



MarLIN
*The Marine Life Information
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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
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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:

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

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

<i>Species group</i>	<i>Open rock</i>	<i>+ rockpools</i>	<i>+overhangs</i>	<i>Total of topographically complex shore</i>
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

<i>Species group</i>	<i>Open rock</i>	<i>+ rockpools</i>	<i>+overhangs</i>	<i>Total of topographically complex shore</i>
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

<i>Species group</i>	<i>Sheltered – euryhaline intertidal</i>	<i>Sheltered – polyhaline intertidal</i>	<i>Circolittoral rock</i>
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 unperturbed 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 coordinates 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 were 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 furoid algae (sheltered shores) or littorinid molluscs (exposed shores) to the lower limit of furoid 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:

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

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.

8. TEXT REFERENCES

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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 furoid 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									
<i>Halichondria panicea</i>	Breadcrumb sponge	L+S	◆					Substratum loss, Smothering, Synthetic compound contamination, Changes in nutrient levels, Displacement	MarLIN reviews; Jones, 1973; Barthel, 1988; Oleson, <i>et al.</i> , 1994; Smith, 1968
<i>Axinella dissimilis</i>	A branching sponge	S	◆	◆				Abrasion & physical disturbance, Changes in oxygen	Cole <i>et al.</i> , 1999. Widely distributed in euryhaline and polyhaline waters
<i>Hymeniacidon perleve</i>	A sponge	L+S	◆					Substratum loss, Displacement	MarLIN reviews; Konnecker, 1977. Confined to open coast habitats
CNIDARIA								Substratum loss, Synthetic compound contamination, Changes in nutrient levels	MarLIN reviews; Jones, 1973. Widely distributed in euryhaline and polyhaline waters.
LEPTOLIDA									
<i>Cordylophora caspia</i>	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.

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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
<i>Tubularia indivisa</i>	Oaten pipes hydroid	S	◆	◆				Acidified-halogenated effluent	Hoare & Hiscock, 1974
<i>Nemertesia ramosa</i>	A hydroid	S	◆	◆				Substratum loss, Displacement, Increase in wave exposure Abrasion & physical disturbance, Smothering, Increased suspended sediment	MarLIN reviews Magorrian & Service, 1998; Service & Magorrian, 1997; Hughes, 1979. Occurs in euryhaline and polyhaline conditions at least and in stressful conditions.
<i>Sertularella polyzonias</i> .	A hydroid	S				◆		Acidified-halogenated effluent	Hoare & Hiscock, 1974
<i>Sertularella</i> sp.	A hydroid	S			◆			Acidified-halogenated effluent	Hoare & Hiscock, 1974
<i>Obelia geniculata</i>	A hydroid			◆				Acidified-halogenated effluent	Hoare & Hiscock, 1974
<i>Obelia longissima</i>	A hydroid	S	◆					Substratum loss, Temperature change	MarLIN reviews; Boero & Bouillon 1993; Cornelius, 1995; Berrill, 1949.
OCTOCORALLIA								Abrasion & physical disturbance, Smothering, Synthetic compound contamination, Displacement	MarLIN reviews; Bryan & Gibbs, 1991; Boero, 1984; Bryan, 1984; Cornelius, 1995
<i>Alcyonium digitatum</i>	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 <i>et al.</i> , 2000; Hartnoll, 1998; Veale <i>et al.</i> , 2000; Hoare & Hiscock, 1974

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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
<i>Eunicella verrucosa</i>	Pink sea fan	S	♦					Substratum loss, Displacement, Changes in oxygen	MarLIN reviews
HEXACORALLIA				♦				Abrasion & physical disturbance, Smothering, Increase in wave exposure	MarLIN reviews; Bavestrello et al., 1997; Eno et al. 1996.
<i>Leptopsammia pruvoti</i>	Sunset cup coral	S	♦					Substratum loss, Abrasion & physical disturbance, Smothering, Displacement	MarLIN reviews; Cole et al., 1999. Nationally rare and open coast only.
<i>Prostanthea simplex</i>	Sealoch anemone	S	♦					Substratum loss, Abrasion & physical disturbance, Smothering, Increase in wave exposure, Temperature change	MarLIN reviews
<i>Actinia equina</i>	Beadlet anemone	L	♦					Acidified-halogenated effluent	Hoare & Hiscock, 1974
<i>Urticina felina</i>	Dahlia anemone		♦					Substratum loss	MarLIN reviews
		L+S		♦				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
<i>Metridium senile</i>	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
<i>Actinothoe sphyrodeta</i>	Sandalled	S			♦			Sedimentation	MarLIN reviews; Saiz Salinas & Urdangarin, 1994.

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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
NEMERTEA	anemone								
ANOPLA									
<i>Tubulanus annulatus</i>	Football jersey worm	S	◆					Synthetic compound contamination, Changes in nutrient levels	Jones, 1973
Nemertea indet.				◆				Acidified-halogenated effluent	Hoare & Hiscock, 1974
ANNELIDA									
POLYCHAETA									
<i>Cirratulus cirratus</i>	A bristleworm	L+S				◆		Changes in nutrient levels	Bellan, 1980
<i>Eulalia sanguinea</i>	A bristleworm	L+S			◆			Increased temperature, Increased levels of suspended sediment, Increased turbidity	Gibbs, 1971; Clay, 1967a
<i>Eulalia viridis</i>	A bristleworm	L+S			◆			Acidified-halogenated effluent	Hoare & Hiscock, 1974
<i>Polydora ciliata</i>	A bristleworm	L+S			◆			Acidified-halogenated effluent	Hoare & Hiscock, 1974
							◆	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
<i>Lagisca extenuata</i>	A bristleworm	S			♦			Acidified-halogenated effluent	Hoare & Hiscock, 1974 (<i>As Harmothoe extenuata</i>)
<i>Hydroides norvegica</i>	A tubeworm	S				♦		Acidified-halogenated effluent	Hoare & Hiscock, 1974
<i>Jasminiera elegans</i>	A bristleworm	S			♦			Acidified-halogenated effluent	Hoare & Hiscock, 1974
<i>Lepidonotus squamatus</i>	A bristleworm	S			♦			Acidified-halogenated effluent	Hoare & Hiscock, 1974
<i>Nereis pelagica</i>	A bristleworm	S			♦			Acidified-halogenated effluent	Hoare & Hiscock, 1974
<i>Polycirrus denticulatus</i>	A bristleworm	S			♦			Acidified-halogenated effluent	Hoare & Hiscock, 1974
<i>Pomatoceros triqueter</i>	A tubeworm				♦			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.
		L+S	♦					Substratum loss, Smothering	MarLIN reviews
				♦				Abrasion & physical disturbance	MarLIN reviews
<i>Sclerocheilus minutus</i>	A bristleworm	S				♦		Acidified-halogenated effluent	Hoare & Hiscock, 1974
<i>Sabellaria spinulosa</i>	Ross worm	L+S			♦			Acidified-halogenated effluent	Hoare & Hiscock, 1974
					♦			Synthetic compound contamination, Changes in nutrient levels	Walker & Rees, 1980
						♦		Acidified-halogenated effluent	Hoare & Hiscock, 1974
<i>Serpula vermicularis</i>	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
Spirorbiniidae indet.	A serpulid tubeworm	L+S			♦			Acidified-halogenated effluent	Hoare & Hiscock, 1974
<i>Syllis hyalina</i>			♦					Acidified-halogenated effluent	Hoare & Hiscock, 1974
CHELICERATA									
PYCNOGONIDA									
<i>Nymphon gracile</i>	A sea spider	L+S	♦					Synthetic compound contamination, Changes in nutrient levels	Jones, 1973
<i>Pycnogonum littorale</i>	A sea spider	L+S			♦			Acidified-halogenated effluent	Hoare & Hiscock, 1974
CRUSTACEA									
MAXILLOPODA									
<i>Balanus crenatus</i>	An acorn barnacle						♦	Substratum loss, Siltation, Displacement	MarLIN reviews
		S		♦				Increased temperature, Changes in oxygenation	Naylor, 1965; Southward, 1955; MarLIN reviews
					♦			Acidified-halogenated effluent	Hoare & Hiscock, 1974
<i>Chthamalus montagui</i>	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

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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
<i>Chthamalus stellatus</i>	Poli's stellate barnacle	L		♦	♦			Abrasion & physical disturbance, Increased turbidity, Decreased wave exposure	Barnes & Barnes, 1968; MarLIN reviews
					♦	♦		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
<i>Semibalanus balanoides</i>	An acorn barnacle		♦					Substratum loss, Displacement	MarLIN reviews
		L		♦				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
<i>Corophium bonelli</i>	An amphipod	S	♦					Acidified-halogenated effluent	Hoare & Hiscock, 1974
<i>Erichthonius brasiliensis</i>	An amphipod	S	♦					Acidified-halogenated effluent	Hoare & Hiscock, 1974
<i>Eurystheus maculatus</i>	An amphipod	S		♦				Acidified-halogenated effluent	Hoare & Hiscock, 1974 (As <i>Gammaropsis maculate</i>)

Development of a hard substratum benthic invertebrate Water Framework Directive compliant classification tool

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
<i>Hyale prevostii</i>	An amphipod	L	◆					Substratum loss, Hydrocarbons, Changes in oxygenation	McCook & Chapman, 1993; Suchanek, 1993; Cabiocch <i>et al.</i> , 1978; Wieser & Kanwisher, 1959
<i>Jassa falcata</i>	An amphipod	S	◆	◆				Abrasion & physical disturbance, Synthetic compound contamination, Heavy metals	McHenry <i>et al.</i> , 1990; Hong & Reish, 1987. Likely to be intolerant of chemical contamination.
<i>Panopea minuta</i>			◆					Hydrocarbons, Changes in oxygenation, Siltation, Acidified-halogenated effluent	Suchanek, 1993; Cabiocch <i>et al.</i> , 1978; Saiz Salinas & Urdangarin, 1994 ; Hoare & Hiscock, 1974. Likely to be intolerant of chemical contamination.
<i>Aora typica</i>		S	◆	◆				Substratum loss, Abrasion & physical disturbance, Heavy metals, Synthetic compound contamination	MarLIN reviews; Hong & Reish, 1987; McLusky <i>et al.</i> , 1986; Meador <i>et al.</i> , 1993.
<i>Cancer pagurus</i>	Edible crab		◆					Acidified-halogenated effluent	Hoare & Hiscock, 1974 (As <i>Iphimedia minuta</i>)
			◆					Acidified-halogenated effluent	Hoare & Hiscock, 1974
			◆					Synthetic chemical contamination	Smith (ed.), 1968
			◆	◆				Substratum loss, Abrasion & physical disturbance, Increase in temperature	MarLIN reviews; Karlsson & Christiansen, 1996; Bennett, 1995; Bradshaw <i>et al.</i> , 2000
		S			◆			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
<i>Carcinus maenas</i>	Common shore crab	S	◆					Hydrocarbon contamination	Baker, 1976; Depledge, 1984

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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 <i>et al.</i> , 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
<i>Hippolyte varians</i>	A prawn		◆					Acidified-halogenated effluent	Hoare & Hiscock, 1974
<i>Necora puber</i>	Velvet swimming crab			◆				Acidified-halogenated effluent	Hoare & Hiscock, 1974
<i>Pisidia longicornis</i>	Long clawed porcelain crab	L+S	◆					Abrasion & physical disturbance; Acidified-halogenated effluent	MarLIN reviews; Hoare & Hiscock, 1974
<i>Pilumnus hirtellus</i>	A crab	L+S		◆				Heavy metals, Hydrocarbons, Changes in oxygenation, Decrease in temperature	Roesijadi <i>et al.</i> , 1974; Crisp (ed.), 1964; MarLIN reviews. An underboulder species that lives in wave sheltered euryhaline and possibly polyhaline habitats
EUMALACOS TRACA								Acidified-halogenated effluent	Hoare & Hiscock, 1974
<i>Galathea squamifera</i>	A squat lobster	L+S	◆					Substratum loss, Synthetic compound contamination, Changes in nutrient levels	Jones, 1973
MOLLUSCA									
GASTROPODA									

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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
<i>Berthella plumula</i>	Yellow-plumed sea slug	S	◆					Substratum loss, Abrasion & physical disturbance, Displacement, Synthetic compound contamination, Changes in nutrient levels	Jones, 1973; MarLIN reviews
<i>Helcion pellucidum</i>	Blue-rayed limpet	S	◆					Substratum loss; Acidified-halogenated effluent	MarLIN reviews; Hoare & Hiscock, 1974
<i>Lacuna parva</i>	A periwinkle	L+S	◆					Abrasion & physical disturbance, Changes in water flow rate, Synthetic compound contamination	Ebling <i>et al.</i> , 1948; Warburton, 1976; MarLIN reviews
<i>Lacuna vincta</i>	A periwinkle	S	◆					Acidified-halogenated effluent	Hoare & Hiscock, 1974
<i>Littorina littorea</i>	Common periwinkle	L	◆					Substratum loss, Siltation, Hydrocarbons	Chandrasekara & Frid, 1998; Moore, 1997
<i>Littorina mariae</i>	Flat periwinkle	L		◆				Heavy metals, Abrasion & physical disturbance	Bryan & Gibbs, 1983; MarLIN reviews
<i>Littorina saxatilis</i>	A periwinkle	L		◆				Acidified-halogenated effluent	Hoare & Hiscock, 1974
<i>Nucella lapillus</i>	Dogwhelk	L	◆					Substratum loss, Synthetic compound contamination, Changes in nutrient levels	Hawkins <i>et al.</i> , 1994 ; Bryan & Gibbs, 1991; Gibbs, & Bryan, 1987; Gibbs <i>et al.</i> 1987; Gibbs <i>et al.</i> , 1988; Gibbs <i>et al.</i> 1991. Dogwhelks will take a number of years to respond in terms of mortality to contaminants 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
<i>Osilinus lineatus</i>	Thick top shell	L	◆	◆				Acidified-halogenated effluent	Hoare & Hiscock, 1974
<i>Rissoa parva</i>	A winkle	L+S	◆					Substratum loss, Smothering, Decrease in temperature, Changes in oxygenation	Crothers, 2001; Crisp (ed.), 1964; <i>MarLIN</i> reviews
<i>Tricolia pullus</i>	A winkle	S	◆					Changes in water flow, Increase in wave exposure, Displacement, Hydrocarbon contamination	Little, 1999; <i>MarLIN</i> reviews
<i>Patella ulysipponensis</i>	China limpet	L	◆	◆				Acidified-halogenated effluent	Hoare & Hiscock, 1974
								Acidified-halogenated effluent	Hoare & Hiscock, 1974
								Substratum loss, Smothering, Synthetic compound contamination, Hydrocarbon contamination	<i>MarLIN</i> reviews; Marshall & McQuaid, 1993; Southward, & Southward, 1978; Hawkins & Southward, 1992; Bonner <i>et al.</i> , 1993
								Decrease in wave exposure, Abrasion & physical disturbance, Displacement	Evans, 1953; <i>MarLIN</i> reviews
								Increase in wave exposure, Increase in water flow rate, Increase in turbidity	<i>MarLIN</i> reviews
								Changes in nutrient levels	Rogers, 2003; Tablado <i>et al.</i> , 1994
<i>Patella vulgata</i>	Common limpet	L	◆			◆		Substratum loss, Smothering, Synthetic compound contamination, Hydrocarbon contamination; Acidified-halogenated effluent	Bonner <i>et al.</i> , 1993; Smith (ed.), 1968; Glegg, 1999; Moore, 1997; Petpiroon & Dicks, 1982; Hoare & Hiscock, 1974. Occurs in euryhaline and polyhaline conditions.
PELYCOPODA								Changes in oxygenation	Marshall & McQuaid, 1993; Grenon & Walker, 1981

Development of a hard substratum benthic invertebrate Water Framework Directive compliant classification tool

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
<i>Chlamys varia</i>	A scallop	S			♦			Acidified-halogenated effluent	Hoare & Hiscock, 1974
<i>Hiatella arctica</i>	A bivalve mollusc	S			♦			Acidified-halogenated effluent	Hoare & Hiscock, 1974
<i>Modiolus modiolus</i>	Horse Mussel	SL	♦					Substratum loss, Abrasion & physical disturbance	MarLIN reviews; Holt <i>et al.</i> , 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. MarLIN reviews; Holt <i>et al.</i> , 1998; Bryan & Gibbs, 1991
<i>Monia squama</i>	A saddle oyster	S		♦			♦	Siltation, Synthetic compound contamination,	Hoare & Hiscock, 1974
<i>Mytilus edulis</i>	Common mussel	L+S	♦					Substratum loss	MarLIN reviews
<i>Ostrea edulis</i>								Smothering, Abrasion & physical disturbance, Displacement, Reduced wave exposure, Synthetic compound contamination, Hydrocarbon contamination	MarLIN reviews; Holt <i>et al.</i> , 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.
<i>Pholas dactylus</i>	Common piddock	L+S	♦					Substratum loss, Displacement, Synthetic compound contamination	MarLIN reviews; Barnes, 1980; Beaumont, 1989; Waldock & Thain, 1983

Development of a hard substratum benthic invertebrate Water Framework Directive compliant classification tool

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
BRYOZOA				♦				Abrasion & physical disturbance	MarLIN reviews
<i>Alcyonidium mytili</i>	A gelatinous bryozoan	S	♦					Acidified-halogenated effluent	Hoare & Hiscock, 1974
<i>Bugula turbinata</i>	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
<i>Cellaria</i> sp.	A branching bryozoan	S	♦					Acidified-halogenated effluent	Hoare & Hiscock, 1974
<i>Cellepora hyalina</i> .	A branching bryozoan	S					♦	Acidified-halogenated effluent	Hoare & Hiscock, 1974
<i>Electra pilosa</i>	An encrusting Bryozoan	L+S			♦			Acidified-halogenated effluent	Hoare & Hiscock, 1974
<i>Escharoides coccineus</i>	An encrusting bryozoan	S			♦			Acidified-halogenated effluent	Hoare & Hiscock, 1974
<i>Flustra foliacea</i>	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; Dyrnnda, 1994; Holme & Wilson, 1985; Hiscock, 1983; Hiscock, 1985; Hoare & Hiscock, 1974

Development of a hard substratum benthic invertebrate Water Framework Directive compliant classification tool

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.
<i>Membranipora membranacea</i>	An encrusting bryozoan	S	♦		♦			Substratum loss, Displacement	MarLIN reviews. Especially present where sand inundation occurs on the open coast.
<i>Scrupocellaria reptans</i>	An erect bryozoan	S		♦				Acidified-halogenated effluent	Hoare & Hiscock, 1974
<i>Scrupocellia scrupea</i>	An erect bryozoan	S	♦					Acidified-halogenated effluent	Hoare & Hiscock, 1974
PHORONIDA								Acidified-halogenated effluent	Hoare & Hiscock, 1974
<i>Phoronis hippocrepia</i>	Polychaete worm	S				♦		Increase in suspended sediment	Saiz Salinas & Urdangarin, 1994
ECHINODERMATA									
CRINOIDEA									
<i>Antedon bifida</i>	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
ASTEROIDEA				♦				Changes in oxygenation	MarLIN reviews; Cole <i>et al.</i> , 1999. Present in wave sheltered, tidal stream exposed habitats in euryhaline and possibly polyhaline situations.

Development of a hard substratum benthic invertebrate Water Framework Directive compliant classification tool

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
<i>Ophiothrix fragilis</i>	Common brittlestar	L+S	◆					Substratum loss, Smothering, Hydrocarbons	Newton & McKenzie, 1995
<i>Asterias rubens</i>	Common starfish	L+S		◆				Abrasion & physical disturbance; Acidified-halogenated effluent	Bradshaw <i>et al.</i> , 2002; Sköld, 1998; Hoare & Hiscock, 1974. Widely distributed under boulders on the shore and may form beds offshore. Present in euryhaline conditions.
<i>Henricia</i> sp.	Bloody Henry starfish	S	◆					Acidified-halogenated effluent	Hoare & Hiscock, 1974
ECHINOIDEA								Acidified-halogenated effluent	Hoare & Hiscock, 1974
<i>Echinus esculentus</i>	Edible sea urchin		◆					Synthetic compound contamination, Hydrocarbons, Heavy metals	Gommez & Miguez-Rodriguez, 1999; Smith (ed.), 1968; Dinnel <i>et al.</i> , 1988
		S		◆				Substratum loss, Abrasion & physical disturbance, Changes in oxygenation	Bradshaw <i>et al.</i> , 2002; Hall-Spencer & Moore, 2000; Griffiths <i>et al.</i> , 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.
<i>Psammechinus miliaris</i>	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 <i>et al.</i> , 1988; Suchanek, 1993

Development of a hard substratum benthic invertebrate Water Framework Directive compliant classification tool

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
CHORDATA								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.
ASCIDIACEA									
<i>Ascidella scabra</i>	A sea squirt	L+S	◆					Substratum loss, Displacement, Abrasion & physical disturbance, Acidified-halogenated effluent	Jennings & Kaiser, 1998; Bradshaw <i>et al.</i> , 2002; Hoare & Hiscock, 1974
<i>Botryllus sclosseri</i>	Star sea squirt	L+S	◆	◆				Synthetic compound contamination, Inorganic particulates	Rees <i>et al.</i> , 2001; Robbins, 1985. A rapid colonizing species that is especially found in sheltered euryhaline conditions.
<i>Ciona intestinalis</i>	A sea squirt	L+S	◆					Acidified-halogenated effluent	Hoare & Hiscock, 1974
								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 <i>et al.</i> , 2001 ; Bellas <i>et al.</i> , 2004. A rapid colonizing species that is especially found in sheltered euryhaline and polyhaline conditions.
<i>Clavelina lepadiformis</i>	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
<i>Dendrodoa grossularia</i>	Baked bean ascidian	SL	◆	◆				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.
<i>Didemniidae</i> indet.					◆			Substratum loss, Displacement, Abrasion & physical disturbance, Hydrocarbons, Changes in nutrient levels Acidified-halogenated effluent	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. Hoare & Hiscock, 1974

Development of a hard substratum benthic invertebrate Water Framework Directive compliant classification tool

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

Biotores (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

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

CNIDARIA: HYDROZOA

	<i>Clava multicornis</i>
	<i>Dynamena pumila</i>
	<i>Laomedea flexuosa</i>
	<i>Obelia geniculata</i>
	<i>Obelia longissima</i>
	<i>Obelia dichotoma</i>
	<i>Tubularia indivisa</i>

CNIDARIA: ANTHOZOA

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

ANNELIDA: POLYCHAETA

	<i>Harmothoe sp.</i>
	<i>Lepidonotus squamatus</i>
	<i>Eulalia viridis</i>
	<i>Polydora sp.</i> (☹)
	<i>Sabellaria alveolata</i>
	<i>Sabellaria spinulosa</i>
	<i>Terebellidae indet.</i>
	<i>Pomatoceros lamarcki</i>
	<i>Pomatoceros triqueter</i>
	<i>Spirorbidae indet.</i>

	<i>Janua pagenstecheri</i>
	<i>Spirorbis corallinae</i>
	<i>Spirorbis rupestris</i>
	<i>Spirorbis spirorbis</i>
	<i>Spirorbis tridentatus</i>
	<i>Ficopomatus enigmatic.</i> ☹

CRUSTACEA: CIRRIPIEDIA

	Cirripedia indet. (juv.)
	<i>Verruca stroemia</i>
	<i>Chthamalus montagui</i>
	<i>Chthamalus stellatus</i>
	<i>Elminius modestus</i> ☹
	<i>Semibalanus balanoides</i>
	<i>Balanus crenatus</i>
	<i>Balanus improvisus</i>
	<i>Balanus perforatus</i>

CRUSTACEA: AMPHIPODA

	Amphipoda indet.
	<i>Hyale nilssoni</i>
	Gammaridae

CRUSTACEA: ISOPODA

	<i>Sphaeroma rugicauda</i>
	<i>Jaera albifrons</i>
	<i>Idotea sp.</i>
	<i>Idotea baltica</i>
	<i>Idotea granulosa</i>

CRUSTACEA: DECAPODA

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

MOLLUSCA: POLYPLACOPHORA

	Polyplacophora indet.
	<i>Lepidochitona cinerea</i>

MOLLUSCA: GASTROPODA

	<i>Tectura testudinalis</i> N
	<i>Tectura virginea</i>
	<i>Patella spp.</i>
	<i>Helcion pellucidum</i> ☺☺
	<i>Margarites helicinus</i> N
	<i>Osilinus lineatus</i>
	<i>Gibbula cineraria</i>
	<i>Gibbula umbilicalis</i>
	<i>Calliostoma zizyphinum</i>
	<i>Lacuna pallidula</i> N
	<i>Lacuna vincta</i>
	<i>Littorina arcana</i>
	<i>Littorina littorea</i>
	<i>Littorina neglecta</i>
	<i>Littorina nigrolineata</i>
	<i>Littorina obtusata/mariae</i>
	<i>Littorina saxatilis</i>
	<i>Melarhaphe neritoides</i>

	<i>Skeneopsis planorbis</i>
	<i>Rissoa parva</i>
	<i>Hydrobia ulvae</i>
	<i>Crepidula fornicata</i> ☹
	<i>Trivia arctica</i>
	<i>Trivia monacha</i>
	<i>Ocenebra erinacea</i>
	<i>Nucella lapillus</i> ☺☺

MOLLUSCA: OPISTHBRANCHIA

	<i>Goniodoris nodosa</i>
	<i>Onchidoris bilamellata</i>
	<i>Archidoris pseudoargus</i>
	<i>Berthella plumula</i>
	<i>Aplysia punctata</i>

MOLLUSCA: PELECYPODA

	<i>Mytilus edulis</i>
	<i>Modiolus modiolus</i>
	<i>Anomia ehippium</i>
	<i>Heteranomia squamula</i>
	<i>Pododesmus patelliformis</i>
	<i>Lasaea adansoni</i>
	<i>Hiatella arctica</i>
	<i>Pholas dactylus</i> ☺
	<i>Ostrea edulis</i>
	<i>Crassostrea gigas</i> ☹

BRYOZOA

	<i>Crisiidae indet.</i>
	<i>Alcyonidium diaphanum</i>
	<i>Alcyonidium gelatinosum</i>
	<i>Alcyonidium hirsutum</i>
	<i>Alcyonidium mytili</i>
	<i>Flustrellidra hispida</i>
	<i>Bowerbankia imbricata</i>
	<i>Membranipora membranacea</i>
	<i>Electra pilosa</i>
	<i>Scrupocellaria reptans</i>
	<i>Umbonula littoralis</i>

	<i>Schizoporella unicornis</i>
	Bryozoa indet. (crusts)

ECHINODERMATA

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

ASCIDIACEA

	<i>Clavelina lepadiformis</i>
	Polyclinidae
	Didemnidae
	<i>Ciona intestinalis</i>
	<i>Ascidia sp.</i>
	<i>Ascidia conchilega</i>
	<i>Ascidia mentula</i>
	<i>Dendrodoa grossularia</i>
	<i>Distomus variolosus</i>
	<i>Botryllus schlosseri</i>
	<i>Botrylloides leachi</i>
	<i>Styela clava</i> ☹

PISCES – FISH

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

ANNEX 2. FIELD RECORDING FORM FOR SUBTIDAL INVERTEBRATES AND FISH

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

<i>Clathrina coriacea</i>
<i>Leucosolenia complicata</i>
<i>Leucosolenia botryoides</i>
<i>Scypha ciliate</i>
<i>Grantia compressa</i>
<i>Oscarella lobularis</i>
<i>Pachymatisma johnstonia</i>
<i>Tethya aurantium</i>
<i>Suberites carnosus</i>
<i>Suberites ficus</i>
<i>Polymastia boletiformis</i>
<i>Polymastia mamillaris</i>
<i>Cliona celata</i>
<i>Stelligera rigida</i>
<i>Stelligera stuposa</i>
<i>Axinella dissimilis</i>
<i>Axinella infundibuliformis</i>
<i>Halichondria bowerbanki</i>
<i>Halichondria panicea</i>
<i>Ciocalypa penicillus</i>
<i>Hymeniacion perleve</i>
<i>Mycale sp.</i>
<i>Mycale rotalis</i>
<i>Esperiopsis fucorum</i>
<i>Hymedesmia paupertas</i>
<i>Phorbas fictitius</i>
<i>Hemimycale columella</i>
<i>Myxilla sp.</i>
<i>Myxilla incrustans</i>
<i>Iophonopsis nigricans</i>
<i>Iophon hyndmani</i>
<i>Raspailia hispida</i>

<i>Raspailia ramosa</i>
<i>Haliclona sp.</i>
<i>Haliclona fistulosa</i>
<i>Haliclona oculata</i>
<i>Haliclona simulans</i>
<i>Haliclona urceolus</i>
<i>Haliclona viscosa</i>
<i>Dysidea fragilis</i>
<i>Halisarca dujardini</i>
<i>Porifera indet. (crusts)</i>

CNIDARIA: SCYPHOZOA

<i>Haliclystus auricula</i>
<i>Aurelia aurita</i> (scyphistomae)

CNIDARIA: HYDROZOA

<i>Tubularia indivisa</i>
<i>Tubularia larynx</i>
<i>Eudendrium sp.</i>
<i>Bougainvillia ramosa</i>
<i>Hydractinia echinata</i>
<i>Lafoea dumosa</i>
<i>Halecium beanii</i>
<i>Halecium halecinum</i>
<i>Aglaophenia sp.</i>
<i>Aglaophenia pluma</i>
<i>Aglaophenia tubulifera</i>
<i>Gymnangium montagui</i>
<i>Halopteris catharina</i>
<i>Kirchenpaueria pinnata</i>

<i>Nemertesia antennina</i>
<i>Nemertesia ramosa</i>
<i>Plumularia setacea</i>
<i>Polyplumaria frutescens</i>
<i>Abietinaria abietina</i>
<i>Abietinaria filicula</i>
<i>Diphasia rosacea</i>
<i>Hydrallmania falcata</i>
<i>Thuaria thuja</i>
<i>Sertularella gayi</i>
<i>Sertularella polyzonias</i>
<i>Sertularia argentea</i>
<i>Sertularia cupressina</i>
<i>Obelia sp.</i>
<i>Obelia dichotoma</i>
<i>Obelia geniculata</i>
<i>Obelia longissima</i>
<i>Rhizocaulus verticillatus</i>

CNIDARIA: ANTHOZOA

<i>Alcyonium digitatum</i>
<i>Alcyonium glomeratum</i>
<i>Swiftia pallida</i>
<i>Eunicella verrucosa</i>
<i>Epizoanthus couchii</i>
<i>Isozoanthus sulcatus</i>
<i>Parazoanthus axinellae</i>
<i>Parazoanthus anquicomus</i>
<i>Protanthea simplex</i>
<i>Actinia equina</i>

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

PLATYHELMINTHES

	<i>Prostheceraeus vittatus</i>

ANNELIDA: POLYCHAETA

	<i>Tubulanus annulatus</i>
	<i>Cerebratulus sp.</i>
	<i>Lineus longissimus</i>

ANNELIDA: POLYCHAETA

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

CRUSTACEA: CIRRIPIEDIA

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

CRUSTACEA: DECAPODA

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

MOLLUSCA: POLYPLACOPHORA

	<i>Polyplacophora indet.</i>
	<i>Leptochiton asellus</i>
	<i>Tonicella marmorea</i>
	<i>Tonicella rubra</i>

MOLLUSCA: GASTROPODA

	<i>Emarginula fissura</i>
	<i>Tectura testudinalis</i>
	<i>Tectura virginea</i>
	<i>Helcion pellucidum</i>
	<i>Margarites helicinus</i>
	<i>Jujubinus miliaris</i>
	<i>Gibbula cineraria</i>
	<i>Calliostoma zizyphinum</i>
	<i>Lacuna vincta</i>
	<i>Crepidula fornicata</i> ♀
	<i>Trivia arctica</i>
	<i>Trivia monacha</i>
	<i>Polinices polianus</i>
	<i>Ocenebra erinacea</i>

	<i>Nucella lapillus</i>
	<i>Buccinum undatum</i>
	<i>Hinia reticulata</i>
	<i>Hinia incrassata</i>

MOLLUSCA: OPISTHOBRANCHIA

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

MOLLUSCA: PELECYPODA

	<i>Mytilus edulis</i>
	<i>Modiolus modiolus</i>
	<i>Ostrea edulis</i>
	<i>Pecten maximus</i>
	<i>Pododesmus patelliformis</i>
	<i>Astarte sulcata</i>
	<i>Hiatella arctica</i>

CEPHALOPODA

	<i>Eledone cirrhosa</i>

BRACHIOPODA

	<i>Neocrania anomala</i>
	<i>Terebratulina retusa</i>

BRYOZOA

	<i>Crisiidae indet.</i>
	<i>Crisidia cornuta</i>
	<i>Crisia denticulata</i>
	<i>Crisia eburnea</i>
	<i>Alcyonidium diaphanum</i>

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

PHORONIDA

	<i>Phoronis hippocrepia</i>

ECHINODERMATA

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

ASCIDIACEA

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

PISCES – FISH

	<i>Scyliorhinus canicula</i>
	<i>Conger conger</i>
	<i>Diplecogaster bimaculata</i>
	<i>Lophius piscatorius</i>
	<i>Gadidae indet.</i>
	<i>Molva molva</i>
	<i>Pollachius pollachius</i>
	<i>Pollachius virens</i>
	<i>Trisopterus luscus</i>
	<i>Trisopterus minutus</i>
	<i>Gasterosteus aculeatus</i>
	<i>Spinachia spinachia</i>
	<i>Syngnathus acus</i>
	<i>Myoxocephalus scorpius</i>
	<i>Taurulus bubalis</i>
	<i>Agonus cataphractus</i>

	<i>Centrolabrus exoletus</i>
	<i>Crenilabrus melops</i>
	<i>Ctenolabrus rupestris</i>
	<i>Labrus bergylta</i>
	<i>Labrus mixtus</i>
	<i>Parablennius gattorugine</i>
	<i>Chirolophis ascanii</i>
	<i>Pholis gunnellus</i>
	<i>Gobiidae indet.</i>
	<i>Gobius niger</i>
	<i>Gobiusculus flavescens</i>
	<i>Lesueurigobius friesii</i>
	<i>Pomatoschistus sp.</i>
	<i>Pomatoschistus minutus</i>
	<i>Pomatoschistus pictus</i>
	<i>Thorogobius ephippiatus</i>
	<i>Phrynorhombus norvegicus</i>
	<i>Zeugopterus punctatus</i>
	<i>Pleuronectidae indet.</i>
	<i>Pleuronectes platessa</i>