DEVELOPMENT OF A HARD SUBSTRATUM BENTHIC INVERTEBRATE WATER FRAMEWORK DIRECTIVE COMPLIANT CLASSIFICATION TOOL: SCOPING STUDY AND INITIAL WORK

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This report provides a starting-point review. Additions, errors and omissions should be drawn to the attention of the first author: khis@mba.ac.uk

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CONTENTS

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ABSTRACT

The Water Framework Directive (WFD) (Directive 2000/60/EC) incorporates ecological status assessments in conjunction with hydromorphology and physico-chemical assessments. The determination of ecological quality elements includes benthic invertebrates. This report identifies, for hard substrata, likely indicator species of quality, a metric to bring together different elements of survey results to produce a numerical indicator, and survey forms that should be used to trial the approach developed.

In order to correspond with the typologies established for coastal and transitional waters, shore types are based on those developed by the Marine Environment Monitoring Group. The types are equated to the Algal tool developed for quality assessment and to the European Union Nature Information System (EUNIS) classification level 2 with the addition of salinity type, which is not a part of the EUNIS classification at level 2. Level 3 of the classification is used in field recording.

In order to identify the number of invertebrate species that might be expected to occur on a rocky shore or on circalittoral rock, the MNCR database was used as a source of survey records. For the present report, only data from Shetland has been analysed because of time constraints although data analysis continues.

At the same time as the development of a hard substratum tool described here, the various terms previously used to express tolerance or intolerance were rationalised. It was determined that the following terminology would be used: **Highly intolerant** (likely to be absent as a result of the factor); **Intolerant** (likely to be present in lower abundance than expected); **Neutral/Tolerant**; **Favoured** (likely to be present in higher abundance than expected); **Highly Favoured** (likely to be present in much higher abundance than expected).

Having established the approximate number of species **FROM THE FIELD SURVEY CHECKLIST** which might be expected on a particular type of shore or circalittoral rocky area in a particular geographical area, it is suggested that the following metric is trialed:

Quality = (P + (((1-PF) + (1-A))/2) +PI) / 3

Where:

P = Number of characteristic species present as a proportion of those which are expected for targeted typology (Range 0-1);

PF = Number of Pressure-Favoured species present as a proportion of those which may be possibly be present on each type of shore or circalittoral rock (Range 0-1);

PI = Number of Pressure-Intolerant species present as a proportion of those which may be possibly be present on each type of shore or circalittoral rock (Range 0-1);

A = Number of non-native (Alien) species present as a proportion of those which may be possibly present in targeted typology (Range 0-1).

Methods are suggested for field trials. It is suggested that testing in 2005 is restricted to intertidal areas and application of the check lists is supported by identification aids.

DEVELOPMENT OF A HARD SUBSTRATUM BENTHIC INVERTEBRATE WATER FRAMEWORK DIRECTIVE COMPLIANT CLASSIFICATION TOOL: SCOPING STUDY AND INITIAL WORK

1. INTRODUCTION

The Water Framework Directive (WFD) (Directive 2000/60/EC) incorporates ecological status assessments in conjunction with hydromorphology and physico-chemical assessments. The determination of ecological status is itself an integrated process, combining the 'health' of several biological water quality elements. For marine water bodies (i.e 'transitional' (estuarine) and 'coastal' waters), the biological quality elements contributing to the ecological status assessment are:

Fish

Phytoplankton,

Macroalgae,

Angiosperms, and

Benthic invertebrates.

For sediment benthic invertebrates and for macroalgae, classification tools have been under development for some time. This report describes work towards the development of a tool for hard substratum benthic invertebrates that will indicate water quality to the following status classes:

1. **High Quality.** The composition of animal taxa is consistent with undisturbed conditions and disturbance sensitive taxa are present. There are no disturbance – favoured species found and no non-native species.
2. **Good Quality**. The composition of animal taxa is consistent with undisturbed conditions although species diversity (as number of species) may be below expected. Most of the disturbance sensitive taxa are present and/or there are some disturbance-favoured taxa present and/or non-native species.
3. **Moderate Quality.** The composition of animal taxa is predominantly consistent with undisturbed conditions although species diversity (as number of species) may be below expected and/or disturbance-sensitive taxa are absent and/or significant numbers of the disturbance-favoured taxa are present and/or non-native species dominate in places.
4. **Poor Quality.** Taxonomic diversity is low. The hard substratum is dominated by disturbance-favoured taxa and disturbance sensitive taxa are absent and/or the hard substratum is dominated by non-native species.
5. **Bad Quality.** Taxonomic diversity is very low. The hard substratum is occupied only by disturbance - highly favoured or neutral taxa.

The work undertaken to develop hard substratum invertebrate tools takes account of and, as far as possible, follows the approach described in Prior *et al*. (2005).

2. HABITAT TYPES

In order to correspond with the typologies established for coastal and transitional waters, the following shore types (based on MEMG, 2003) are identified. The types are equated to the Algal tool developed for quality assessment and to the European Union Nature Information System (EUNIS) classification level 2 with the addition of salinity type, which is not a part of the EUNIS classification at level 2. Level 3 of the classification (see Appendix

1) is used in field recording. The version of the EUNIS classification was that available from the Internet (http://eunis.eea.eu.int/habitats-code-browser.jsp) on 21 July 2005.

The habitat types are:

Exposed (all are euryhaline) [=Coastal Water High energy littoral rock in the algal tool; EUNIS A.1.1 and A.4.1 salinity >30]

Moderately exposed – euryhaline. Fully saline having a salinity of >30 [= Coastal/Transitional Water Moderate energy littoral rock in the algal tool; EUNIS A.1.2 and A.4.2 salinity >30]

Moderately exposed – polyhaline. Brackish water having a salinity between 18 and 30 [= Coastal/Transitional Water Moderate energy littoral rock in the algal tool; EUNIS A.1.2 and A.4.2 salinity 18-30]

Sheltered – euryhaline. Fully saline having a salinity of >30 [=Coastal Water Low energy littoral rock in the algal tool; EUNIS A.1.3 and A.4.3 salinity >30]

Sheltered – polyhaline. Brackish water having a salinity between 18 and 30 [=Coastal Water Low energy littoral rock in the algal tool; EUNIS A.1.3 and A.4.3 salinity 18-30]

Sheltered – mesohaline. Brackish water having a salinity between 5 and 18. [=Coastal Water Low energy littoral rock in the algal tool: EUNIS A.1.3 and A.4.3 salinity 5-18]

Sheltered – oligohaline. Brackish water having a salinity between 0.5 and 5. [=Coastal Water Low energy littoral rock in the algal tool; EUNIS A.1.3 and A.4.3 salinity 0.5-5]

Degree of 'exposure' refers to wave action.

Underboulder communities – which are highly distinctive and often include sensitive and indicator species – are not included in the JNCC and EUNIS classifications but have been included as a 'feature' on recording forms (see Annex 1).

The distribution of water bodies according to the agreed habitat types is mapped but some local interpretation when undertaking survey work is appropriate especially where, in estuaries, a salt wedge means that deeper hard substrata may have a higher salinity than suggested by surface waters.

The habitats above do not include tidal current regime which is very important in determining circalittoral communities including species richness. Tidal current velocity must therefore be another 'moderating' factor to be taken into account when interpreting the results of surveys.

3. EXPECTED NUMBER OF SPECIES

In order to identify the number of invertebrate species that might be expected to occur on a rocky shore or on circalittoral rock, the MNCR database has been used as a source of survey records. For the present report, only data from Shetland has been analysed because of time constraints although data analysis continues. Difficulties exist in using the MNCR data because:

1. not all zonal communities on a particular shore were surveyed;
2. terminologies used by the MNCR and in categories of shore type being used for Water Framework Directive work are different for Variable/Reduced and Low salinity situations;
3. the MNCR records (especially for Shetland) include very few variable or reduced salinity locations.

Salinity categories from MNCR survey records are equated as follows:

MNCR categories	Coastal types for WFD
Fully marine (30-40 ‰)	Euryhaline (Salinity >30)
Variable (18-40 ‰)	Polyhaline (Salinity 18-30)
Reduced (18-30 ‰)	Polyhaline (Salinity 18-30)
Low (<18 ‰)	Mesohaline (Salinity 5-18) Oligohaline (Salinity 0-5)

Species numbers were calculated using the following approach:

- For each shore type, the mean number of species likely (per phylum and in total) to be found has been calculated based on data from all corresponding biotopes.
- The biotope descriptions of rockpools and overhangs used do not include any description of the shore type on which they are found. For this reason and for the purpose of this study the additional numbers of species likely to be found in rockpools and overhangs have only been included for Exposed and Moderately exposed (euryhaline) shores, and are the same for each.
- Data for subtidal rock does not include additional species numbers for topographically complex areas.
- Data for subtidal rock came from surveys on only 4 different types of biotope. Further investigation is required to establish whether or not sufficient data exists from studies in other geographical locations to produce an effective estimate of species numbers for these areas.

Table 1. Expected number of check list species on any one hard substratum area in Shetland. The table format requires completing for different geographical areas and salinity regimes.

Exposed intertidal

Species group	*Open rock*	*+ rockpools*	*+overhangs*	*Total of topo-graphically complex shore*
Sponges	1	4	4	9
Cnidarians	1	5	4	10
Polychaetes	1	15	3	18
Crustaceans	3	13	4	20
Molluscs	9	17	5	31
Bryozoans	0	4	2	6
Echinoderms	0	2	1	3
Ascidians	0	3	1	4
Other	0	1	1	2
Total	15	63	23	102

Moderately exposed – euryhaline intertidal

Species group	*Open rock*	*+ rockpools*	*+overhangs*	*Total of topo-graphically complex shore*
Sponges	1	4	4	10
Cnidarians	1	5	4	10
Polychaetes	2	15	3	19
Crustaceans	3	13	4	20
Molluscs	9	17	5	31
Bryozoans	1	4	2	6
Echinoderms	0	2	1	2
Ascidians	0	3	1	3
Other	0	1	1	2
Total	17	63	23	104

Open rock only

Species group	*Sheltered – euryhaline intertidal*	*Sheltered – polyhaline intertidal*	*Circalittoral rock*
Sponges	3	0	2
Cnidarians	3	0	4
Polychaetes	4	0.5	3
Crustaceans	6	1	8
Molluscs	11	3.5	2
Bryozoans	1	0	1
Echinoderms	1	0	7
Ascidians	0	0	7
Other	0	0	0
Total	28	5	34

4. IDENTIFICATION OF SPECIES TO BE INCLUDED IN SURVEY CHECKLISTS

4.1 Identifying species that appear characteristic of unperturturbed and perturbed situations on hard substratum.

The review by Hiscock *et al.* (2004) of potential indicator species was used as a starting point for research into likely indicator species. However, that review included very few hard substratum species that had been shown to be either adversely affected or favoured by the range of factors researched. Whilst the paucity of species that might be indicators of quality was a reflection of the low quantity of research available, a major effort was made to identify more papers and to add to the likely indicator species. Also, it was considered that, from the *MarLIN* Biology and Sensitivity Key Information reviews, it was 'Intolerance' that was most relevant to research as 'Sensitivity' depended on recoverability. However, species described as "High" or "Very High" sensitivity were relevant as past events will be reflected in their absence or low numbers.

At the same time as the development of a hard substratum tool described here, the table of species tolerance in relation to Exposure Pressures and *MarLIN* Factors from Hiscock *et al.* (2004) was adjusted so that the various terms used to express tolerance or intolerance were rationalised. It was determined that the following terminology would be used:

Highly intolerant: Described as "Highly Intolerant" or "Very High/High Sensitivity" (*MarLIN* Reviews); identified as "likely to be absent as a result of the factor" (Hiscock *et al.*, 2004).

Intolerant: Described as "Sensitive" or "Intermediate" (Diaz & Rosenberg, 1995), Intermediate (Meire,*et al*., 1994) or "Identified as likely to be present in lower abundance than expected" (see Hiscock *et al.* 2004).

Neutral/Tolerant: Described as "Tolerant" in several publications (see Hiscock *et al.* 2004)

Favoured: Identified as "likely to be present in higher abundance than expected" (see Hiscock *et al.* 2004).

Highly Favoured: Identified as "likely to be present in much higher abundance than expected" (see Hiscock *et al.* 2004).

The results of the literature investigation for the current project are given in Appendix 2.

As a part of the current study the original 'Indicators' report (Hiscock *et al.* 2004) has been updated, information clarified and summarised into a new report (Hiscock *et al.* 2005).

We considered results of the literature reviews at a meeting between Professor Steve Hawkins, Drs Keith Hiscock and Stuart Jenkins and Anna Smith on 2 March 2005. We concluded that many of the results are equivocal. Few 'true' pollution or disturbance effects other than gross pollution impacts such as oil spills or species extremely susceptible to a pollutant (e.g. dogwhelks to TBT) had been identified for hard substratum species although natural effects from turbidity and salinity gradients in particular had. Exceptions occurred where point source discharges had a gradient of effect. The paper by Hoare & Hiscock (1974) of the effects of an acidified halogenated effluent on rocky coast biota was exceptionally useful but was only one reference and for a very specific and unusual pollutant.

We considered that the best 'way forward' was to characterize biotope complexes (Level 3 of the EUNIS classification but from the 2004/05 version of the JNCC biotopes classification as 'species expected to be present' in particular conditions of wave and tide exposure and of salinity and in particular sub-habitats (overhangs, under boulders, on stony or shingle beaches and in rock pools). We would highlight characterising species and add species that have been identified as intolerant or favoured by particular adverse conditions.

We would produce an intertidal and a subtidal check list for field workers to use. The checklists would include all of the species that are characterising species and species identified as intolerant or favoured by a particular disturbance. The layout of the check lists would be based on those used during MNCR surveys.

An aid to field surveyors undertaking intertidal surveys could be produced that displays the expected species, enables electronic entry of presence/absence and also provides an identification guide.

The field worker would check habitats present, record species represented and consider whether the site is:

1. **High Quality.** The composition of animal taxa is consistent with undisturbed conditions and disturbance sensitive taxa are present. There are no disturbance – favoured species found and no non-native species.
2. **Good Quality**. The composition of animal taxa is consistent with undisturbed conditions although species diversity (as number of species) may be below expected. Most of the disturbance sensitive taxa are present and/or there are some disturbance-favoured taxa present and/or non-native species.
3. **Moderate Quality.** The composition of animal taxa is predominantly consistent with undisturbed conditions although species diversity (as number of species) may be below expected and/or disturbance-sensitive taxa are absent and/or significant numbers of the disturbance-favoured taxa are present and/or non-native species dominate in places.
4. **Poor Quality.** Taxonomic diversity is low. The hard substratum is dominated by disturbance-favoured taxa and disturbance sensitive taxa are absent and/or the hard substratum is dominated by non-native species.
5. **Bad Quality.** Taxonomic diversity is very low. The hard substratum is occupied only by disturbance - highly favoured or neutral taxa.

The assessment of quality would be assisted by a 'Shore scoring system' that corresponds to the Algal Tool system, incorporating a measure of the number of check list species that would be expected according to the complexity of the shore (cobbly only, upfacing bedrock only, upfacing bedrock and mid/lower shore overhangs or underboulder habitats, upfacing bedrock and mid/lower shore overhangs and underboulder habitats).

We discussed an appropriate metric that would reflect quality of a shore or hard substratum subtidal area. We considered that there is an insufficient number of 'disturbance sensitive' or 'disturbance favoured' taxa to produce an equivalent of the AMBI index for hard substratum. We also felt that some of the species identified in the literature as disturbance sensitive are, in fact, reflecting natural gradients such as disturbance, turbidity or salinity, thus reducing the number of potential taxa further.

We considered that the algal and hard substratum invertebrate tools should be merged.

We are concerned at the definition of 'quality' for three main reasons:

1. 'Disturbance favoured' taxa are often widespread and likely to be present in many of the situations studied where water quality and general environmental quality is high.

2. 'Disturbance favoured' taxa can be abundant as a result of natural disturbance including abrasion and localised freshwater flow.

3. Non-native species are well-established especially on some intertidal areas and do not indicate poor water quality.

Further discussion is needed and a re-definition of 'quality' measurements.

4.2 Identifying and listing species to be used in check lists

The MNCR database was used to identify species characteristic of habitat complexes from the 2004/05 Marine Habitats Classification for Britain and Ireland (Connor *et al*. 2004). Whilst the hard substratum tool being developed should work at Level 3 of the EUNIS classification, MNCR datasets are matched to level 4 of the classification and it was therefore necessary to analyse data at that level for later combination to biotope complexes at level 3. The process used was:

1. Identify geographical areas to search database using bounding boxes. The co-ordinates chosen are shown in Table 1.
2. Identify relevant biotopes to search including translating from 1997 biotope codes (the ones data is held in) to the 2005 classification. [Due to the number of species and biotopes associated with each geographical area, it was decided to use only two areas for the purpose of this scoping study. The 'south-west of England and South Wales' and 'Shetland' areas were selected, as these were considered likely to represent the geographically greatest differences in species composition and number of species in each biotope or biotope complex.]

Once species for each biotope where identified, the following steps were taken:

1. Species were entered into Excel with a worksheet per biotope. All species were sorted by phylum or taxonomic group Algae were not considered together as they were not considered to be entirely relevant to the study nor were fish.
2. Where species were not identified to species level, records were only used when no individual species from that group were listed. This was to avoid replicate records of potentially the same species.
3. Within each biotope, the number of species that were present at or more than frequent at 50% or more of the sites in which they were found or were found at more than 10 of the sites surveyed were calculated for each phylum.
4. The total number of species found in each group of biotopes (sorted by level of exposure and features present) was then calculated.
5. The number of species by phylum for each category of area was calculated and tabulated. To give a number of species likely to be found on each shore type in total for a high/average water quality shore).

[At the time of this draft report, difficulties of interpretation are being addressed especially in developing lists and numbers of species that will represent Level 3 of the classification.]

Table 1. Corners of bounding boxes for each geographical region for which data analysis has been undertaken.

Area	**SW & NE Latitudes**	**SW & NE Longitudes**
Shetland	>59.8206and<60.8733	>-2.2036and<-0.7079
South-west England and South Wales (including Severn estuary)	>49.9239and<51.9821	>-5.7779and<-2.3693

4.3 Creating a check list of species for surveys

Three sources of information were used to identify likely characterising species that would be meaningful for the identification of quality:

1. The list of characterising species of habitat complexes from the 2004/05 Marine Habitats Classification for Britain and Ireland (Connor *et al*. 2004).

2. Species that have been identified as Highly Intolerant, Intolerant, Favoured and Highly Favoured according to the research described in Section 3.1.

3. Non-native species likely to be found on hard substrata.

Since survey requires an ability by the surveyor to identify organisms without doubt and to a meaningful as well as practical level, reduced check lists of species have been produced.

For intertidal surveys, the check list is designed to be used for whole shores from the upper level of fucoid algae (sheltered shores) or littorinid molluscs (exposed shores) to the lower limit of fucoid algae or upper limit of kelp. The intertidal surveys should be undertaken on the same defined area of shore and at the same time as macroalgal surveys.

For subtidal surveys, the invertebrate species selected are circalittoral species and surveys are to be undertaken by SCUBA diving or by remote high quality video.

As a practical means of listing the species that should be included in surveys, the MNCR Littoral and Sublittoral Habitat Recording sheets have been adjusted and are presented as an annex at the end of this report.

5. DEVELOPING A METRIC

We have not found any examples of indices that assess the quality of hard substratum invertebrate species. In part, this is because existing indices are based on the ability to count individual organisms from quantitative samples. Many invertebrate hard substratum species are colonial and not countable.

We have taken species richness (as a simple count of the number of invertebrate species in the reduced check list present in a defined survey area) as the first step in developing a metric. Appendix 3 and 4 are to be populated for each geographical area from the analysis of survey results held in the MNCR database and some informed judgement. As in the algal tool, the more topographically complex a shore is, the more species are expected. However, that approach is not adopted for subtidal areas where survey constraints suggest that it is best to require that check lists are applied to upward facing surfaces only.

Appendix 3 and 4 provide a basis for identifying the 'quality' (as species richness) of the invertebrate community on a particular shore or circalittoral rock area. The 'quality' of the community does not necessarily translate directly into quality of the water.

Whatever score is achieved by the number of species present at a location, it is adjusted according to whether there are pressure-intolerant or pressure-favoured species and non-native species present. The score also has to be moderated. For instance, whilst the rock-boring worm *Polydora ciliata* may dominate a shore in heavily polluted situations, it may also dominate a chalk or limestone shore which is easy to bore: therefore presence of *Polydora ciliata* would not necessarily downgrade a limestone shore.

Having established the approximate number of species **FROM THE FIELD SURVEY CHECKLIST** which might be expected on a particular type of shore or circalittoral rocky area in a particular geographical area, it is suggested that the following metric is trialed:

$$\textbf{Quality} = (P + (((1-PF) + (1-A))/2) + PI) / 3$$

Where:

P = Number of characteristic species present as a proportion of those which are expected for targeted typology (Range 0-1)

PF = Number of Pressure-Favoured species present as a proportion of those which may be possibly be present on each type of shore or circalittoral rock (Range 0-1)

PI = Number of Pressure-Intolerant species present as a proportion of those which may be possibly be present on each type of shore or circalittoral rock (Range 0-1)

A = Number of non-native (Alien) species present as a proportion of those which may be possibly present in targeted typology (Range 0-1)

e.g. If P =100%, PF = 0%, A = 0%, PI = 100% then Q = 1

e.g. If P = 50%, PF =80%, A=100% and PI = 20% then Q = 0.27

High quality Q=0.8-1

Good quality Q= 0.6-0.8

Moderate quality Q = 0.4-0.6

Poor quality Q = 0.2-0.4

Bad quality Q =0-0.2

Under this metric example the proportion of characteristic species accounts for one third of the metric, the proportion of species which will lower quality (disturbance favoured and alien species) account for one third together and the proportion of species which will increase quality (disturbance tolerant) account for one third. These proportions can easily be changed dependent on which aspects of quality we judge to be most important.

6. UNDERTAKING THE SURVEY WORK

6.2 Hard substratum intertidal

1. Identify suitable shores for algal and animal surveys. Shores are likely to be predominantly upward facing and have hard substratum from above high water mark to mean low water of ordinary tides (i.e. to the lowest fucoids/highest kelps).

2. Define the area to be searched and recorded. This should be at least a 10 m length of shore (as a belt transect).

3. Define the location using GPS positioning and sketch the site and the area (to be) searched.

4. Search the shore including sub-habitats (if present) and record the abundance of check-list species present (other species can be recorded as additional information but only check-list species ‘count’). (Apparently absent species on the check list should be searched hard for.) This is **not** a timed search but until all check list species have been searched for.

5. Note any conditions that might adversely affect the shore community – for instance, a freshwater stream, proximity to an effluent, human usage.

6.3 Hard substratum subtidal

1. Identify suitable upward facing circalittoral rock areas.

2. Define the area to be searched and recorded. This should be at least a 100 sq m area.

3. Define the location using GPS positioning and sketch the site and the area (to be) searched.

4. Search the defined area and record the abundance of check-list species present (other species can be recorded as additional information but only check-list species ‘count’). (Apparently absent species on the check list should be searched hard for.) This is **not** a timed search but until all check list species have been searched for.

5. Note any conditions that might adversely affect the community – for instance, local scour.

7. TESTING THE HARD SUBSTRATUM TOOL

At the completion of this report, the metric and the species lists contributing to it are unproven as a meaningful and practical tool. Since existing data sets held on the MNCR database have been used to develop the tool, it would be a circular argument if we were to test the tool against existing datasets held on the MNCR database. Few other datasets are likely to be suitable to test the tool although Sullom Voe rocky shore survey datasets should be used. Field tests will need to be done in situations that are geographically distant and that are subject to apparently unstressed and stressed conditions.

Support information will be needed and some training. It is suggested that testing in 2005 is restricted to intertidal areas and application of the check lists is supported by identification aids.

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Note

Where reference is made in Appendix 2 to "*MarLIN* Reviews", the reader should refer to http://www.marlin.ac.uk and cite the reference as shown in the relevant pages for each species. The full url for a species is constructed as in the following example: http://www.marlin.ac.uk/species/asteriasrubens.htm. (*MarLIN* reviews are each derived from a wide range of published sources and the reader seeking further information should investigate source material.)

APPENDIX 1. The European Union Nature Information (Eunis) classification for littoral and circalittoral hard substrata to levels 2 and 3. The classification was copied from http://eunis.eea.eu.int/habitats-code-browser.jsp on 21 July 2005 and excludes types that are Mediterranean only; that are supralittoral; that are hydrolittoral, and vents and seeps.

LITTORAL ROCK AND OTHER HARD SUBSTRATA TO LEVEL 2 and 3

A.1.1 High energy littoral rock

- A.1.11 [*Mytilus edulis*] and/or barnacle communities
- A.1.12 Robust fucoid and/or red seaweed communities
- A.1.15 Fucoids in tide-swept conditions

A.1.2 Moderate energy littoral rock

- A.1.21 Barnacles and fucoids on moderately exposed shores
- A.1.22 Mussels and fucoids on moderately exposed shores

A.1.3 Low energy littoral rock

- A.1.31 Fucoids on sheltered marine shores
- A.1.32 Fucoids in variable salinity
- A.1.33 Red algal turf in lower eulittoral, sheltered from wave action

A.1.4 Features of littoral rock

- A.1.41 Communities of littoral rockpools
- A.1.44 Communities of littoral caves and overhangs
- A.1.45 Ephemeral green or red seaweed communities (freshwater or sand-influenced) on non-mobile substrata

CIRCALITTORAL ROCK AND OTHER HARD SUBSTRATA TO LEVEL 2 and 3

A.4.1 Atlantic & Mediterranean high energy circalittoral rock

- A.4.11 Very tide-swept faunal communities on circalittoral rock
- A.4 12 Sponge communities on deep circalittoral rock
- A.4.13 Mixed faunal turf communities on circalittoral rock

A.4.2 Atlantic & Mediterranean moderate energy circalittoral rock

- A.4.21 Echinoderms and crustose communities on circalittoral rock
- A.4.22 [*Sabellaria*] on circalittoral rock
- A.4.23 Communities on soft circalittoral rock
- A.4.24 Mussel beds on circalittoral rock
- A.4.25 Circalittoral faunal communities in variable salinity
- A.4.27 Faunal communities on deep moderate energy circalittoral rock

A.4.3 Atlantic & Mediterranean low energy circalittoral rock

- A.4.31 Brachiopod and ascidian communities on circalittoral rock
- A.4.33 Faunal communities on deep low energy circalittoral rock

A.4.7 Features of circalittoral rock

- A.4.71 Communities of circalittoral caves and overhangs
- A.4.72 Circalittoral fouling faunal communities

APPENDIX 2. Hard substratum species identified as Highly Intolerant to Highly Favoured from the literature review.

Species identified as 'Very High sensitivity' or 'High sensitivity' in *MarLIN* reviews have a very low recoverability potential and absence may therefore be the result of some previous adverse condition.

Phylum / Class and name	Common name or descriptor	Littoral (L) or Sublittoral (S)	Highly intolerant / Very High sensitivity	Intolerant / High sensitivity	Tolerant / Neutral	Favoured	Highly Favoured	Type of pollution or disturbance	References and notes
PORIFERA									
DEMOSPONGIAE									
Halichondria panicea	Breadcrumb sponge	L+S	♦					Substratum loss, Smothering, Synthetic compound contamination, Changes in nutrient levels, Displacement	*MarLIN* reviews; Jones, 1973; Barthel, 1988; Oleson, *et al.*, 1994; Smith, 1968
				♦				Abrasion & physical disturbance, Changes in oxygen	Cole *et al.,* 1999. Widely distributed in euryhaline and polyhaline waters
Axinella dissimilis	A branching sponge	S	♦					Substratum loss, Displacement	*MarLIN* reviews; Konnecker, 1977. Confined to open coast habitats
Hymeniacidon perleve	A sponge	L+S	♦					Substratum loss, Synthetic compound contamination, Changes in nutrient levels	*MarLIN* reviews; Jones, 1973. Widely distributed in euryhaline and polyhaline waters.
CNIDARIA									
LEPTOLIDA									
Cordylophora caspia	A hydroid	S	♦					Substratum loss	*MarLIN* reviews;
				♦				Abrasion & physical disturbance, Heavy metals, Increase in wave exposure	*MarLIN* reviews; Boero, 1984; Bryan & Gibbs, 1991; Bryan, 1984; Fulton, 1962; Michel & Case, 1984; Ringelband & Karbe, 1996. Occurs only in oligohaline and mesohaline waters.

Phylum / Class and name	Common name or descriptor	Littoral (L) or Sublittoral (S)	Highly intolerant / Very High sensitivity	Intolerant / High sensitivity	Tolerant / Neutral	Favoured	Highly Favoured	Type of pollution or disturbance	References and notes
Tubularia indivisa	Oaten pipes hydroid	S		♦				Acidified-halogenated effluent	Hoare & Hiscock, 1974
Nemertesia ramosa	A hydroid	S	♦					Substratum loss, Displacement, Increase in wave exposure	*MarLIN* reviews
				♦				Abrasion & physical disturbance, Smothering, Increased suspended sediment	Magorrian & Service, 1998; Service & Magorrian, 1997; Hughes, 1979. Occurs in euryhaline and polyhaline conditions at least and in stressful conditions.
Sertularella polyzonias.	A hydroid	S				♦		Acidified-halogenated effluent	Hoare & Hiscock, 1974
Sertularella sp.	A hydroid	S			♦			Acidified-halogenated effluent	Hoare & Hiscock, 1974
Obelia geniculata	A hydroid			♦				Acidified-halogenated effluent	Hoare & Hiscock, 1974
Obelia longissima	A hydroid	S	♦					Substratum loss, Temperature change	*MarLIN* reviews; Boero & Bouillon 1993; Cornelius, 1995; Berrill, 1949.
				♦				Abrasion & physical disturbance, Smothering, Synthetic compound contamination, Displacement	*MarLIN* reviews; Bryan & Gibbs, 1991; Boero, 1984; Bryan, 1984; Cornelius, 1995
OCTOCORALLIA									
Alcyonium digitatum	Dead man's fingers	S	♦					Substratum loss, Displacement, Changes in oxygen, Synthetic compound contamination	*MarLIN* reviews Smith, (ed.), 1968; Hickson, 1901. Seems to be a fast colonizing species. Only present in euryhaline conditions.
				♦				Abrasion & physical disturbance, Smothering, Acidified-halogenated effluent	*MarLIN* reviews; Bradshaw *et al*, 2000; Hartnoll, 1998; Veale *et al.*, 2000; Hoare & Hiscock, 1974

Phylum / Class and name	Common name or descriptor	Littoral (L) or Sublittoral (S)	Highly intolerant / Very High sensitivity	Intolerant / High sensitivity	Tolerant / Neutral	Favoured	Highly Favoured	Type of pollution or disturbance	References and notes
Eunicella verrucosa	Pink sea fan	S	♦					Substratum loss, Displacement, Changes in oxygen	*MarLIN* reviews
				♦				Abrasion &physical disturbance, Smothering, Increase in wave exposure	*MarLIN* reviews; Bavestrello *et al.*, 1997 ; Eno *et al.* 1996.
HEXACORALLIA									
Leptopsammia pruvoti	Sunset cup coral	S	♦					Substratum loss, Abrasion & physical disturbance, Smothering, Displacement	*MarLIN* reviews; Cole *et al.*, 1999. Nationally rare and open coast only.
Protanthea simplex	Sealoch anemone	S	♦					Substratum loss, Abrasion & physical disturbance, Smothering, Increase in wave exposure, Temperature change	*MarLIN* reviews
Actinia equina	Beadlet anemone	L	♦					Acidified-halogenated effluent	Hoare & Hiscock, 1974
Urticina felina	Dahlia anemone	L+S	♦					Substratum loss	*MarLIN* reviews
				♦				Abrasion & physical disturbance, Changes in oxygenation, Synthetic compound contamination	*MarLIN* reviews; Cole *et al.*, 1999. Present in euryhaline and polyhaline waters and survives in polluted conditions.
					♦			Acidified-halogenated effluent	Hoare & Hiscock, 1974
Metridium senile	Plumose anemone	S	♦					Substratum loss	*MarLIN* reviews
				♦				Abrasion & physical disturbance	*MarLIN* reviews
					♦			Temperature change, Changes in oxygenation, Increase in turbidity, Acidified-halogenated effluent	*MarLIN* reviews; Crisp 1964; Manuel, 1988; Svane & Groendahl, 1988; Wahl, 1984; Hoare & Hiscock, 1974
Actinothoe sphyrodeta	Sandalled	S			♦			Sedimentation	*MarLIN* reviews; Saiz Salinas & Urdangarin, 1994.

Phylum / Class and name	Common name or descriptor	Littoral (L) or Sublittoral (S)	Highly intolerant / Very High sensitivity	Intolerant / High sensitivity	Tolerant / Neutral	Favoured	Highly Favoured	Type of pollution or disturbance	References and notes
	anemone								
NEMERTEA									
ANOPLA									
Tubulanus annulatus	Football jersey worm	S	♦					Synthetic compound contamination, Changes in nutrient levels	Jones, 1973
Nemertea indet.					♦			Acidified-halogenated effluent	Hoare & Hiscock, 1974
ANNELIDA									
POLYCHAETA									
Cirratulus cirratus	A bristleworm	L+S				♦		Changes in nutrient levels	Bellan, 1980
					♦			Increased temperature, Increased levels of suspended sediment, Increased turbidity	Gibbs, 1971; Clay, 1967a
Eulalia sanguinea	A bristleworm	L+S			♦			Acidified-halogenated effluent	Hoare & Hiscock, 1974
Eulalia viridis	A bristelworm	L+S				♦		Acidified-halogenated effluent	Hoare & Hiscock, 1974
Polydora ciliata	A bristleworm	L+S			♦			Smothering, Synthetic compound contamination, Changes in nutrient levels, Changes in levels of suspended sediment	*MarLIN* reviews; Lagadeuc, 1991; McLusky *et al.*, 1986; Smyth, 1968; Sordino *et al.*, 1989; Pearson & Rosenberg, 1978. A species that is particularly abundant in limestone or chalk rocks but which also occurs on harder rocks where there is contamination.
							♦	Acidified-halogenated effluent	Hoare & Hiscock, 1974

Phylum / Class and name	Common name or descriptor	Littoral (L) or Sublittoral (S)	Highly intolerant / Very High sensitivity	Intolerant / High sensitivity	Tolerant / Neutral	Favoured	Highly Favoured	Type of pollution or disturbance	References and notes
Lagisca extenuata	A bristleworm	S			♦			Acidified-halogenated effluent	Hoare & Hiscock, 1974 (As *Harmothoe extenuate*)
Hydroides norvegica	A tubeworm	S				♦		Acidified-halogenated effluent	Hoare & Hiscock, 1974
Jasminiera elegans	A bristleworm	S			♦			Acidified-halogenated effluent	Hoare & Hiscock, 1974
Lepidonotus squamatus	A bristleworm	S			♦			Acidified-halogenated effluent	Hoare & Hiscock, 1974
Nereis pelagica	A bristleworm	S			♦			Acidified-halogenated effluent	Hoare & Hiscock, 1974
Polycirrus denticulatus	A bristleworm	S			♦			Acidified-halogenated effluent	Hoare & Hiscock, 1974
Pomatoceros triqueter	A tubeworm	L+S			♦			Increased rate in water flow, Increased temperature, Increased turbidity, Synthetic compound contamination	*MarLIN* reviews; Price *et al.*,1980; Wood (ed.). 1988; Hiscock, 1983; de Kluijver, 1993. Often a first colonizing species and may occur where other species are adversely affected by a factor.
			♦					Substratum loss, Smothering	*MarLIN* reviews
				♦				Abrasion & physical disturbance	*MarLIN* reviews
							♦	Acidified-halogenated effluent	Hoare & Hiscock, 1974
Sclerocheilus minutus	A bristleworm	S				♦		Acidified-halogenated effluent	Hoare & Hiscock, 1974
Sabellaria spinulosa	Ross worm	L+S			♦			Synthetic compound contamination, Changes in nutrient levels	Walker & Rees, 1980
						♦		Acidified-halogenated effluent	Hoare & Hiscock, 1974
Serpula vermicularis	A serpulid tubeworm	S	♦					Substratum loss, Abrasion & physical disturbance, Siltation	*MarLIN* reviews; Holt *et al.*, 1998; Moore, 1996

Phylum / Class and name	Common name or descriptor	Littoral (L) or Sublittoral (S)	Highly intolerant / Very High sensitivity	Intolerant / High sensitivity	Tolerant / Neutral	Favoured	Highly Favoured	Type of pollution or disturbance	References and notes
				♦				Changes in oxygenation, Changes in nutrient levels	Moore, 1996 ; Cole *et al.*, 1999
Spirorbinidae indet.	A serpulid tubeworm	L+S			♦			Acidified-halogenated effluent	Hoare & Hiscock, 1974
Syllis hyalina				♦				Acidified-halogenated effluent	Hoare & Hiscock, 1974
CHELICERATA									
PYCNOGONIDA									
Nymphon gracile	A sea spider	L+S	♦					Synthetic compound contamination, Changes in nutrient levels	Jones, 1973
Pycnogonum littorale	A sea spider	L+S			♦			Acidified-halogenated effluent	Hoare & Hiscock, 1974
CRUSTACEA									
MAXILLOPODA									
Balanus crenatus	An acorn barnacle	S	♦					Substratum loss, Siltation, Displacement	*MarLIN* reviews
				♦				Increased temperature, Changes in oxygenation	Naylor, 1965; Southward, 1955; *MarLIN* reviews
					♦			Acidified-halogenated effluent	Hoare & Hiscock, 1974
Chthamalus montagui	Montagu's stellate barnacle	L	♦					Substratum loss, Displacement, Decreased temperature, Changes in oxygenation	*MarLIN* reviews; Crisp (ed.), 1964; Southward, 1991; Burrows *et al.*, 1992; Southward, 1955

Phylum / Class and name	Common name or descriptor	Littoral (L) or Sublittoral (S)	Highly intolerant / Very High sensitivity	Intolerant / High sensitivity	Tolerant / Neutral	Favoured	Highly Favoured	Type of pollution or disturbance	References and notes
				♦				Abrasion & physical disturbance, Increased turbidity, Decreased wave exposure	Barnes & Barnes, 1968; *MarLIN* reviews
Chthamalus stellatus	Poli's stellate barnacle	L			♦			Decrease in turbidity, Increased wave exposure, Decrease in suspended sediment, Hydrocarbons	*MarLIN* reviews; Smith (ed.), 1968
						♦		Increase in temperature	Southward, 1955
			♦					Substratum loss, Displacement, Changes in oxygenation, Decrease in temperature	*MarLIN* reviews; Burrows *et al.*, 1992; Southward & Crisp, 1956
				♦				Synthetic chemicals	Holt *et al.*, 1995; Hawkins & Southward, 1992
Semibalanus balanoides	An acorn barnacle	L	♦					Substratum loss, Displacement	*MarLIN* reviews
				♦				Abrasion & physical disturbance, Smothering, Changes in temperature, Synthetic compound contamination, Hydrocarbons, Acidified-halogenated effluent	*MarLIN* reviews; Crisp (ed.), 1964; Southward *et al.*, 1995; Southward, 1955; Smith (ed.), 1968; Hoare & Hiscock, 1974
EUMALACOSTRACA									
Caprellidae indet.	A skeleton shrimp	S	♦					Acidified-halogenated effluent	Hoare & Hiscock, 1974
Corophium bonelli	An amphipod	S	♦					Acidified-halogenated effluent	Hoare & Hiscock, 1974
Ericthonius brasiliensis	An amphipod	S	♦					Acidified-halogenated effluent	Hoare & Hiscock, 1974
Eurystheus maculatus	An amphipod	S		♦				Acidified-halogenated effluent	Hoare & Hiscock, 1974 (As *Gammaropsis maculate*)

Phylum / Class and name	Common name or descriptor	Littoral (L) or Sublittoral (S)	Highly intolerant / Very High sensitivity	Intolerant / High sensitivity	Tolerant / Neutral	Favoured	Highly Favoured	Type of pollution or disturbance	References and notes
Hyale prevostii	An amphipod	L	♦					Substratum loss, Hydrocarbons, Changes in oxygenation	McCook & Chapman, 1993; Suchanek, 1993; Cabioch *et al.*, 1978; Wieser & Kanwisher, 1959
				♦				Abrasion & physical disturbance, Synthetic compound contamination, Heavy metals	McHenery *et al.*, 1990; Hong & Reish, 1987. Likely to be intolerant of chemical contamination.
Jassa falcata	An amphipod	S	♦					Hydrocarbons, Changes in oxygenation, Siltation, Acidified-halogenated effluent	Suchanek, 1993; Cabioch *et al.*, 1978; Saiz Salinas & Urdangarin, 1994 ; Hoare & Hiscock, 1974. Likely to be intolerant of chemical contamination.
				♦				Substratum loss, Abrasion & physical disturbance, Heavy metals, Synthetic compound contamination	*MarLIN* reviews; Hong & Reish, 1987; McLusky *et al.*, 1986; Meador *et al.*, 1993.
Panoplea minuta			♦					Acidified-halogenated effluent	Hoare & Hiscock, 1974 (As *Iphimedia minuta*)
Aora typica		S	♦					Acidified-halogenated effluent	Hoare & Hiscock, 1974
Cancer pagurus	Edibile crab	S	♦					Synthetic chemical contamination	Smith (ed.), 1968
				♦				Substratum loss, Abrasion & physical disturbance, Increase in temperature	*MarLIN* reviews; Karlsson & Christiansen, 1996; Bennett, 1995; Bradshaw *et al.*, 2000
					♦			Changes in water flow rate, Displacement, Changes in oxygenation, Changes in turbidity, Changes in nutrient levels	Nickell & Moore, 1992; Aldrich & Regnault, 1990; Regnault, 1992; Overnell, 1984; *MarLIN* reviews. An underboulder species on the shore that lives in euryhaline and possibly polyhaline habitats
Carcinus maenas	Common shore crab	S	♦					Hydrocarbon contamination	Baker, 1976; Depledge, 1984

Phylum / Class and name	Common name or descriptor	Littoral (L) or Sublittoral (S)	Highly intolerant / Very High sensitivity	Intolerant / High sensitivity	Tolerant / Neutral	Favoured	Highly Favoured	Type of pollution or disturbance	References and notes
							♦	Synthetic chemical contamination	Gowland, 2002; Depledge, 1984; Jowett *et al.*, 1981
				♦				Acidified-halogenated effluent	Hoare & Hiscock, 1974
					♦			Changes in oxygenation, Changes in nutrient levels, Smothering, Change in levels of suspended sediment, Displacement, Changes in salinity	Brante & Hughes, 2001; Johnson, 1987; Legeay & Massabuau, 2000; *MarLIN* reviews; Ameyaw-Akumfi & Naylor, 1987
						♦		Decrease in wave exposure, Increase in temperature	Crothers, 1967; Sprung, 2001; Snachez-Salazar, 1987
Hippolyte varians	A prawn		♦					Acidified-halogenated effluent	Hoare & Hiscock, 1974
Necora puber	Velvet swimming crab			♦				Acidified-halogenated effluent	Hoare & Hiscock, 1974
Pisidia longicornis	Long clawed porcelain crab	L+S	♦					Abrasion & physical disturbance; Acidified-halogenated effluent	*MarLIN* reviews; Hoare & Hiscock, 1974
				♦				Heavy metals, Hydrocarbons, Changes in oxygenation, Decrease in temperature	Roesijadi et al., 1974; Crisp (ed.), 1964; *MarLIN* reviews. An underboulder species that lives in wave sheltered euryhaline and possibly polyhaline habitats
Pilumnus hirtellus	A crab	L+S		♦				Acidified-halogenated effluent	Hoare & Hiscock, 1974
EUMALACOSTRACA									
Galathea squamifera	A squat lobster	L+S	♦					Substratum loss, Synthetic compound contamination, Changes in nutrient levels	Jones, 1973
MOLLUSCA									
GASTROPODA									

Phylum / Class and name	Common name or descriptor	Littoral (L) or Sublittoral (S)	Highly intolerant / Very High sensitivity	Intolerant / High sensitivity	Tolerant / Neutral	Favoured	Highly Favoured	Type of pollution or disturbance	References and notes
Berthella plumula	Yellow-plumed sea slug	S	♦					Substratum loss, Abrasion & physical disturbance, Displacement, Synthetic compound contamination, Changes in nutrient levels	Jones, 1973; *MarLIN* reviews
Helcion pellucidum	Blue-rayed limpet	S	♦					Substratum loss; Acidified-halogenated effluent	*MarLIN* reviews; Hoare & Hiscock, 1974
				♦				Abrasion & physical disturbance, Changes in water flow rate, Synthetic compound contamination	Ebling *et al.*, 1948; Warburton, 1976; *MarLIN* reviews
Lacuna parva	A periwinkle	L+S	♦					Acidified-halogenated effluent	Hoare & Hiscock, 1974
Lacuna vincta	A periwinkle	S	♦					Acidified-halogenated effluent	Hoare & Hiscock, 1974
Littorina littorea	Common periwinkle	L	♦					Substratum loss, Siltation, Hydrocarbons	Chandrasekara & Frid, 1998; Moore, 1997
				♦				Heavy metals, Abrasion & physical disturbance	Bryan & Gibbs, 1983; *MarLIN* reviews
Littorina mariae	Flat periwinkle	L	♦					Acidified-halogenated effluent	Hoare & Hiscock, 1974
Littorina saxatilus	A periwinkle	L		♦				Acidified-halogenated effluent	Hoare & Hiscock, 1974
Nucella lapillus	Dogwhelk	L	♦					Substratum loss, Synthetic compound contamination, Changes in nutrient levels	Hawkins *et al.*, 1994 ; Bryan & Gibbs, 1991; Gibbs, & Bryan, 1987; Gibbs *et al.* 1987; Gibbs *et al.*, 1988; Gibbs *et al.* 1991. Dogwhelks will take a number of years to respond in terms of mortality to contaminents that cause imposex.
				♦				Hydrocarbon contamination	Smith (ed.), 1968; Bryan, 1968; Crapp, 1970

Phylum / Class and name	Common name or descriptor	Littoral (L) or Sublittoral (S)	Highly intolerant / Very High sensitivity	Intolerant / High sensitivity	Tolerant / Neutral	Favoured	Highly Favoured	Type of pollution or disturbance	References and notes
				♦				Acidified-halogenated effluent	Hoare & Hiscock, 1974
Osilinus lineatus	Thick top shell	L	♦					Substratum loss, Smothering, Decrease in temperature, Changes in oxygenation	Crothers, 2001; Crisp (ed.), 1964; *MarLIN* reviews
				♦				Changes in water flow, Increase in wave exposure, Displacement, Hydrocarbon contamination	Little, 1999; *MarLIN* reviews
Rissoa parva	A winkle	L+S	♦					Acidified-halogenated effluent	Hoare & Hiscock, 1974
Tricolia pullus	A winkle	S	♦					Acidified-halogenated effluent	Hoare & Hiscock, 1974
Patella ulyssiponensis	China limpet	L	♦					Substratum loss, Smothering, Synthetic compound contamination, Hydrocarbon contamination	*MarLIN* reviews; Marshall & McQuaid, 1993; Southward, & Southward, 1978; Hawkins & Southward, 1992; Bonner *et al.*, 1993
				♦				Decrease in wave exposure, Abrasion & physical disturbance, Displacement	Evans, 1953; *MarLIN* reviews
					♦			Increase in wave exposure, Increase in water flow rate, Increase in turbidity	*MarLIN* reviews
						♦		Changes in nutrient levels	Rogers, 2003; Tablado *et al.*, 1994
Patella vulgata	Common limpet	L	♦					Substratum loss, Smothering, Synthetic compound contamination, Hydrocarbon contamination; Acidified-halogenated effluent	Bonner *et al.*, 1993; Smith (ed.), 1968; Glegg, 1999; Moore, 1997; Petpiroon & Dicks, 1982; Hoare & Hiscock, 1974. Occurs in euryhaline and polyhaline conditions.
				♦				Changes in oxygenation	Marshall & McQuaid, 1993; Grenon & Walker, 1981
PELYCOPODA									

Phylum / Class and name	Common name or descriptor	Littoral (L) or Sublittoral (S)	Highly intolerant / Very High sensitivity	Intolerant / High sensitivity	Tolerant / Neutral	Favoured	Highly Favoured	Type of pollution or disturbance	References and notes
Chlamys varia	A scallop	S			♦			Acidified-halogenated effluent	Hoare & Hiscock, 1974
Hiatella arctica	A bivalve mollusc	S			♦			Acidified-halogenated effluent	Hoare & Hiscock, 1974
Modiolus modiolus	Horse Mussel	SL	♦					Substratum loss, Abrasion & physical disturbance	*MarLIN* reviews; Holt *et al.*, 1998; Service & Magorrian, 1997; Magorrian & Service, 1998; Service, 1998. The Very High sensitivity of the biotope dominated by this species to physical disturbance makes the biotope a sensitive indicator of undisturbed conditions. Likely to occur only in euryhaline conditions making it sensitive to high freshwater run-off.
				♦				Siltation, Synthetic compound contamination,	*MarLIN* reviews; Holt *et al.*, 1998; Bryan & Gibbs, 1991
Monia squama	A saddle oyster	S					♦	Acidified-halogenated effluent	Hoare & Hiscock, 1974
Mytilus edulis	Common mussel	L+S	♦					Substratum loss	*MarLIN* reviews
				♦				Smothering, Abrasion & physical disturbance, Displacement, Reduced wave exposure, Synthetic compound contamination, Hydrocarbon contamination	*MarLIN* reviews; Holt *et al.*, 1998; Dare, 1976; Daly & Mathieson, 1977; Lewis, 1964; Widdows & Donkin, 1992; Livingstone & Pipe, 1992; Bayne, 1976; Clay, 1967b. Likely to be tolerant of adverse conditions in terms of survival but demonstrate sublethal impacts.
Ostrea edulis									
Pholas dactylus	Common piddock	L+S	♦					Substratum loss, Displacement, Synthetic compound contamination	*MarLIN* reviews; Barnes, 1980; Beaumont, 1989; Waldock & Thain, 1983

Phylum / Class and name	Common name or descriptor	Littoral (L) or Sublittoral (S)	Highly intolerant / Very High sensitivity	Intolerant / High sensitivity	Tolerant / Neutral	Favoured	Highly Favoured	Type of pollution or disturbance	References and notes
				♦				Abrasion & physical disturbance	*MarLIN* reviews
BRYOZOA									
Alcyonidium mytili	A gelatinous bryozoan	S	♦					Acidified-halogenated effluent	Hoare & Hiscock, 1974
Bugula turbinata	A branching bryozoan	L+S	♦					Substratum loss, Smothering, Siltation, Displacement, Hydrocarbon contamination	*MarLIN* reviews; Wendt, 1998; Hiscock & Mitchell, 1980; Soule & Soule, 1979; Mohammad, 1974
				♦				Increase in wave exposure, Abrasion & physical disturbance	Keough & Chernoff, 1987; Jennings & Kaiser, 1998
					♦			Increase in temperature	*MarLIN* reviews; Hyman, 1959
Cellaria sp.	A branching bryozoan	S	♦					Acidified-halogenated effluent	Hoare & Hiscock, 1974
Cellepora hyalina.	A branching bryozoan	S					♦	Acidified-halogenated effluent	Hoare & Hiscock, 1974
Electra pilosa	An encrusting Bryozoan	L+S			♦			Acidified-halogenated effluent	Hoare & Hiscock, 1974
Escharoides coccineus	An encrusting bryozoan	S			♦			Acidified-halogenated effluent	Hoare & Hiscock, 1974
Flustra foliacea	Hornwrack	S			♦			Smothering, Decrease in suspended sediment, Increase in water flow rate, Synthetic compound contamination (evidence of intolerance to TBT), Acidified-halogenated effluent	*MarLIN* reviews; Dyrynda, 1994; Holme & Wilson, 1985; Hiscock, 1983; Hiscock, 1985; Hoare & Hiscock, 1974

Phylum / Class and name	Common name or descriptor	Littoral (L) or Sublittoral (S)	Highly intolerant / Very High sensitivity	Intolerant / High sensitivity	Tolerant / Neutral	Favoured	Highly Favoured	Type of pollution or disturbance	References and notes
						♦		Increase in suspended sediment	Knight-Jones & Nelson-Smith, 1977; Holme & Wilson, 1985; Hartnoll, 1983.
			♦					Substratum loss, Displacement	*MarLIN* reviews. Especially present where sand inundation occurs on the open coast.
Membranipora membranacea	An encrusting bryozoan	S			♦			Acidified-halogenated effluent	Hoare & Hiscock, 1974
Scrupocellaria reptans	An erect bryozoan	S		♦				Acidified-halogenated effluent	Hoare & Hiscock, 1974
Scrupocellia scrupea	An erect bryozoan	S	♦					Acidified-halogenated effluent	Hoare & Hiscock, 1974
PHORONIDA									
Phoronis hippocrepia	Polychaete worm	S				♦		Increase in suspended sediment	Saiz Salinas & Urdangarin, 1994
ECHINODERMATA									
CRINOIDEA									
Antedon bifida	Rosy feather-star	S	♦					Substratum loss, Siltation, Abrasion & physical disturbance, Synthetic compound contamination, Hydrocarbons, Acidified-halogenated effluent	*MarLIN* reviews; Smith (ed.), 1968; Hoare & Hiscock, 1974
				♦				Changes in oxygenation	*MarLIN* reviews; Cole *et al.*, 1999. Present in wave sheltered, tidal stream exposed habitats in euryhaline and possibly polyhaline situations.
ASTEROIDEA									

Phylum / Class and name	Common name or descriptor	Littoral (L) or Sublittoral (S)	Highly intolerant / Very High sensitivity	Intolerant / High sensitivity	Tolerant / Neutral	Favoured	Highly Favoured	Type of pollution or disturbance	References and notes
Ophiothrix fragilis	Common brittlestar	L+S	♦					Substratum loss, Smothering, Hydrocarbons	Newton & McKenzie, 1995
				♦				Abrasion & physical disturbance; Acidified-halogenated effluent	Bradshaw *et al*., 2002; Sköld, 1998; Hoare & Hiscock, 1974. Widely distributed under boulders on the shore and may form beds offshore. Present in euryhaline conditions.
Asterias rubens	Common starfish	L+S			♦			Acidified-halogenated effluent	Hoare & Hiscock, 1974
Henricea sp.	Bloody Henry starfish	S	♦					Acidified-halogenated effluent	Hoare & Hiscock, 1974
ECHINOIDEA									
Echinus esculentus	Edible sea urchin	S	♦					Synthetic compound contamination, Hydrocarbons, Heavy metals	Gommez & Miguez-Rodriguez, 1999; Smith (ed.), 1968; Dinnel *et al*., 1988
				♦				Substratum loss, Abrasion & physical disturbance, Changes in oxygenation	Bradshaw *et al*., 2002; Hall-Spencer & Moore, 2000; Griffiths *et al*., 1979. Characteristic of the sublittoral regions but abundance shows no clear geographical pattern except that it is uncommon in sheltered situations and only occurs in euryhaline conditions.
Psammechinus miliaris	Green sea urchin	L+S	♦					Substratum loss, Smothering, Abrasion & physical disturbance, Synthetic compound contamination, Hydrocarbons	Kaiser & Spencer, 1994; Gommez & Miguez-Rodriguez, 1999; Smith (ed.), 1968; Dinnel *et al*., 1988; Suchanek, 1993

Phylum / Class and name	Common name or descriptor	Littoral (L) or Sublittoral (S)	Highly intolerant / Very High sensitivity	Intolerant / High sensitivity	Tolerant / Neutral	Favoured	Highly Favoured	Type of pollution or disturbance	References and notes
				♦				Changes in oxygenation, Changes in wave exposure,	Spicer, 1995; Lawrence, 1975. A species that is characteristic of underboulders in southern Britain but may be abundant on algae in the sublittoral in Scotland. Probably only found in euryhaline conditions.
CHORDATA									
ASCIDIACEA									
Ascidiella scabra	A sea squirt	L+S	♦					Substratum loss, Displacement, Abrasion & physical disturbance, Acidified-halogenated effluent	Jennings & Kaiser, 1998; Bradshaw *et al.*, 2002; Hoare & Hiscock, 1974
				♦				Synthetic compound contamination, Inorganic particulates	Rees *et al.*, 2001; Robbins, 1985. A rapid colonizing species that is especially found in sheltered euryhaline conditions.
Botryllus sclosseri	Star sea squirt	L+S	♦					Acidified-halogenated effluent	Hoare & Hiscock, 1974
Ciona intestinalis	A sea squirt	L+S	♦					Substratum loss, Abrasion & physical disturbance, Inorganic particulates	Jennings & Kaiser, 1998; Service & Magorrian, 1997; Magorrian & Service, 1998; Service, 1998; Robbins, 1985
				♦				Heavy metals	Johnston & Keough, 2002; Bellas *et al.*, 2001 ; Bellas *et al.*, 2004. A rapid colonizing species that is especially found in sheltered euryhaline and polyhaline conditions.
Clavelina lepadiformis	Light bulb sea squirt	S	♦					Substratum loss, Smothering, Displacement, Abrasion & physical disturbance	*MarLIN* reviews

Phylum / Class and name	Common name or descriptor	Littoral (L) or Sublittoral (S)	Highly intolerant / Very High sensitivity	Intolerant / High sensitivity	Tolerant / Neutral	Favoured	Highly Favoured	Type of pollution or disturbance	References and notes
				♦				Changes in temperature, Changes in wave exposure	Crisp (ed.), 1964; Picton & Costello, 1998; *MarLIN* reviews. The species is characteristically found on the open coast and in wave-sheltered habitats including in the euryhaline or polyhaline parts of estuaries.
Dendrodoa grossularia	Baked bean ascidian	SL	♦					Substratum loss, Displacement, Abrasion & physical disturbance, Hydrocarbons, Changes in nutrient levels	Jones, 1973. The species is characteristically found in wave surge gullies and in wave-sheltered, tide-swept habitats including in the euryhaline or polyhaline parts of estuaries.
Didemnidae indet.					♦			Acidified-halogenated effluent	Hoare & Hiscock, 1974

APPENDIX 3. Expected number of check list species on any one hard substratum intertidal area. The tables are to be completed for each of the different geographical areas.

Exposed (all are euryhaline) [=Coastal Water High energy littoral rock in the algal tool; EUNIS A1.1 salinity >30]

Species group	**Open rock**	**+ rockpools**	**+overhangs**	**Total of topographically complex shore**
Sponges				
Cnidarians				
Polychaetes				
Crustaceans				
Molluscs				
Bryozoans				
Echinoderms				
Ascidians				
Fish				
Total				

Moderately exposed – euryhaline. Fully saline having a salinity of >30 [= Coastal/Transitional Water Moderate energy littoral rock in the algal tool; EUNIS A1.2 salinity >30]

Species group	**Open rock**	**+ rockpools**	**+overhangs**	**Total of topographically complex shore**
Sponges				
Cnidarians				
Polychaetes				
Crustaceans				
Molluscs				
Bryozoans				
Echinoderms				
Ascidians				
Fish				
Total				

Moderately exposed – polyhaline. Brackish water having a salinity between 18 and 30 [= Coastal/Transitional Water Moderate energy littoral rock in the algal tool; EUNIS A1.2 salinity 18-30]

Species group	Open rock	+ rockpools	+overhangs	Total of topographically complex shore
Sponges				
Cnidarians				
Polychaetes				
Crustaceans				
Molluscs				
Bryozoans				
Echinoderms				
Ascidians				
Fish				
Total				

Sheltered – euryhaline. Fully saline having a salinity of >30 [=Coastal Water Low energy littoral rock in the algal tool; EUNIS A1.3 salinity >30]

Species group	Open rock	+ rockpools	+overhangs	Total of topographically complex shore
Sponges				
Cnidarians				
Polychaetes				
Crustaceans				
Molluscs				
Bryozoans				
Echinoderms				
Ascidians				
Fish				
Total				

Sheltered – polyhaline. Brackish water having a salinity between 18 and 30 [=Coastal Water Low energy littoral rock in the algal tool; EUNIS A1.3 salinity 18-30]

Species group	Open rock	+ rockpools	+overhangs	Total of topographically complex shore
Sponges				
Cnidarians				
Polychaetes				
Crustaceans				
Molluscs				
Bryozoans				
Echinoderms				
Ascidians				
Fish				
Total				

Sheltered – mesohaline. Brackish water having a salinity between 5 and 18. [=Coastal Water Low energy littoral rock in the algal tool: EUNIS A1.3 salinity 5-18]

Species group	Open rock	+ rockpools	+overhangs	Total of topographically complex shore
Sponges				
Cnidarians				
Polychaetes				
Crustaceans				
Molluscs				
Bryozoans				
Echinoderms				
Ascidians				
Fish				
Total				

Sheltered – oligohaline. Brackish water having a salinity between 0.5 and 5. [=Coastal Water Low energy littoral rock in the algal tool; EUNIS A1.3 salinity 0.5-5]

Species group	**Open rock**	**+ rockpools**	**+overhangs**	**Total of topographically complex shore**
Sponges				
Cnidarians				
Polychaetes				
Crustaceans				
Molluscs				
Bryozoans				
Echinoderms				
Ascidians				
Fish				
Total				

APPENDIX 4. Expected number of check list species on any one hard substratum circalittoral subtidal area. The tables are to be completed for each of the different geographical areas.

Exposed (all are euryhaline) [=Coastal Water High energy littoral rock in the algal tool; EUNIS A1.1 salinity >30]

Species group	Open rock	+ rockpools	+overhangs	Total of topographically complex shore
Sponges				
Cnidarians				
Polychaetes				
Crustaceans				
Molluscs				
Bryozoans				
Echinoderms				
Ascidians				
Fish				
Total				

Moderately exposed – euryhaline. Fully saline having a salinity of >30 [= Coastal/Transitional Water Moderate energy littoral rock in the algal tool; EUNIS A1.2 salinity >30]

Species group	Open rock	+ rockpools	+overhangs	Total of topographically complex shore
Sponges				
Cnidarians				
Polychaetes				
Crustaceans				
Molluscs				
Bryozoans				
Echinoderms				
Ascidians				
Fish				
Total				

Moderately exposed – polyhaline. Brackish water having a salinity between 18 and 30 [= Coastal/Transitional Water Moderate energy littoral rock in the algal tool; EUNIS A1.2 salinity 18-30]

Species group	**Open rock**	**+ rockpools**	**+overhangs**	**Total of topographically complex shore**
Sponges				
Cnidarians				
Polychaetes				
Crustaceans				
Molluscs				
Bryozoans				
Echinoderms				
Ascidians				
Fish				
Total				

Sheltered – euryhaline. Fully saline having a salinity of >30 [=Coastal Water Low energy littoral rock in the algal tool; EUNIS A1.3 salinity >30

Species group	**Open rock**	**+ rockpools**	**+overhangs**	**Total of topographically complex shore**
Sponges				
Cnidarians				
Polychaetes				
Crustaceans				
Molluscs				
Bryozoans				
Echinoderms				
Ascidians				
Fish				
Total				

Sheltered – polyhaline. Brackish water having a salinity between 18 and 30 [=Coastal Water Low energy littoral rock in the algal tool; EUNIS A1.3 salinity 18-30]

Species group	**Open rock**	**+ rockpools**	**+overhangs**	**Total of topographically complex shore**
Sponges				
Cnidarians				
Polychaetes				
Crustaceans				
Molluscs				
Bryozoans				
Echinoderms				
Ascidians				
Fish				
Total				

ANNEX 1. FIELD RECORDING FORM FOR INTERTIDAL INVERTEBRATES AND FISH

Water Framework Directive Site Quality Surveys

INTERTIDAL INVERTEBRATES & FISH

Site name & Number:		
Site position (OS Grid):		
Survey date and GMT (24 hr):		
Surveyors:		
Predicted low tide ht & time:		
Weather:		

Tick	TYPE OF SHORE REPRESENTED
	Exposed [all are eury-haline] A1.1 salinity >30
	Moderately exposed - euryhaline. A.1.2 sal. >30
	Moderately exposed -poly-haline. A.1.2 salinity 18-30
	Sheltered – euryhaline A1.3 salinity >30
	Sheltered – polyhaline A1.3 salinity 18 – 30
	Sheltered – mesohaline A1.3 salinity 5 – 18

Tick	SHORE FEATURES INCLUDED IN SURVEY
	Open sloping bedrock
	Rockpools
	Overhangs
	Underboulders

%	SUBSTRATUM SURVEYED
	Bedrock
	Fissures >10mm
	Crevices <10mm
	Rockpools
	Boulders
	- very large >1024 mm
	- large 512-1024 mm
	- small 256-512 mm
	Cobbles 64-256 mm
	Pebbles 16-64 mm
	Gravel 4-16 mm
	Artificial
	- metal
	- concrete
	- wood
	Trees/branches
100	Total

1-5	FEATURES OF ROCK
	Surface relief (even-rugged)
	Texture (smooth-pitted)
	Stability (stable-mobile)
	Scour (none-scoured)
	Silt (none-silted)
	Boulder/cobble/pebble shape (rounded-angular)

✓	MODIFIERS
	Freshwater runoff
	Wave surge (gullies/channels)
	Tidal streams - accelerated) (tidal rapids)
	Grazing
	Shading
	Chemical pollution (describe)
	Litter (terrestrial)
	Sewage debris

1-5	BIOTOPE GROUPINGS PRESENT (EUNIS Level 3) and JNCC codes + underboulders
	HIGH ENERGY [WAVE EXPOSED]
	Mussel and/or barnacle communities (MusB)
	Robust fucoid and/or red seaweed comms (FR)
	Fucoids in tide-swept conditions (FT)
	MODERATE ENERGY [MODERATELY WAVE EXPOSED]
	Barnacles and fucoids (BF)
	Mussels and fucoids (MusF)
	LOW ENERGY [WAVE SHELTERED]
	Fucoids – full salinity (F)
	Fucoids – variable /low salinity (FVS)
	Red algal turf in lower eulittoral
	FEATURES
	Rockpools (Rkp)
	Caves and overhangs (CVOv)
	Underboulders (.B)
	Ephemeral green or red seaweeds (Eph)

IMAGES

Code	SUBJECT

Biotopes (Level 4) present in area surveyed:

SURVEY NOTES INCLUDING ANY ADVERSE SURVEY FACTORS

SPECIES RECORDED AND ABUNDANCE (NAMED SPECIES ARE SELECTED TO CHARACTERISE SHORES AND ARE REQUIRED TO BE IDENTIFIED IF PRESENT. ADD ANY OTHER SPECIES FOUND AND IDENTIFIED WITH CERTAINTY.)

👽 = Non-native species; ☺☺ = Highly disturbance-sensitive (Highly Intolerant) species; ☺ = Disturbance-sensitive (Intolerant) species; ☹ = Disturbance- favoured (Favoured) species; ☹☹ = Highly disturbance-favoured (Highly favoured) species.

SPONGES

	Grantia compressa
	Halichondria panicea
	Hymeniacidon perleve
	Myxilla incrustans
	Ophlitaspongia seriata
	Scypha ciliata
	Porifera indet. (crusts)
	Dysidea fragilis

CNIDARIA: HYDROZOA

	Clava multicornis
	Dynamena pumila
	Laomedea flexuosa
	Obelia geniculata
	Obelia longissima
	Obelia dichotoma
	Tubularia indivisa

CNIDARIA: ANTHOZOA

	Actinia equina
	Actinia fragacea
	Anemonia viridis ☺
	Urticina felina
	Aulactinia verrucosa
	Metridium senile
	Sagartia elegans
	Cereus pedunculatus
	Actinothoe sphyrodeta
	Corynactis viridis
	Caryophyllia smithii

ANNELIDA: POLYCHAETA

	Harmothoe sp.
	Lepidonotus squamatus
	Eulalia viridis
	Polydora sp.(☹)
	Sabellaria alveolata
	Sabellaria spinulosa
	Terebellidae indet.
	Pomatoceros lamarcki
	Pomatoceros triqueter
	Spirorbidae indet.
	Janua pagenstecheri
	Spirorbis corallinae
	Spirorbis rupestris
	Spirorbis spirorbis
	Spirorbis tridentatus
	Ficopomatus enigmatic. 👽

CRUSTACEA: CIRRIPEDIA

	Cirripedia indet. (juv.)
	Verruca stroemia
	Chthamalus montagui
	Chthamalus stellatus
	Elminius modestus 👽
	Semibalanus balanoides
	Balanus crenatus
	Balanus improvisus
	Balanus perforatus

CRUSTACEA: AMPHIPODA

	Amphipoda indet.
	Hyale nilssoni
	Gammaridae

CRUSTACEA: ISOPODA

	Sphaeroma rugicauda
	Jaera albifrons
	Idotea sp.
	Idotea baltica
	Idotea granulosa

CRUSTACEA: DECAPODA

	Palaemon sp.
	Pagurus bernhardus
	Galathea squamifera
	Pisidia longicornis
	Porcellana platycheles
	Hyas araneus
	Cancer pagurus
	Necora puber
	Carcinus maenas
	Pilumnus hirtellus
	Xantho pilipes
	Athanas nitescens
	Crangon crangon

MOLLUSCA: POLYPLACOPHORA

	Polyplacophora indet.
	Lepidochitona cinerea

MOLLUSCA: GASTROPODA

	Tectura testudinalis N
	Tectura virginea
	Patella spp.
	Helcion pellucidum ☺☺
	Margarites helicinus N
	Osilinus lineatus
	Gibbula cineraria
	Gibbula umbilicalis
	Calliostoma zizyphinum
	Lacuna pallidula N
	Lacuna vincta
	Littorina arcana
	Littorina littorea
	Littorina neglecta
	Littorina nigrolineata
	Littorina obtusata/mariae
	Littorina saxatilis
	Melarhaphe neritoides
	Skeneopsis planorbis
	Rissoa parva
	Hydrobia ulvae
	Crepidula fornicata 👽
	Trivia arctica
	Trivia monacha
	Ocenebra erinacea
	Nucella lapillus ☺☺

MOLLUSCA: OPISTHOBRANCHIA

	Goniodoris nodosa
	Onchidoris bilamellata
	Archidoris pseudoargus
	Berthella plumula
	Aplysia punctata

MOLLUSCA: PELECYPODA

	Mytilus edulis
	Modiolus modiolus
	Anomia ephippium
	Heteranomia squamula
	Pododesmus patelliformis
	Lasaea adansoni
	Hiatella arctica
	Pholas dactylus ☺
	Ostrea edulis
	Crassostrea gigas 👽

BRYOZOA

	Crisiidae indet.
	Alcyonidium diaphanum
	Alcyonidium gelatinosum
	Alcyonidium hirsutum
	Alcyonidium mytili
	Flustrellidra hispida
	Bowerbankia imbricata
	Membranipora membranacea
	Electra pilosa
	Scrupocellaria reptans
	Umbonula littoralis
	Schizoporella unicornis
	Bryozoa indet. (crusts)

ECHINODERMATA

	Asterina gibbosa S
	Henricia sp.
	Asterias rubens
	Ophiothrix fragilis
	Ophiopholis aculeate N
	Amphipholis squamata
	Psammechinus miliaris
	Paracentrotus lividus

ASCIDIACEA

	Clavelina lepadiformis
	Polyclinidae
	Didemnidae
	Ciona intestinalis
	Ascidiella sp.
	Ascidia conchilega
	Ascidia mentula
	Dendrodoa grossularia
	Distomus variolosus
	Botryllus schlosseri
	Botrylloides leachi
	Styela clava 👽

PISCES – FISH

	Lepadogaster lepadogaster (shore clingfish)
	Ciliata mustela (five-bearded rockling)
	Gasterosteus aculeatus (three-spine stickleback)
	Nerophis lumbriciformis (worm pipefish)
	Lipophrys pholis (shanny)
	Pholis gunnellus (butterfish)
	Gobius paganellus (rock goby)

ANNEX 2. FIELD RECORDING FORM FOR SUBTIDAL INVERTEBRATES AND FISH

Water Framework Directive Site Quality Surveys

SUBTIDAL INVERTEBRATES & FISH

Site name & Number:		
Site position (lat/long):		
Survey date and GMT (24 hr):		
Surveyors:		
Depth below chart datum:		
Weather:		

Tick	**TYPE OF SHORE REPRESENTED**
	Exposed [all are euryhaline] A1.1 salinity >30
	Moderately exposed - euryhaline. A.1.2 sal. >30
	Moderately exposed -polyhaline. A.1.2 salinity 18-30
	Sheltered – euryhaline A1.3 salinity >30
	Sheltered – polyhaline A1.3 salinity 18 – 30
	Sheltered – mesohaline A1.3 salinity 5 – 18

%	**SUBSTRATUM SURVEYED**
	Bedrock
	Fissures >10mm
	Crevices <10mm
	Rockpools
	Boulders
	- very large >1024 mm
	- large 512-1024 mm
	- small 256-512 mm
	Cobbles 64-256 mm
	Pebbles 16-64 mm
	Gravel 4-16 mm
	Artificial
	- metal
	- concrete
	- wood
	Trees/branches
100	Total

1-5	**FEATURES OF ROCK**
	Surface relief (even-rugged)
	Texture (smooth-pitted)
	Stability (stable-mobile)
	Scour (none-scoured)
	Silt (none-silted)

	Boulder/cobble/pebble shape (rounded-angular)

✓	**MODIFIERS**
	Freshwater runoff
	Wave surge (gullies/channels)
	Tidal streams- accelerated) (tidal rapids)
	Grazing
	Shading
	Chemical pollution (describe)
	Litter (terrestrial)
	Sewage debris

1-5	**BIOTOPE GROUPINGS PRESENT (EUNIS Level 3)**
	HIGH ENERGY CIRCALITTORAL ROCK
	Very tide swept faunal communities (HCR.FaT)
	Sponge communities (deep) (HCR.DpSp)
	Mixed faunal turf communities (HCR.XFa)
	MODERATE ENERGY CIRCALITTORAL ROCK
	Echinoderms and crustose communities (MCR.EcCr)
	[*Sabellaria spinulosa*] (MCR.CSab)
	Communities on soft rock (MCR.SfR)
	Faunal communities in variable salinity (MCR.CFaVS)
	Faunal communities (deep) [No JNCC code]
	LOW ENERGY CIRCALITTORAL ROCK
	Brachiopod and ascidian communities (LCR.BrAs)
	Faunal communities (deep) [No JNCC code]
	FEATURES PRESENT
	Communities of caves and overhangs (FCR.Cv)
	Fouling faunal communities (FCR.Fou.Fa)

IMAGES	
Code	**SUBJECT**

Biotopes (Level 4) present in area surveyed:

SURVEY NOTES INCLUDING ANY ADVERSE SURVEY FACTORS

SPECIES RECORDED AND ABUNDANCE (NAMED SPECIES ARE SELECTED TO CHARACTERISE SHORES AND ARE REQUIRED TO BE IDENTIFIED IF PRESENT. ADD ANY OTHER SPECIES FOUND AND IDENTIFIED WITH CERTAINTY.)

👽 = Non-native species; ☺☺ = Highly disturbance-sensitive (Highly Intolerant) species; ☺ = Disturbance-sensitive (Intolerant) species; ☹ = Disturbance- favoured (Favoured) species; ☹☹ = Highly disturbance-favoured (Highly favoured) species.

SPONGES

	Clathrina coriacea
	Leucosolenia complicata
	Leucosolenia botryoides
	Scypha ciliate
	Grantia compressa
	Oscarella lobularis
	Pachymatisma johnstonia
	Tethya aurantium
	Suberites carnosus
	Suberites ficus
	Polymastia boletiformis
	Polymastia mamillaris
	Cliona celata
	Stelligera rigida
	Stelligera stuposa
	Axinella dissimilis
	Axinella infundibuliformis
	Halichondria bowerbanki
	Halichondria panicea
	Ciocalypta penicillus
	Hymeniacidon perleve
	Mycale sp.
	Mycale rotalis
	Esperiopsis fucorum
	Hymedesmia paupertas
	Phorbas fictitius
	Hemimycale columella
	Myxilla sp.
	Myxilla incrustans
	Iophonopsis nigricans
	Iophon hyndmani
	Raspailia hispida
	Raspailia ramosa
	Haliclona sp.
	Haliclona fistulosa
	Haliclona oculata
	Haliclona simulans
	Haliclona urceolus
	Haliclona viscosa
	Dysidea fragilis
	Halisarca dujardini
	Porifera indet. (crusts)

CNIDARIA: SCYPHOZOA

	Haliclystus auricula
	Aurelia aurita (scyphistomae)

CNIDARIA: HYDROZOA

	Tubularia indivisa
	Tubularia larynx
	Eudendrium sp.
	Bougainvillia ramosa
	Hydractinia echinata
	Lafoea dumosa
	Halecium beanii
	Halecium halecinum
	Aglaophenia sp.
	Aglaophenia pluma
	Aglaophenia tubulifera
	Gymnangium montagui
	Halopteris catharina
	Kirchenpaueria pinnata
	Nemertesia antennina
	Nemertesia ramosa
	Plumularia setacea
	Polyplumaria frutescens
	Abietinaria abietina
	Abietinaria filicula
	Diphasia rosacea
	Hydrallmania falcata
	Thuiaria thuja
	Sertularella gayi
	Sertularella polyzonias
	Sertularia argentea
	Sertularia cupressina
	Obelia sp.
	Obelia dichotoma
	Obelia geniculata
	Obelia longissima
	Rhizocaulus verticillatus

CNIDARIA: ANTHOZOA

	Alcyonium digitatum
	Alcyonium glomeratum
	Swiftia pallida
	Eunicella verrucosa
	Epizoanthus couchii
	Isozoanthus sulcatus
	Parazoanthus axinellae
	Parazoanthus anguicomus
	Protanthea simplex
	Actinia equina

	Anemonia viridis
	Urticina felina
	Urticina eques
	Anthopleura ballii
	Aureliania heterocera
	Aiptasia mutabilis
	Metridium senile
	Sagartia elegans
	Sagartia troglodytes
	Cereus pedunculatus
	Actinothoe sphyrodeta
	Sagartiogeton laceratus
	Sagartiogeton undatus
	Corynactis viridis
	Caryophyllia smithii

PLATYHELMINTHES

	Prostheceraeus vittatus

ANNELIDA: POLYCHAETA

	Tubulanus annulatus
	Cerebratulus sp.
	Lineus longissimus

ANNELIDA: POLYCHAETA

	Polychaeta indet. (tubes)
	Alentia gelatinosa
	Harmothoe sp.
	Lepidonotus squamatus
	Ophiodromus flexuosus
	Polydora sp.
	Chaetopterus variopedatus
	Sabellaria spinulosa
	Terebellidae indet.
	Eupolymnia nebulosa
	Bispira volutacornis
	Sabella pavonina
	Pomatoceros lamarcki
	Pomatoceros triqueter
	Serpula vermicularis
	Filograna implexa
	Protula tubularia
	Salmacina dysteri
	Spirorbidae indet.

CRUSTACEA: CIRRIPEDIA

	Verruca stroemia
	Balanus balanus
	Balanus crenatus
	Boscia anglica
	Amphipoda indet. (tubes)
	Dyopedos porrectus (whips)
	Caprellidae indet.

CRUSTACEA: DECAPODA

	Caridea indet. (prawns/shrimps)
	Palaemon serratus
	Pandalus montagui
	Homarus gammarus
	Palinurus elephas
	Paguridae indet.
	Anapagurus hyndmanni
	Pagurus bernhardus
	Pagurus cuanensis
	Pagurus pubescens
	Galathea sp.
	Galathea intermedia
	Galathea nexa
	Galathea squamifera
	Galathea strigosa
	Pisidia longicornis
	Porcellana platycheles
	Ebalia tuberosa
	Maja squinado
	Hyas araneus
	Hyas coarctatus
	Inachus dorsettensis
	Inachus phalangium
	Macropodia rostrata
	Corystes cassivelaunus
	Atelecyclus rotundatus
	Cancer pagurus
	Liocarcinus depurator
	Liocarcinus pusillus
	Necora puber
	Carcinus maenas
	Xantho incisus

MOLLUSCA: POLYPLACOPHORA

	Polyplacophora indet.
	Leptochiton asellus
	Tonicella marmorea
	Tonicella rubra

MOLLUSCA: GASTROPODA

	Emarginula fissura
	Tectura testudinalis
	Tectura virginea
	Helcion pellucidum
	Margarites helicinus
	Jujubinus miliaris
	Gibbula cineraria
	Calliostoma zizyphinum
	Lacuna vincta
	Crepidula fornicata
	Trivia arctica
	Trivia monacha
	Polinices polianus
	Ocenebra erinacea
	Nucella lapillus
	Buccinum undatum
	Hinia reticulata
	Hinia incrassata

MOLLUSCA: OPISTHOBRANCHIA

	Elysia viridis
	Aplysia punctata
	Pleurobranchus membranaceus
	Tritonia hombergii
	Dendronotus frondosus
	Doto sp.
	Goniodoris nodosa
	Onchidoris muricata
	Acanthodoris pilosa
	Polycera faeroensis
	Polycera quadrilineata
	Limacia clavigera
	Cadlina laevis
	Archidoris pseudoargus
	Jorunna tomentosa
	Janolus cristatus
	Coryphella browni
	Coryphella lineata
	Flabellina pedata
	Eubranchus tricolor
	Facelina bostoniensis
	Aeolidia papillosa

MOLLUSCA: PELECYPODA

	Mytilus edulis
	Modiolus modiolus
	Ostrea edulis
	Pecten maximus
	Pododesmus patelliformis
	Astarte sulcata
	Hiatella arctica

CEPHALOPODA

	Eledone cirrhosa

BRACHIOPODA

	Neocrania anomala
	Terebratulina retusa

BRYOZOA

	Crisiidae indet.
	Crisidia cornuta
	Crisia denticulata
	Crisia eburnea
	Alcyonidium diaphanum

	Alcyonidium hirsutum
	Vesicularia spinosa
	Eucratea loricata
	Membranipora membranacea
	Electra pilosa
	Flustra foliacea
	Chartella papyracea
	Securiflustra securifrons
	Bugula flabellata
	Bugula plumosa
	Bugula turbinata
	Bicellariella ciliata
	Scrupocellaria sp.
	Scrupocellaria reptans
	Scrupocellaria scruposa
	Cellaria sp.
	Cellaria fistulosa
	Cellaria sinuosa
	Umbonula littoralis
	Escharoides coccinea
	Porella compressa
	Pentapora foliacea
	Schizomavella linearis
	Parasmittina trispinosa
	Cellepora pumicosa
	Omalosecosa ramulosa
	Bryozoa indet. (crusts)

PHORONIDA

	Phoronis hippocrepia

ECHINODERMATA

	Antedon bifida
	Antedon petasus
	Leptometra celtica
	Luidia ciliaris
	Porania pulvillus
	Asterina gibbosa
	Anseropoda placenta
	Solaster endeca
	Crossaster papposus
	Henricia sp.
	Henricia oculata
	Henricia sanguinolenta
	Asterias rubens
	Leptasterias muelleri
	Marthasterias glacialis
	Ophiothrix fragilis
	Ophiocomina nigra
	Ophiopholis aculeata
	Amphiura brachiata
	Psammechinus miliaris
	Echinus esculentus
	Holothuria forsskåli
	Pawsonia saxicola
	Aslia lefevrei

ASCIDIACEA

	Clavelina lepadiformis
	Pycnoclavella aurilucens
	Distaplia rosea
	Polyclinidae indet.
	Polyclinum aurantium
	Synoicum pulmonaria
	Morchellium argus
	Sidnyum elegans
	Sidnyum turbinatum
	Aplidium nordmanni
	Aplidium punctum
	Didemnidae indet.
	Didemnum maculosum
	Diplosoma listerianum
	Diplosoma spongiforme
	Lissoclinum perforatum
	Ciona intestinalis
	Diazona violacea
	Corella parallelogramma
	Ascidiella aspersa
	Ascidiella scabra
	Ascidia conchilega
	Ascidia mentula
	Ascidia virginea
	Phallusia mammillata
	Styela clava
	Polycarpa pomaria
	Polycarpa scuba
	Dendrodoa grossularia
	Distomus variolosus
	Stolonica socialis
	Botryllus schlosseri
	Botrylloides leachi
	Boltenia echinata
	Pyura microcosmus
	Pyura squamulosa
	Molgula manhattensis

PISCES – FISH

	Scyliorhinus canicula
	Conger conger
	Diplecogaster bimaculata
	Lophius piscatorius
	Gadidae indet.
	Molva molva
	Pollachius pollachius
	Pollachius virens
	Trisopterus luscus
	Trisopterus minutus
	Gasterosteus aculeatus
	Spinachia spinachia
	Syngnathus acus
	Myoxocephalus scorpius
	Taurulus bubalis
	Agonus cataphractus
	Centrolabrus exoletus
	Crenilabrus melops
	Ctenolabrus rupestris
	Labrus bergylta
	Labrus mixtus
	Parablennius gattorugine
	Chirolophis ascanii
	Pholis gunnellus
	Gobiidae indet.
	Gobius niger
	Gobiusculus flavescens
	Lesueurigobius friesii
	Pomatoschistus sp.
	Pomatoschistus minutus
	Pomatoschistus pictus
	Thorogobius ephippiatus
	Phrynorhombus norvegicus
	Zeugopterus punctatus
	Pleuronectidae indet.
	Pleuronectes platessa