting. Whilst the potential for damage is lower per unit deployment compared to

towed gear, there is a risk of cumulative damage to sensitive species if use is intensive[2]. Species that are able to bore into chalk reefs for example, piddocks and the boring sponge *Cliona celata*, are predicted to be relatively unaffected by fishing using static gears that do not damage the reef[2]. Sensitivity to low intensity potting is considered low[2]

Evidence

[1]OSPAR (2009); [2]Roberts *et al.* (2010)							
No study has been found that addresses directly the impact of static gears on chalk communities. Our advice is therefore based on our interpretation of sensitivity assessments and the OSPAR assessment.							
Directly relevant peer reviewed literature		Directly relevant grey literature		Inference from studies on comparable habitats, gears or geographical areas.		Expert judgement	✔

JNCC/Natural England Advice

Possible management options(see introduction section 2.5)	**Consequences to habitat/feature**	**Will the option help to meet the conservation objective?**		**Certainty**
		Maintain	**Recover**	
Unrestricted access	The habitat may be maintained in a modified state with reduced abundance of some species. If fishing effort is low, the degree of modification may be small. If fishing pressure increases or expands to new areas, the degree of modification will be expected to increase.	This option may help to achieve the conservation objective but with a potential risk of deterioration	The conservation objective is unlikely to be met under this management option.	Low certainty. Conclusions have been based on sensitivity assessments which may rely on significant assumptions or generalisations. It has not been possible to validate these assumptions.
Managed access	If fishingis restricted to low or moderate levels, the habitat may be maintained in a modified state and some recovery may be possible. There is risk that cumulative effects from ongoing fishing may result in increasing levels of modification.	If appropriate management is applied, this option may help to achieve the conservation objective.	If appropriate management is applied, this option may help to achieve the conservation objective.	Low certainty. Conclusions have been based on sensitivity assessments which may rely on significant assumptions or generalisations. It has not been possible to validate these assumptions. Some assumptions have been made regarding recovery potential.

No access	The habitat will not be subject to further modification. If there are no other unregulated pressures, recovery would be expected to take place at a natural pace.	This option will help to achieve the conservation objective.	This option will help to achieve the conservation objective.	High certainty. Inevitable conclusions based on the application of common sense.

26.3 Hand gathering of shellfish, trampling, bait collection

Impacts

OSPAR[1] indicated that there was a low threat of an adverse impact occurring to littoral chalk communities as a result of shellfish harvesting. The UK BAP[2] highlights human disturbance of littoral plant and animal communities especially by trampling, stone-turning, small-scale fisheries and damage to rocks through removal of piddocks, is a potential factor affecting infralittoral chalk biota

Evidence

[1]OSPAR (2009); [2]BRIG (2008)							
No study has been found that addresses directly the impact of hand-gathering on chalk communities. Our advice is therefore based on our interpretation of expert judgement in BAP and OSPAR assessment.							
Directly relevant peer reviewed literature		Directly relevant grey literature		Inference from studies on comparable habitats, gears or geographical areas.		Expert judgement	✔

JNCC/Natural England Advice

Possible management options(see introduction section 2.5)	**Consequences to habitat/feature**	**Will the option help to meet the conservation objective?**		**Certainty**
		Maintain	**Recover**	
Unrestricted access	The habitat may be maintained in a modified state with reduced abundance of some species. If fishing activity is low, the degree of modification may be small. Further modification may occur if fishing intensity increases.	This option may help to achieve the conservation objective but with a potential risk of deterioration	The conservation objective is unlikely to be met under this management option.	Low certainty. Conclusions have been based on sensitivity assessments which may rely on significant assumptions or generalisations. It has not been possible to validate these assumptions.

Managed access	If effort is restricted to low or moderate levels, the habitat may be maintained in a modified state and some recovery may be possible. There is risk that cumulative effects from ongoing fishing may result in increasing levels of modification .	If appropriate management is applied, this option may help to achieve the conservation objective.	If appropriate management is applied, this option may help to achieve the conservation objective.	Low certainty. Conclusions have been based on sensitivity assessments which may rely on significant assumptions or generalisations. It has not been possible to validate these assumptions. Some assumptions have been made regarding recovery potential.
No access	The habitat will not be subject to further modification. If there are no other unregulated pressures, recovery would be expected to take place at a natural pace.	This option will help to achieve the conservation objective.	This option will help to achieve the conservation objective.	High certainty. Inevitable conclusions based on the application of common sense.

27 PEAT AND CLAY EXPOSURES

27.1 All towed demersal gears (including beam trawl, scallop and mussel dredge, otter trawl)

Impacts

Significant and long-lasting if not permanent damage may be caused by a single pass of the gear[1]. Scallop dredges and beam trawls will penetrate this substrate and the mussel matrix (when present) and cause ecological damage to mussel beds and non-target fauna[1]. Lighter gears do not penetrate the mussel matrix or peat but may cause ecological modification by killing associated species[1]

Evidence

[1]Hall *et al.* (2008)							
No studies could be found that directly address the impact of mobile gears on this habitat. The assessment is therefore based on sensitivity assessments.							
Directly relevant peer reviewed literature		Directly relevant grey literature		Inference from studies on comparable habitats, gears or geographical areas.		Expert judgement	✔

JNCC/Natural England Advice

Possible management options (see introduction section 2.5)	**Consequences for habitats/features**	**Will the option help to meet the conservation objective?**		**Certainty**
		Maintain	**Recover**	
Unrestricted access	The habitat and underlying peat/clay may be degraded. If the peat/clay is removed entirely, recovery will not occur.	The conservation objective is unlikely to be met under this management option.	The conservation objective is unlikely to be met under this management option.	Low certainty. Conclusions have been based on sensitivity assessments which may rely on significant assumptions or generalisations. It has not been possible to validate these assumptions.

Managed access	Restriction of more penetrating gears (beam trawl, scallop dredge) while allowing less penetrating gears (eg. light otter trawl) will reduce modification of the substrate. If effort is restricted to low levels, the habitat may be maintained in a modified state and some recovery may be possible. There is risk that cumulative effects from ongoing fishing may result in increasing levels of modification.. If the peat and clay substrate has been entirely removed, no recovery will be expected.	If appropriate management is applied, this option may help to achieve the conservation objective.	If appropriate management is applied, this option may help to achieve the conservation objective.	Low certainty. Conclusions have been based on sensitivity assessments which may rely on significant assumptions or generalisations. It has not been possible to validate these assumptions. Some assumptions have been made regarding recovery potential.
No access	The habitat will not incur damage. If sufficient substrate remains, recovery will be expected to take place at a natural pace in the absence of any other unregulated pressure.	This option will help to achieve the conservation objective.	This option will help to achieve the conservation objective.	High certainty. Inevitable conclusions based on the application of common sense.

27.2 All demersal static gears (including pots, traps gillnets, lines etc.)

Impacts

Anchors may penetrate and damage substrate and nets and lines may remove seaweed reducing habitat complexity[1]. The severity of the effect will be related to fishing intensity with low sensitivity at low fishing intensity and medium sensitivity at high fishing intensity[1].

Evidence

[1]Hall *et al.* (2008)							
No studies could be found that directly address the impact of mobile demersal gears on this habitat. The assessment is therefore based on sensitivity assessments.							
Directly relevant peer reviewed literature		Directly relevant grey literature		Inference from studies on comparable habitats, gears or geographical areas.		Expert judgement	✔

JNCC/Natural England Advice

Possible management options (see introduction section 2.5)	Consequences for habitats/features.	Will the option help to meet the conservation objective?		Certainty
		Maintain	Recover	
Unrestricted access	Some modification will occur if fishing effort is high.	This option may help to achieve the conservation objective but with a risk of deterioration if fishing pressure is very high	This option is unlikely to achieve the conservation objective.	Low certainty. Conclusions have been based on sensitivity assessments which may rely on significant assumptions or generalisations. It has not been possible to validate these assumptions.
Managed access	If fishing is limited to low or moderate levels, the habitat may be maintained in a modified state. There is risk that cumulative effects from ongoing fishing may result in increasing levels of modification	If appropriate management is applied, this option may help to achieve the conservation objective.	If appropriate management is applied, this option may help to achieve the conservation objective.	Low certainty. Conclusions have been based on sensitivity assessments which may rely on significant assumptions or generalisations. It has not been possible to validate these assumptions. Some assumptions have been made regarding recovery potential.
No access	The habitat will not incur damage. If sufficient substrate remains, recovery will be expected to take place at a natural pace in the absence of any other unregulated pressure..	This option will help to achieve the conservation objective.	This option will help to achieve the conservation objective.	High certainty. Inevitable conclusions based on the application of common sense.

27.3 Hand Gathering and bait collection.

Impacts

Assessed as medium sensitivity to trampling but high sensitivity to high levels of vehicular access[1]. Mussel beds and other epifauna associated with this habitat may be impacted by repeated trampling[1,2]. Trampling and vehicular access may potentially damage the peat and clay substrates (although there is no direct evidence for this having occurred)[1].

Evidence

[1]Tyler-Walters and Arnold (2008); [2]Smith and Murray (2005)							
No direct evidence could be found for the impact of hand gathering and bait collection on this habitat. The assessment is therefore based on sensitivity assessments for trampling and vehicular access.							
Directly relevant peer reviewed literature		Directly relevant grey literature		Inference from studies on comparable habitats, gears or geographical areas.	✔	Expert judgement	✔

JNCC/Natural England Advice

Possible management options (see introduction section 2.5)	**Consequences for habitats/features**	**Will the option help to meet the conservation objective?**		**Certainty**
		Maintain	**Recover**	
Unrestricted access	Damage to the peat and clay substrates and associated biological communities may occur if effort level is high. Repeated exposure may result in complete loss of the substrate.	This option may help to achieve the conservation objective but with a potential risk of deterioration if fishing pressure is very high	The conservation objective is unlikely to be met under this management option.	Medium certainty. There is no direct evidence and it has been necessary to make assumptions based on knowledge of similar habitats or comparable pressures. There is good reason to believe that the assumptions are justified (eg. occurrence of species with similar characteristics).
Managed access	If fishing is restricted to low or moderate levels and vehicular access prevented, the habitat may be maintained in a modified state. There is risk that cumulative effects from ongoing fishing may result in increasing levels of modification. If sufficient substrate remains, some recovery will occur.	If appropriate management is applied, this option may help to achieve the conservation objective.	If appropriate management is applied, this option may help to achieve the conservation objective.	Medium certainty. There is no direct evidence and it has been necessary to make assumptions based on knowledge of similar habitats or comparable pressures. There is good reason to believe that the assumptions are justified (eg. occurrence of species with similar characteristics).

No access	The habitat will not incur damage. If sufficient substrate remains, recovery will be expected to take place at a natural pace in the absence of any other unregulated pressure.	This option will help to achieve the conservation objective.	This option will help to achieve the conservation objective.	High certainty. Inevitable conclusions based on the application of common sense.

28 ESTUARINE ROCKY HABITATS

28.1 All demersal towed gears (including beam trawl, otter trawl, seine, dredges etc.)

Impacts

Estuarine rocky habitats are very variable between subtidal to intertidal areas and they support a variety of species across this range. Communities in naturally sheltered conditions, such as those of estuarine rocky habitats, are not resilient to the type of impacts caused by mobile fishing gear[1.] Towing fishing gear across rocky substrates is likely to cause damage or death of attached species[2,3], and reduce habitat complexity as boulders and cobbles are moved around[4.]

Evidence

[1]BRIG (2008); [2]Løkkeborg, (2005); [3]Engel & Kvitek (1998); [4]Freese *et al.* 1999.							
There is no direct evidence relating to impacts of towed gears on this habitat. The assessment is therefore based on knowledge of impacts of towed gear on other habitats with similar characteristics (low energy infralittoral and circalittoral rock).							
Directly relevant peer reviewed literature		Directly relevant grey literature		Inference from studies on comparable habitats, gears or geographical areas.	✔	Expert judgement	✔

JNCC/Natural England Advice

Possible management options (see introduction section 2.5)	**Consequences for habitats/features**	**Will the option help to meet the conservation objective?**		**Certainty**
		Maintain	**Recover**	
Unrestricted access	Abundance of characteristic fragile epifauna will be reduced resulting in significant damage to the feature and potentially to the underlying substrate.	The conservation objective will not be met under this management option	The conservation objective will not be met under this management option	Medium certainty. There is no direct evidence and it has been necessary to make assumptions based on knowledge of similar habitats or comparable pressures. There is good reason to believe that the assumptions are justified (eg. occurrence of species with similar characteristics).

Managed access	Where impact occurs, if fishing is restricted, the habitat will be maintained in a modified state with reduced abundance of fragile species. If effort is reduced, limited recovery may occur. It is not known if this will be sufficient to achieve favourable condition. Removal of heavier gears (dredges, heavy trawls) may reduce damage to substrate and improve the potential for recovery.	If appropriate management is applied, this option may help to achieve the conservation objective.	If appropriate management is applied, this option may help to achieve the conservation objective.	Medium certainty. There is no direct evidence and it has been necessary to make assumptions based on knowledge of similar habitats or comparable pressures. There is good reason to believe that the assumptions are justified (eg. occurrence of species with similar characteristics).
No access	The habitat will not be subject to further modification. If there are no other unregulated pressures, recovery would be expected to take place at a natural pace.	This option will help to achieve the conservation objective.	This option will help to achieve the conservation objective.	High certainty. Inevitable conclusions based on the application of common sense.

28.2 All demersal static gears (including pots, traps, gillnets, lines etc.)

Impacts

Mechanical impacts of static gear (e.g. pots, weights and anchors hitting the seabed, hauling gear over seabed, rubbing/entangling effect of ropes) can damage some species[1]. Other species appear to be resilient to individual fishing operations but the effects of high fishing intensity are unknown[2]. Recovery will be slow[3] resulting in significant reduction or even loss of characteristic species. The individual impact of a single fishing operation may be slight but cumulative damage may be significant[2,3]. Sensitivity to low intensity potting is considered low[4]

Evidence

[1]Eno *et al*. (1996); [2]Eno *et al*. (2001); [3]Foden *et al.* (2010); [4]Hall *et al*. (2008).

There is no direct evidence relating to impacts of static gears on this habitat. The assessment is therefore based on knowledge of impacts of static gear on other habitats with similar characteristics (low energy infralittoral and circalittoral rock).

Directly relevant peer reviewed literature		Directly relevant grey literature		Inference from studies on comparable habitats, gears or geographical areas.	✔	Expert judgement	✔

JNCC/Natural England Advice

Possible management options (see introduction section 2.5)	Consequences for habitats/features	Will the option help to meet the conservation objective?		Certainty
		Maintain	Recover	
Unrestricted access	Habitat may be maintained in a modified state with reduced abundance of some species. If fishing effort is low, the degree of modification may be small. Further modificationmay occur if fishing effort increases.	This option may help to achieve the conservation objective but with a potential risk of deterioration.	The conservation objective is unlikely to be met under this management option.	Medium certainty. There is no direct evidence and it has been necessary to make assumptions based on knowledge of similar habitats or comparable pressures. There is good reason to believe that the assumptions are justified (eg. occurrence of species with similar characteristics).
Managed access	Where impacts occur, if fishing is restricted, the habitat may be maintained in a modified state. Recovery may be expected if effort is reduced to low levels.	If appropriate management is applied, this option may help to achieve the conservation objective.	If appropriate management is applied, this option may help to achieve the conservation objective.	Medium certainty. There is no direct evidence and it has been necessary to make assumptions based on knowledge of similar habitats or comparable pressures. There is good reason to believe that the assumptions are justified (eg. occurrence of species with similar characteristics).
No access	The habitat will not be subject to further modification. If there are no other unregulated pressures, recovery would be expected to take place at a natural pace.	This option will help to achieve the conservation objective.	This option will help to achieve the conservation objective.	High certainty. Inevitable conclusions based on the application of common sense.

29 INTERTIDAL UNDERBOULDER COMMUNITIES

29.1 Hand gathering of shellfish and bait species (e.g. peeler crabs) and foot and vehicle access

Impacts

The community is classified as moderately sensitive to desiccation and moderately sensitive to displacement and physical abrasion[1]. Boulder turning during bait collecting and gathering adversely affects intertidal boulder habitats, and at high levels and without returning boulders to their original position can degrade habitat stability and reduce biodiversity[2]. No specific examples of the effect of access on this habitat were found[3]. But the community was considered to have a medium sensitivity to foot access and high sensitivity to vehicle access[3].

Evidence

[1]Hiscock (2008); [2]Davenport and Davenport (2006); [3]Tyler-Walters and Arnold (2008)							
There is limited peer reviewed literature from the UK directly applicable to the habitat. The advice is principally based on Marlin sensitivity assessments and expert judgement.							
Directly relevant peer reviewed literature	✔	Directly relevant grey literature	✔	Inference from studies on comparable habitats, gears or geographical areas.		Expert judgement	✔

Evidence

Possible management options (see introduction section 2.5)	Consequences for habitats/features	Will the option help to meet the conservation objective?		Certainty
		Maintain	Recover	
Unrestricted access	The habitat will be maintained in a modified state and may be subject to continued modification. There is risk that cumulative effects from ongoing fishing may result in increasing levels of modification.	This option may help to achieve the conservation objective but with a significant risk of deterioration.	The conservation objective is unlikely to be achieved under this option.	Medium certainty. There is some direct evidence but it has been necessary to make assumptions based on knowledge of similar habitats or comparable pressures. There is good reason to believe that the assumptions are justified (eg. occurrence of species with similar characteristics).

Managed access	Where impacts occur, if fishing is restricted, the habitat may be maintained in a modified state. There is risk that cumulative effects from ongoing fishing may result in increasing levels of modification. If fishing is restricted to low levels or gathering practice improved (e.g. boulders and stones replaced), limited recovery may occur. It is not known if this will be sufficient to achieve favourable condition.	If appropriate management is applied, this option may help to achieve the conservation objective.	If appropriate management is applied, this option may help to achieve the conservation objective.	Medium certainty. There is some direct evidence but it has been necessary to make assumptions based on knowledge of similar habitats or comparable pressures. There is good reason to believe that the assumptions are justified (eg. occurrence of species with similar characteristics).
No access	The habitat will not be subject to further modification. If there are no other unregulated pressures, recovery Recovery would be expected to take place at a natural pace.	This option will help to achieve the conservation objective.	This option will help to achieve the conservation objective.	High certainty. Inevitable conclusions based on the application of common sense.

30 TIDE-SWEPT CHANNELS

30.1 All gears

Impacts

This habitat has a limited distribution due to its dependence upon very specific coastal geomorphological traits. Tide swept channels may be dominated by invertebrates including barnacles, ascidians, anthozoans, sponges or by kelp and other seaweeds. These different communities can be expected to vary greatly in their sensitivity to fishing impacts; however, no study was found that evaluated fishing impacts on tide-swept channels directly.

It is therefore not possible to give general advice for this FOCI; rather management should be determined at the level of individual sites. In the absence of specific advice, a reasonable proxy may be to consider the advice given for other habitats with similar communities, e.g. high energy intertidal rock, high energy infralittoral rock, high energy circalittoral rock, subtidal biogenic reef, blue mussel beds, file shell beds, maërl, horse mussel beds, native oyster beds, estuarine rocky habitats, fragile sponge and anthrozoan communities on subtidal rocky habitats, littoral chalk and subtidal chalk.

Evidence

There is no direct evidence for fishing gear impacts on the tide swept channel habitat. Biological communities of tide swept channels may include seaweed dominated communities, barnacles or ascidians or sponges that themselves are characteristic of other FOCI. It is suggested that the dominant communities *within* are used as a proxy for assessing fishing impacts on this habitat.							
Directly relevant peer reviewed literature		Directly relevant grey literature		Inference from studies on comparable habitats, gears or geographical areas.		Expert judgement	✔

JNCC/Natural England advice

Possible management options(see introduction section 2.5)	**Consequences to habitat/feature**	**Will the option help to meet the conservation objective?**		**Certainty**
		Maintain	**Recover**	
All management options	Will be heavily dependent on the specific nature of the habitat. This can only be judged at the level of individual sites	This can only be judged at the level of individual sites	This can only be judged at the level of individual sites	Medium certainty. Based on expert knowledge.

31 References

Anon. 1992. An experimental study on the impact of clam dredging on soft sediment macroinvertebrates. (Contractor: Southern Science, Hampshire Laboratory, Otterbourne, Hants.). Unpublished report to English Nature. (English Nature Research Report, No. 13), Peterborough.

Anon. 2010. Ecosystem concepts for sustainable bivalve mariculture. Committee on best practices for shellfish mariculture and the effects of commercial activities in Drakes Estero, Pt. Reyes National Seashore, California. ISBN: 0-309-14696-8, 190 pp. Downloaded from: http://www.nap.edu/catalog/12802.html (March 2011).

ASMFC. 2000. Evaluating fishing gear impacts to submerged aquatic vegetation and determining mitigation strategies. Atlantic States Marine Fisheries Commission Habitat Management Series No. 5, Washington, D.C. 38pp.

Ball, B.J., Fox, G. and Munday, B.W. 2000. Long- and short-term consequences of a *Nephrops* trawl fishery on the benthos and environment of the Irish Sea. ICES Journal of Marine Science, 57: 1315–1320.

Barbera, C., Bordehore, C., Borg, J., Glémarec, M., Grall, J., Hall-Spencer, J. M., de la Huz, C., Lanfranco, E., Lastra, M., Moore, P., Mora, J., Pita, M., Ramos-Esplá, A., Rizzo, M., Sánchez-Mata, A., Seva, A., Schembri, P. and Valle, C. 2003. Conservation and management of northeast Atlantic and Mediterranean maerl beds. Aquatic Conservation: Marine and Freshwater Ecosystems, 13: S65–S76.

Bell, M.C. and Walker, P. 2007. Cockle suction dredging in The Wash and North Norfolk Coast European marine site, Part II - analysis of existing data. Research Report to English Nature.

Bergmann, M.J.N. and Van Santbrink, J.W. 2000. Fishing mortality and populations of megafauna in sandy sediments. In: Kaiser M.J. and de Groot S.J. (eds.) Effects of fishing on non-target species and habitats. Blackwell, Oxford.

Bordehore, C., Ramos-Espla, A.A. and Rodriguez, R. 2003. Comparative study of two maërl beds with different otter trawling history, southeast Iberian Peninsula. Aquatic conservation: Marine and Freshwater Ecosystems, 13: S43–S54.

Bradshaw, C., Veale, L.O., Hill, A.S. and Brand, A.R. 2000. The effects of scallop dredging on gravely seabed communities. in Kaiser M.J. and de Groot S.J. (eds.) Effects of fishing on non-target species and habitats. Blackwell, Oxford.

BRIG. 2008. UK Biodiversity Action Plan; Priority Habitat Descriptions. ed. Maddock, A. http://www.ukbap.org.uk/library/UKBAPPriorityHabitatDescriptionsfinalAllhabitats20081022.pdf

Brosnan, D.M. and Crumrine, L.L. 1994. Effects of human trampling on marine rocky shore communities. Journal of Experimental Marine Biology and Ecology, 177: 79–97.

Brown, B. and Wilson Jr, W.H. 1997. The role of commercial digging of mudflats as an agent for change of infaunal intertidal populations. Journal of Experimental Marine Biology and Ecology, 218: 49–61.

Bishop, M.J., Rivera, J.A., Irlandi, E.A., Ambrose Jr, W.G. and Peterson, C.H. 2005. Spatio-temporal patterns in the mortality of bay scallop recruits in North Carolina: investigation of a life history anomaly. Journal of Experimental Marine Biology and Ecology, 315: 127–146.

Brown, R.A. 1989. Bottom trawling in Strangford Lough: problems and policies. In *Proceedings from the North Sea meeting*, Rotterdam.

Buschbaum, C., Dittmann, S., Hong, J.S., Hwang, I.S., Strasser, M., Thiel, M., Valdivia, N., Yoon, S.P. and Reise, K. 2009. Mytilid mussels: Global habitat engineers in coastal sediments. Helgoland Marine Research, 63: 47–58.

Collie, J.S., Hall, S.J., Kaiser. M.J. and Poiner, I.R. 2000. A quantitative analysis of fishing impacts on shelf-sea benthos. Journal of Animal Ecology, 69: 785–798.

Collie, J.S., Hermsen, J.M., Valentine, P.C. and Almeida, F.P. 2005. Effects of fishing on gravel habitats: assessment and recovery of benthic megafauna on Georges Bank. American Fisheries Society Symposium. American Fisheries Society. 325pp.

Cunningham, P.N., Hawkins, S.J., Jones, H.D. and Burrows, M.T. 1984. The biogeography and ecology of *Sabellaria alveolata*. Nature Conservancy Council CSD report, No 535.

Davenport, J. and Davenport, J.L. 2006. The impact of tourism and personal leisure transport on coastal environments: a review. Estuarine, Coastal and Shelf Science, 67: 280–292.

Dernie, K.M., Kaiser, M.J. and Warwick, R.M. 2003. Recovery rates of benthic communities following physical disturbance. Journal of Animal Ecology, 72: 1043–1056.

Dolmer, P. and Geitner, K. 2004. Integrated Coastal Zone Management of cultures and fishery of mussels in Limfjorden, Denmark. ICES CM 2004/V:07. 9pp. Downloaded from: http://www.ices.dk/products/CMdocs/2004/V/V0704.pdf

Dolmer, P., Kristensen, T., Christiansen, M., Petersen, M., Kristensen, P. and Hoffmann, E. 1999. Short-term impact of blue mussel dredging (*Mytilus edulis* L.) on a benthic community. Journal of Shellfish Research, 18: 714.

Erftemeijer, P.L.A. and Lewis, R.R.R. 2006. Environmental impacts of dredging on seagrasses: a review. Marine Pollution Bulletin, 52: 1553–1572.

Engel, J. and Kvitek, R. 1998. Effects of otter trawling on a benthic community in Monterey Bay National Marine Sanctuary. Conservation Biology, 12: 1204–1214.

Eno, N.C., MacDonald, D. and Amos, S.C. 1996. A study on the effects of fish (Crustacea/Molluscs) traps on benthic habitats and species. Final report to the European Commission. Study Contract, no. 94/076.

Eno, N.C., MacDonald, D.S., Kinnear, J.A.M., Amos, S.C., Chapman, C.J., Clark, R.A., Bunker, F.S.D. and Munro C. Effects of crustacean traps on benthic fauna. ICES Journal of Marine Science, 58: 11–20.

Foden, J., Rogers, S.I. and Jones, A.P. 2010. Recovery of UK seabed habitats from benthic fishing and aggregate extraction- towards a cumulative impact assessment. Marine Ecology Progress Series, 411: 259–270.

Fosså, J.H., Mortensen P. B. and Furevik, D.M. 2000. Lopheliakorallrev langs norskekysten. Forekomst og tilstand (*Lophelia* coral reefs in Norway. Distribution and effects of fishing) Fisken og Havet, No 2. 94 pp. (in Norwegian with abstract and legends to tables and figures in English).

Fosså, J.H., Mortensen, P.B. and Furevik, D.M. 2002. The deep-water coral *Lophelia pertusa* in Norwegian waters: distribution and fishery impacts. Hydrobiologia, 471: 1–12.

Freese, L., Auster, P.J., Heifetz, J. and Wing, B.L. 1999. Effects of trawling on seafloor habitat and associated invertebrate taxa in the Gulf of Alaska. Marine Ecology Progress Series, 182: 119–126.

Gardner, J. and Elliott, M. 2001. UK Biodiversity Action Plan Native Oyster Species Information Review. Final Report English Nature, Institute of Estuarine and Coastal Studies (Report: Z123-F-2001), University of Hull. 192pp.

Greathead, C.F., Donnan, D.W., Mair, J.M. and Saunders, G.R. 2007. The sea pens *Virgularia mirabilis*, *Pennatula phosphorea* and *Funiculina quadrangularis*: distribution and conservation issues in Scottish waters. Journal of the Marine Biological Association of the United Kingdom, 87: 1095–1103.

Grehan, A., Unnithan, V., Wheeler, A., Monteys, X., Beck, T., Wilson, M., Guinan, J., Foubert, A., Klages, M. and Thiede, J. 2004. Evidence of major fisheries impact on cold-water corals in the deep waters off the Porcupine Bank, west coast of Ireland: are interim management measures required? ICES CM 2004/AA:07.

Hall, K., Paramor, O.A.L., Robinson L.A., Winrow-Giffin, A., Frid C.L.J., Eno, N.C., Dernie, K.M., Sharp, R.A.M., Wyn, G.C. and Ramsay, K. 2008. Mapping the sensitivity of benthic habitats to fishing in Welsh waters- development of a protocol. CCW [Policy Research] Report No: [8/12], 85pp.

Hall, S., 1999. The effects of fishing on marine ecosystems and communities. Oxford Blackwell Science.

Hall, S.J. and Harding, M.J.C. 1997. Physical disturbance and marine benthic communities: the effects of mechanical harvesting of cockles on non-target benthic infauna. Journal of Applied Ecology, 34: 497–517.

Hall-Spencer, J., Allain, V. and Fossa, J.H. 2002. Trawling damage to Northeast Atlantic ancient coral reefs. Proceedings of the Royal Society, London B, 269: 507–511.

Hall-Spencer, J.M. and Moore, P.G. 2000. Scallop dredging has profound, long-term impacts on maërl habitats. ICES Journal of Marine Science, 57: 1407–1415.

Hartnoll, R. G., 1998. Circalittoral faunal turf biotopes: An overview of dynamics and sensitivity characteristics for conservation management of marine SACs, Volume VIII. Scottish Association of Marine Sciences, Oban, Scotland.

Hauton, C., Hall-Spencer, J.M. and Moore, P.G. 2003. An experimental study of the ecological impacts of hydraulic bivalve dredging on maërl. ICES Journal of Marine Science, 60, 381–392.

Herlyn, M. and Millat, G. 2000. Decline of the intertidal blue mussel (*Mytilus edulis*) stock at the coast of Lower Saxony (Wadden Sea) and influence of mussel fishery on the development of young mussel beds. Hydrobiologia, 426: 203–210.

Hiddink, J.G. 2003. Effects of suction-dredging for cockles on non-target fauna in the Wadden Sea. Journal of Sea Research, 50: 315–323.

Hinz, H., Prieto, V. and Kaiser, M.J. 2009. Trawl disturbance on benthic communities: chronic effects and experimental predictions. Ecological Applications, 19: 761–773.

Hiscock, K. 2008. Underboulder communities. Marine Life Information Network: Biology and Sensitivity Key Information Sub-programme [on-line]. Plymouth: Marine Biological Association of the United Kingdom. [cited 16/02/2011]. Available from: http://www.marlin.ac.uk/habitatsensitivity.php?habitatid=371andcode=1997

Holt, T.J., Rees, E.I., Hawkins, S.J. and Seed R. 1998. Biogenic Reefs (volume IX). An overview of dynamic and sensitivity characteristics for conservation management of marine SACs. Scottish Association for Marine Science (UK Marine SACs Project). 170 pp.

ICES advice, 2005 – 2010 see www.ices.dk

Ismail, N. 1985. The effects of hydraulic dredging to control oyster drills on benthic macrofauna of oyster grounds in Delaware Bay, New Jersey. Internationale Revue Der Gesamten Hydrobiologie.Berlin, 70: 379–395.

Jackson, A. and Wilding, C. 2009. *Ostrea edulis*. Native oyster. Marine Life Information Network: Biology and Sensitivity Key Information Sub-programme [on-line]. Plymouth: Marine Biological Association of the United Kingdom. Available from: http://www.marlin.ac.uk/speciessensitivity.php?speciesID=3997

Jennings, S. and Kaiser, M. J. 1998. The effects of fishing on marine ecosystems. Advances in Marine Biology, 34: 201–352.

Jones, N.S. 1951. The bottom fauna off the south of the Isle of Man. Journal of Animal Ecology, 20: 132–144.

Jones, L.A., Hiscock, K. and Connor, D.W. 2000. Marine habitat reviews. A summary of ecological requirements and sensitivity characteristics for the conservation and management of marine SACs. Joint Nature Conservation Committee, Peterborough. (UK Marine SACs Project report).

Kaiser M.J., Clarke, K.R., Hinz, H., Austen, M.C.V., Somerfield P.J. and Karakassis, I. 2006. Global analysis of response and recovery of benthic biota to fishing. Marine Ecology Progress Series, 311: 1–14.

Kinnear J.A.M., Barkel, P.J., Mojsiewicz, W.R., Chapman, C.J., Holbrow, A.J., Barnes, C. and Greathead C.F.F. 1996. Effects of Nephrops creels on the environment. Fisheries Research Services Report No 2/96.

Løkkeborg, S. 2005. Impacts of trawling and scallop dredging on benthic habitats and communities. FAO Fisheries Technical Paper. No. 472. Rome, FAO. 58pp.

MacDonald, D.S., Little, M., Eno, C.N., Hiscock, K. 1996. Disturbance of benthic species by fishing activities: a sensitivity index. Aquatic Conservation: Marine and Freshwater Ecosystems, 6: 257–268.

Magorrian, B.H. and Service, M. 1998. Analysis of underwater visual data to identify the impact of physical disturbance on horse mussel (*Modiolus modiolus*) beds. Marine Pollution Bulletin, 36: 354–359.

Neckles, H.A., Short, F.T., Barker, S. and Kopp, B.S. 2005. Disturbance of eelgrass *Zostera marina* by commercial mussel *Mytilus edulis* harvesting in Maine: dragging impacts and habitat recovery. Marine Ecology Progress Series, 285: 57–73.

OSPAR 2006. OSPAR Case Reports for the Initial List of Threatened and/or Declining Species and Habitats in the OSPAR Maritime Area. Publication no. 276, pp 125–128 http://qsr2010.ospar.org/media/assessments/Species/P00491_maerl.pdf

OSPAR. 2009. Background document for littoral chalk communities. OSPAR Commission, London. see: http://www.ospar.org/documents/dbase/publications/P00424_LittoralChalk.pdf

OSPAR. 2010a. Background document for seapen and burrowing megafauna communities. OSPAR Commission. 27pp. see: http://www.ospar.org/documents/dbase/publications/P00481_Seapen%20and%20burrowing%20megafauna.pdf

OSPAR 2010b. Quality status report 2010. Case Reports for the OSPAR List of threatened and/or declining species and habitats update http://qsr2010.ospar.org/media/assessments/Species/p0010_supplements/CH10_04_Sabellaria_spinulosa.pdf

Peterson, C.H., Summerson, H.C., and Fegley, S.R. 1987. Ecological consequences of mechanical harvesting of clams. Fishery Bulletin, U.S., 85: 281–298.

Roberts, D., Davies, C., Mitchell, A., Moore, H., Picton, B., Portig, A., Preston, J., Service, M., Smyth, D. Strong, D. and Vize, S. 2004. Strangford Lough ecological change investigation (SLECI) Report to the environment and heritage service by the Queen's University, Belfast. 7pp.

Roberts, C., Smith, C., Tillin, H. Tyler-Walters, H, 2010. Review of existing approaches to evaluate marine habitat vulnerability to commercial fishing activities. Environment Agency report No SC080016/R3

Rothschild, B.J., Ault, J.S., Goulletquer, P. and Heral, M. 1994. Decline of the Chesapeake Bay oyster population: a century of habitat destruction and overfishing. Marine Ecology Progress Series, 111: 29–39.

Sewell, J. and Hiscock, K. 2005. Effects of fishing within UK European Marine Sites: guidance for nature conservation agencies. Report to the Countryside Council for Wales, English Nature and Scottish Natural Heritage from the Marine Biological Association. CCW Contract FC 73-03-214A. 195 pp.

Smith, J.R. and Murray, S.N. 2005. The effects of experimental bait collection and trampling on a *Mytilus californianus* mussel bed in southern California. Marine Biology, 147: 699–706.

Tillin, H.M., Hull, S.C. and Tyler-Walters, H. 2010. Development of a sensitivity matrix (pressures-MCZ/MPA features). Report to the Department of the Environment, Food and Rural Affairs from ABPMer, Southampton and the Marine Life Information Network (MarLIN) Plymouth: Marine Biological Association of the UK. Defra Contract No. MB102 Task 3a, Report No 22.

Tudela, S. 2004. Ecosystem effects of fishing in the Mediterranean: an analysis of the major threats of fishing gear and practices to biodiversity and marine habitats. Studies and Reviews. General Fisheries Commission for the Mediterranean. No. 74. Rome, FAO. 44pp.

Tyler-Walters, H. 2008. *Mytilus edulis*. Common mussel. Marine Life Information Network: Biology and Sensitivity Key Information Sub-programme [on-line]. Plymouth: Marine Biological Association of the United Kingdom. [cited 21/02/2011]. Available from: http://www.marlin.ac.uk/speciesbenchmarks.php?speciesID=3848

Tyler- Walters, H. and Arnold, C. 2008. Sensitivity of intertidal benthic habitats to impacts caused by access to fishing grounds CCW Policy Research Report No. 08/13.

UKBAP. 2000. UK Biodiversity Group Tranche 2 Action Plans. Volume V – maritime species and habitats. English Nature, Peterborough. 242 pp.

Van Dolah, R.F., Wendt, P.H. and Levisen, M.V. 1991. A study of the effects of shrimp trawling on benthic communities in two South Carolina sounds. Fisheries Research, 12: 139–156.

Vorberg, R. 2000. Effects of shrimp fisheries on reefs of *Sabellaria spinulosa* (Polychaeta). ICES Journal of Marine Science, 57: 1416–1420.

Veale, L.O., Hill, A.S., Hawkins, S.J. and Brand, A.R. 2000. Effects of long-term physical disturbance by commercial scallop fishing on subtidal epifaunal assemblages and habitats. Marine Biology, 137: 325-337.

Wilson, S., Blake, C., Berges, J.A. and Maggs, C.A. 2004. Environmental tolerances of free-living coralline algae (maërl): implications for European marine conservation. Biological Conservation, 120: 279–289.