The Marine Life Information Network® for Britain and Ireland (*MarLIN*)

Identifying offshore biotope complexes and their sensitivities

Integrated Science for Integrated Management – Developing the capacity for adaptive ecosystem management.

Sub contract reference A1148

Report to Centre for Environmental, Fisheries and Aquaculture Sciences (CEFAS)

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Executive summary

1. The Marine Life Information Network (*MarLIN*) programme was commissioned by the Centre for Environment, Fisheries, and Aquaculture Sciences (CEFAS) to process existing CEFAS benthic beam trawl datasets to identify offshore biotope complexes (the habitat and its associated species) and test an approach to assessing the likely sensitivities of those biotope complexes. In particular, the *MarLIN* subcontract would contribute to the integration of spatial data and mapping the sensitivity of offshore biotopes as part of an integrated approach to marine spatial planning.

2. The datasets supplied by CEFAS were from beam trawls and included species abundance and biomass data from 674 stations sampled between 1999 to 2003. Data were analysed and stations assigned to biotopes catalogued in the MNCR biotope classification scheme (2004 version).

3. Sensitivity was assessed for biotope complexes (level 4 of the biotopes classification). An approach that used the highest sensitivity of component biotopes in a complex was trialed using the 1997 biotope classification (for which *MarLIN* has researched sensitivity information) and the 'Sublittoral Sediment (SS)' section of the revised 2004 version of the biotope classification. The evaluation was carried out using sensitivity to physical disturbance.

4. In some cases, biotope complexes included a biotope that significantly differed in sensitivity from the rest of the biotopes in the complex due to differences in ecology and life history traits. Those biotopes were identified for separate sensitivity mapping from the biotope complex.

5. Using the 1997 version of the biotope classification, the proposed approach provided reasonable estimates of biotope complex sensitivity. The only sublittoral sediment biotope complex that could not be assigned a sensitivity was 'Circalittoral mixed sediment' (CMX) due to the difference in horse mussel bed sensitivities and the absence of researched 'representative' or 'represented' biotopes within the biotope complex.

6. The approach developed has proved to be practical and transparent. However, the presence of component biotopes in a complex that are of a higher sensitivity to the majority of biotopes makes it necessary to identify and map sensitivity of those level 5 biotopes separately.

7. The approach was tested used sensitivity to physical disturbance and abrasion (i.e. a factor related to towed fishing gears and dredging activity). The approach will need further testing using other factors.

8. Biotope complexes are thought to be representative mostly in the offshore environment. Therefore it would seem more appropriate to research sensitivity characteristics of biotope complexes, rather than biotopes, in the offshore environment.

9. Biotopes, biotope complexes and species indicative of sensitivity that require additional research are identified.

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1. Introduction

The Marine Life Information Network (*MarLIN*) programme, an initiative of the Marine Biological Association, was commissioned by the Centre for Environment, Fisheries, and Aquaculture Sciences (CEFAS) to process existing CEFAS benthic beam trawl datasets to identify offshore biotope complexes and test an approach to assessing the likely sensitivities of these biotope complexes. This analysis was seen as one step towards achieving the goals of the CEFAS research contract 'Integrated Science for Integrated Management – Developing the capacity for adaptive ecosystem management', which is funded by the Department for the Environment, Food and Rural Affairs (Defra). In particular, the *MarLIN* subcontract would contribute to the integration of spatial data and mapping the sensitivity of offshore biotopes as part of an integrated approach to marine spatial planning.

The following beam trawl datasets were supplied by CEFAS, consisting of both abundance and biomass data, in Excel spreadsheet format:

- Celtic Sea 2000-2002 (2 m beam trawl data);
- Corystes 8/1998 (4 m beam trawl);
- Corystes 9/1998 (4 m beam trawl);
- Corystes 10 and 13/2002 (4 m beam trawl), and
- Corystes 13/2003 (4 m beam trawl).

The subcontract work plan was divided into the following independent tasks:

1. Incorporate CEFAS sample data into Marine Recorder software, *MarLIN* Web site and National Biodiversity Network
2. Multivariate analysis of CEFAS sample data and conversion into biotope complexes (2004 version).
3. Tagging biotope complexes with sensitivity information
4. Identification of offshore species and biotopes that require additional research.

Each of the above tasks is addressed separately in the report that follows.

2. Incorporate CEFAS sample data into Marine Recorder, the *MarLIN* Web site and the National Biodiversity Network (NBN)

2.1. Methodology

The CEFAS beam trawl data was imported into Marine Recorder using the following steps:

1. enter 'survey' information, including survey name, owner and date, survey area (SW/NE corners), metadata and references;
2. enter 'survey event', including date, surveyor, and location (lat./long.);
3. reformat Excel spreadsheet for automated import;
4. import into Marine Recorder (any errors, e.g. spelling mistakes, are flagged up); and
5. depth data added to sample information.

In the above process, for example, Corystes 8/1998 would be a survey, while the individual stations within the survey would be a 'survey event' i.e. a 'discrete survey occurrence'. Replicates at each station are included as discrete samples within a survey event.

The survey data was then mapped in an Geographical Information System (GIS) to produce interactive maps on the Web site. Each survey point is directly linked (using a 'hotspot') to the relevant data on-line.

2.2. Problems encountered

The majority of species lists supplied to *MarLIN* from various sources have minor errors or problems and the CEFAS data was no exception. In particular, species that are not included in the National Biodiversity Network (NBN) Species Dictionary (incorporated in Marine Recorder) are not recognized on entry. Typographical errors in species names can be corrected and the data imported again. Common errors include the use of common names rather than the latin names, use of 'spp.', 'sp.', 'indet.' and species names ending in 'ii' when it should end in 'i' and vice versa. The following data could not be incorporated into the Marine Recorder species list but have been added to the relevant metadata

- E-D-PLEOCYEMATA-BRACHYURA
- Dogfish egg cases
- *Raja* egg cases

When the data is imported into Marine Recorder, if the abundance is a count then Marine Recorder will include a number. Some of the spreadsheets provided had a full stop instead of just being blank. As some species were actually recorded as zero in the spreadsheet, it was assumed that the fields with just a full stop should be blank. Zero abundance was incorporated by Marine Recorder into the relevant species lists, however, stops had to be removed manually to allow the dataset to be imported.

2.3. Outputs

All the datasets provided by CEFAS have been entered into Marine Recorder and placed on-line through the *MarLIN* Web site, together with relevant metadata. The datasets and associated maps can be viewed via the map based search (http://www.marlin.ac.uk/data_access/data_access_home.htm). In addition, a new search tool was developed, which allows users to look-up datasets by provider. The URL is (http://www.marlin.ac.uk/data_access/search_provider.asp).

The CEFAS datasets were included in the April 2004 'Snapshot' of data sent to the NBN. However, there are considerable delays between the supply of data to the NBN and the data appearing on the NBN Gateway. At the time of writing, the NBN Gateway was under-going a major upgrade and the survey data was not available on-line.

3. Multivariate analysis of CEFAS sample data and conversion into biotope complexes (2004 version) (Task 2)

3.1. Methods

Task 2 required analysis of CEFAS datasets to identify biotope complexes in the revised National Marine Habitat Classification for Britain and Ireland (Connor *et al.*, 2003). It should be noted that the revised sublittoral sediment biotope classification was under continued revision during the contract. Therefore, the revised sublittoral sediment classification is henceforth referred to as the '2004 version'. Task 2 was subcontracted to Jim Allen at the Institute of Estuarine and Coastal Studies (ICES).

The trawl data provided, which included 674 stations from between 1999 to 2003, were analysed and stations assigned to biotopes from the MNCR biotope classification scheme (2004 version). The current version of the classification (Connor *et al.*, 2003) is a hierarchical system with 6 levels which equate to the EUNIS classification (Davies & Moss, 1998) as follows:

- Level 1: Environment (Marine)
- Level 2: Broad habitats
- Level 3: Habitat complexes
- Level 4: Biotope complexes
- Level 5: Biotopes
- Level 6: Sub-biotopes

In the current study, each trawl site was characterized to level 4 (biotope complex level). Biotope complexes are groups of biotopes with similar overall physical and biological characteristics and generally provide better units for mapping, management and for assessing sensitivity than the individual biotopes.

The trawl data used in the current study comprised primarily of demersal fish and epibiota, which often lacked the detailed information on the infauna required to assign the trawls to biotope level (level 5). To date, thirty sublittoral sediment biotope complexes have been described based on species assemblage and habitat characteristics (sediment type, depth, salinity etc).

Analysis of the trawl data comprised of a number of stages as follows:

1. data checking/standardisation;
2. multivariate analysis;
3. ranking by dominant taxa at each station;
4. assessment of habitat information where available; and
5. mapping of biotope complexes.

Prior to carrying out data analysis, spreadsheets containing the abundance/biomass data were examined for missing data/inconsistencies in species identification etc. As the sublittoral sediment biotope profiles described in the latest version of the MNCR classification were primarily derived from infaunal species and to a lesser extent epibiota, the demersal fish species were removed from the datasets prior to analysis.

Initially the datasets were analysed using multivariate classification techniques (cluster analysis) using the PRIMER software package. This included derivation of similarity matrices using the Bray-Curtis similarity coefficient (percent similarity) and then clustering the stations using UPGMA (Unweighted Pair-Group Method using Arithmetic averages). The dendrograms derived from cluster analysis were then used to divide the stations into a series of groups (at various levels of similarity) in order to define the main benthic assemblages in which similar species were found. For many groups similarities between stations were over 50% indicating quite high consistency in terms of species composition. However, the data was quite noisy with numerous outlying groups at lower levels of similarity present. Subsequently, a standard cut-off limit (in terms of % similarity) was not used to derive the main groupings but rather a hierarchical approach was employed.

Following multivariate analysis, summary tables of the benthic fauna were compiled using mean abundance (and biomass) and percent occurrence for the species in each group and visually compared with the species profiles for the biotope complexes and biotopes from the MNCR classification. Depth data (either supplied from CEFAS or derived from admiralty charts) were also examined from each group, along with an assessment of sediment type (from admiralty charts), and these parameters were used to assist in the designation of biotope complexes.

In order to obtain a more detailed description of the species composition at each station the trawls from each group were then ranked by abundance (and biomass) in order to assess the dominant taxa at each station. This allowed a more detailed examination of species composition and variation within each cluster group and helped to determine the level of similarity at which to split each group. Expert judgement was used to compare the species profiles and any habitat information (depth/sediment data from admiralty charts) from each cluster group and for each station with the profiles generated for the MNCR biotope classification. Subsequently, biotope complex codes were assigned to each station and the results tabulated and mapped onto GIS (using MapInfo) in order to identify any anomalies in the classification e.g. coastal stations identified with an estuarine biotope complex.

3.2. Problems encountered

In general, the classification of many of the trawl stations was relatively straight-forward based on characterizing taxa and any available depth/habitat information. However, as the data available comprised mainly of epibiota it was in some cases difficult to obtain the level of resolution required to split between biotope complexes. For instance, many trawls were characterized primarily by relatively ubiquitous species of crustaceans or echinoderms, which often occur in a number of biotope complexes. In such cases, an assessment of the habitat (depth range and general sediment type in the area) was required to define the likely biotope complex. For example, the difference between coarser sands and medium-fine mobile sands or muddy sand and sandy mud was often difficult to identify based purely on a few epifaunal species. In the MNCR classification, these complexes are separated using more detailed habitat information and/or subtle changes in the infaunal community. Such information was often not available in the current study so a degree of expert judgement was required in order to identify biotope complex.

3.3. Outputs

The biotope complexes identified (2004 version) for each survey within the CEFAS datasets provided and their distribution are shown in Figures 1-6. Please note that the biotope complex codes used in the analysis now differ from the latest draft version (March 2004) of the codes used by the JNCC. This is due to changes in the codes used by JNCC between versions, and is a minor consideration.

The datasets did not contain any biotopes complexes within the Sublittoral macrophyte-dominated sediment (SMp) habitat complex, and the only biotope complex found within the Sublittoral biogenic reef (SBR) habitat complex was Sublittoral mussel beds. It should be noted, however, that algae are not recorded during the surveys, though catches in shallow water (e.g. in the vicinity of the Solent, off Brixham and Tremadoc Bay) typically include a variety of macroalgae. The only infralittoral biotope complex that did not occur within the datasets was Infralittoral fine mud (IFiMu). In a few cases individual biotopes complexes within a sample could not be separated and were recorded as a combined unit. The combined units identified were:

- Circalittoral gravel and coarse sand / Sublittoral mussel beds (CGvSa/SMus);
- Sublittoral mussel beds / Infralittoral mixed sediment (SMus/IMx); and
- Offshore circalittoral sand & muddy sand / Offshore circalittoral mud & sandy mud (OMu/OSa).

4. Tagging biotope complexes with sensitivity information (Task 3)

4.1. Determination of approach

The SensMap report (McMath *et al.*, 2000) suggested the following approaches for the derivation of the sensitivity of biotope complexes, lifeform or habitat complexes.

Where information on the sensitivity of biotopes exists:

1. **report a mean sensitivity** of a geographically refined list of component biotopes, taking biotope areas into consideration ***or***
2. **report the highest sensitivity** of a geographically refined list of component biotopes.

Alternatively, where no biotope sensitivity information exists:

3. **the sensitivity of the biotope complex** can be derived in the same manner as biotopes themselves, by identification of species indicative of sensitivity.

The first proposal would require an accurate knowledge of the extent of the component biotopes in order to ‘weight’ the mean sensitivity. However, the authors feel that a mean sensitivity could potentially underestimate sensitivity.

The second proposal agrees with present thinking by *MarLIN*, that is:

- **reporting the highest sensitivity of the component biotopes** is simple and practical but does not detract from the information on the sensitivity of the component biotopes since, in any computer-based system, the information on the derivation of sensitivity is available.
- **reporting the highest or worst-case sensitivity may exaggerate overall sensitivity.** However, the author considers that the worst-case scenario fulfils the aims of coastal sensitivity mapping, i.e. to identify or ‘flag’ potential impacts and areas where special care or management may be required.
- **reporting the worst case sensitivity can also be applied with equal transparency** to all levels of the biotope hierarchy, biotope complex, lifeform or habitat complex.

In the absence of biotope sensitivity information, it may be possible to assess the sensitivity of biotope complexes based on the sensitivity of their component species (the third proposal). *MarLIN* has researched two biotope complexes to date, pioneer salt marsh (LMU.Sm) and muddy sand shores (LMS.MS) as separate entities. No species indicative of sensitivity were identified since the biotope complexes encompassed a wide range of biotopes of different community composition.

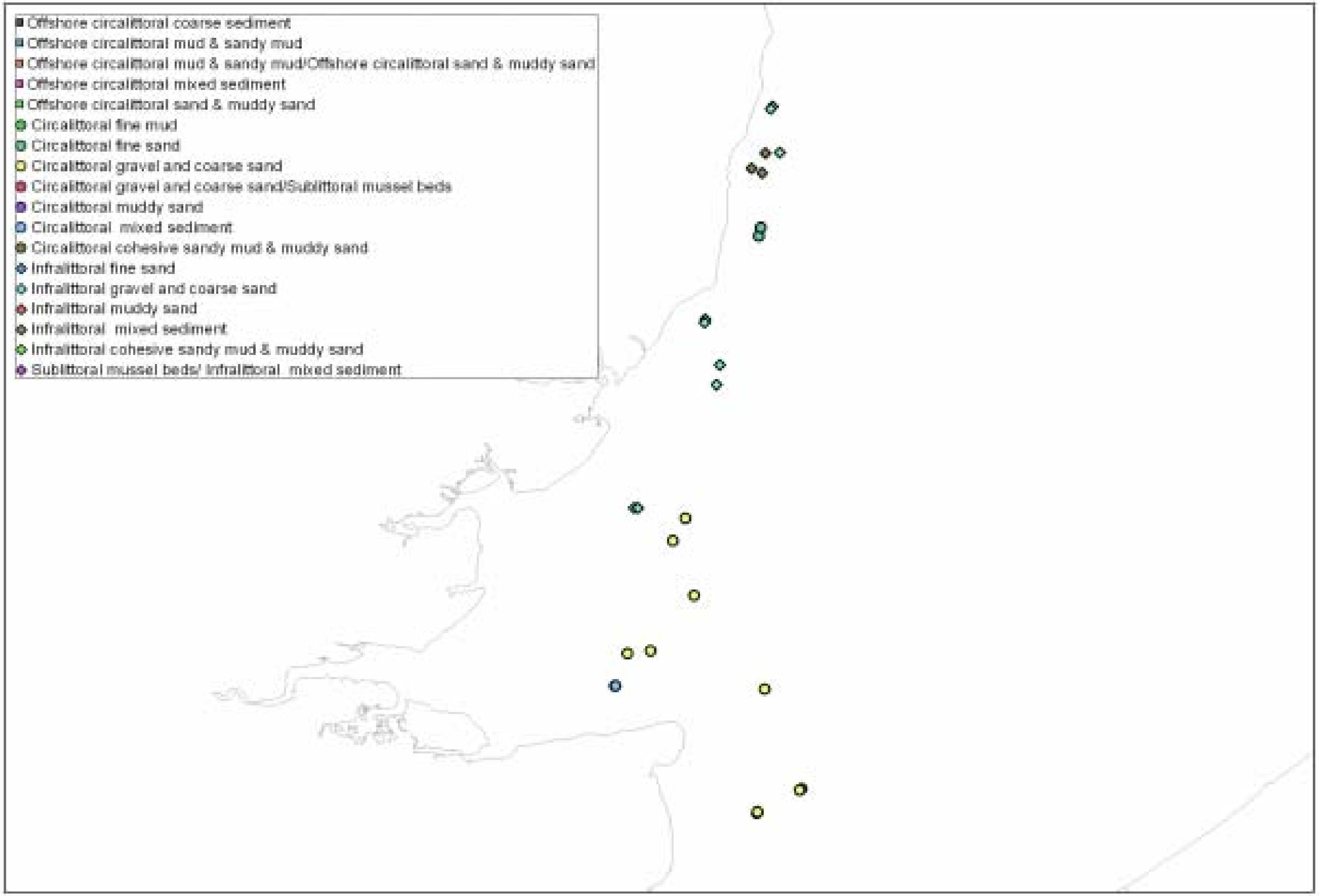


Figure 1. Distribution of 2004 biotope complexes identified within the southern North Sea using the CEFAS datasets provided.

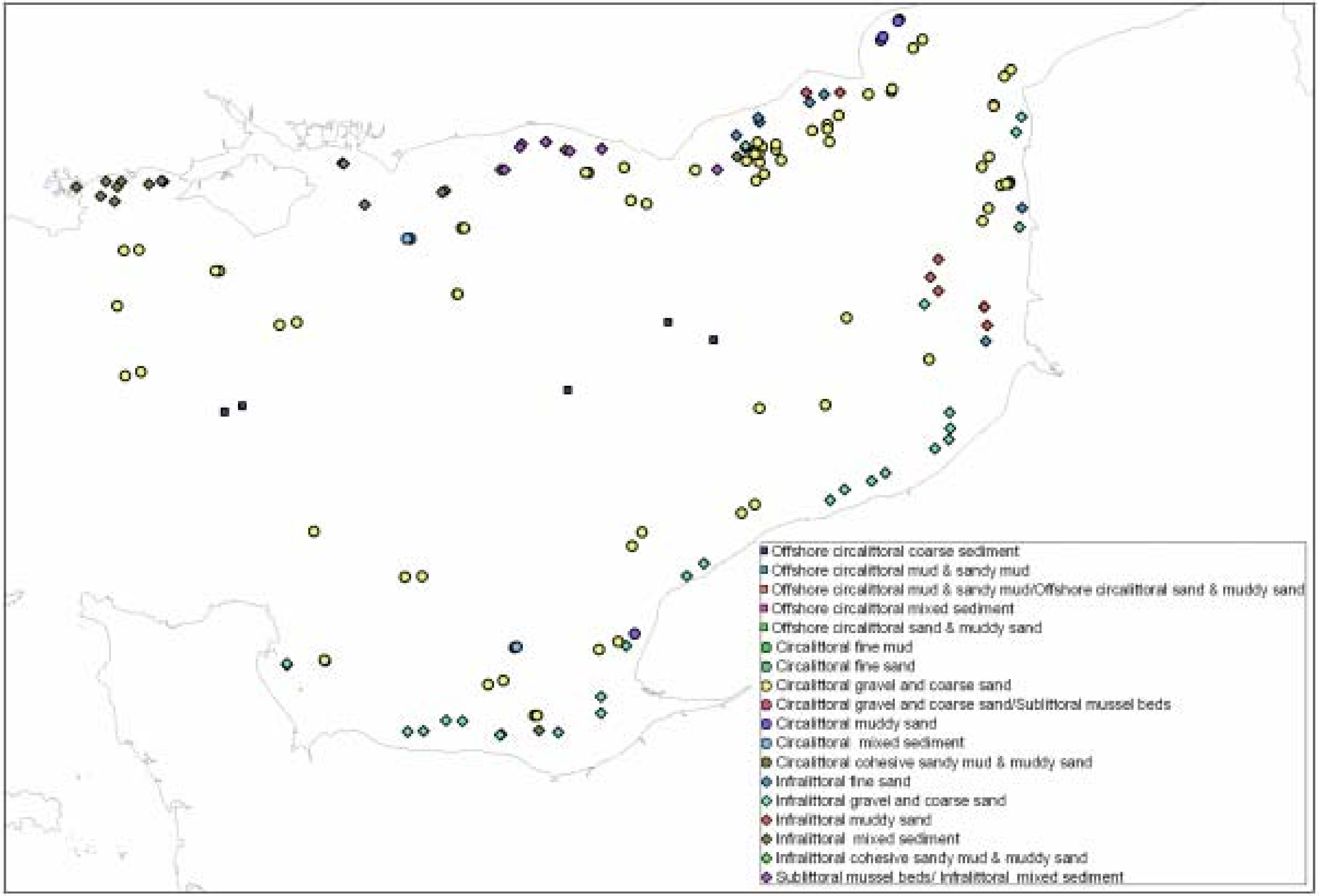


Figure 2. Distribution of 2004 biotope complexes identified within the eastern English Channel using the CEFAS datasets provided.

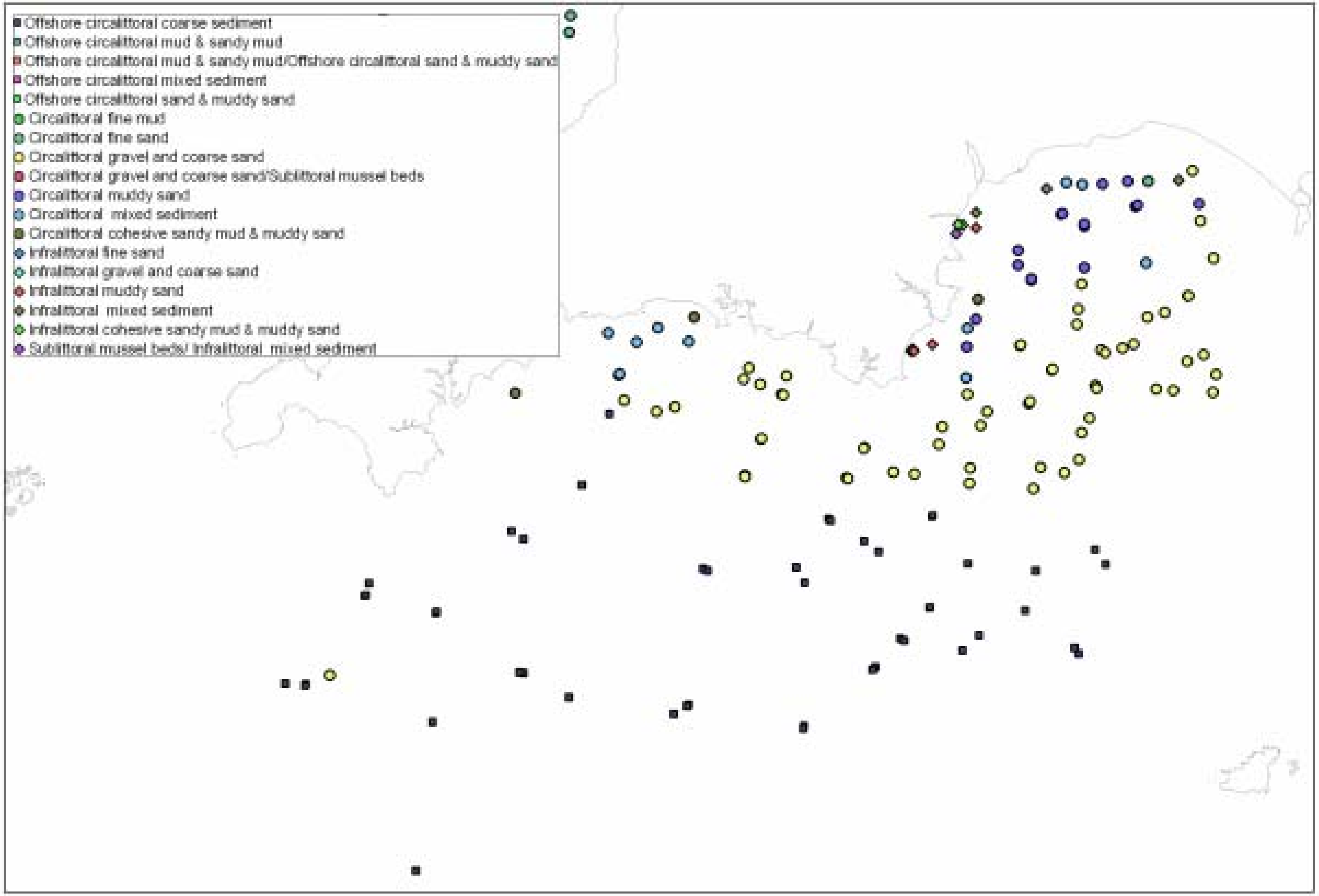


Figure 3. Distribution of 2004 biotope complexes identified within the western English Channel using the CEFAS datasets provided.

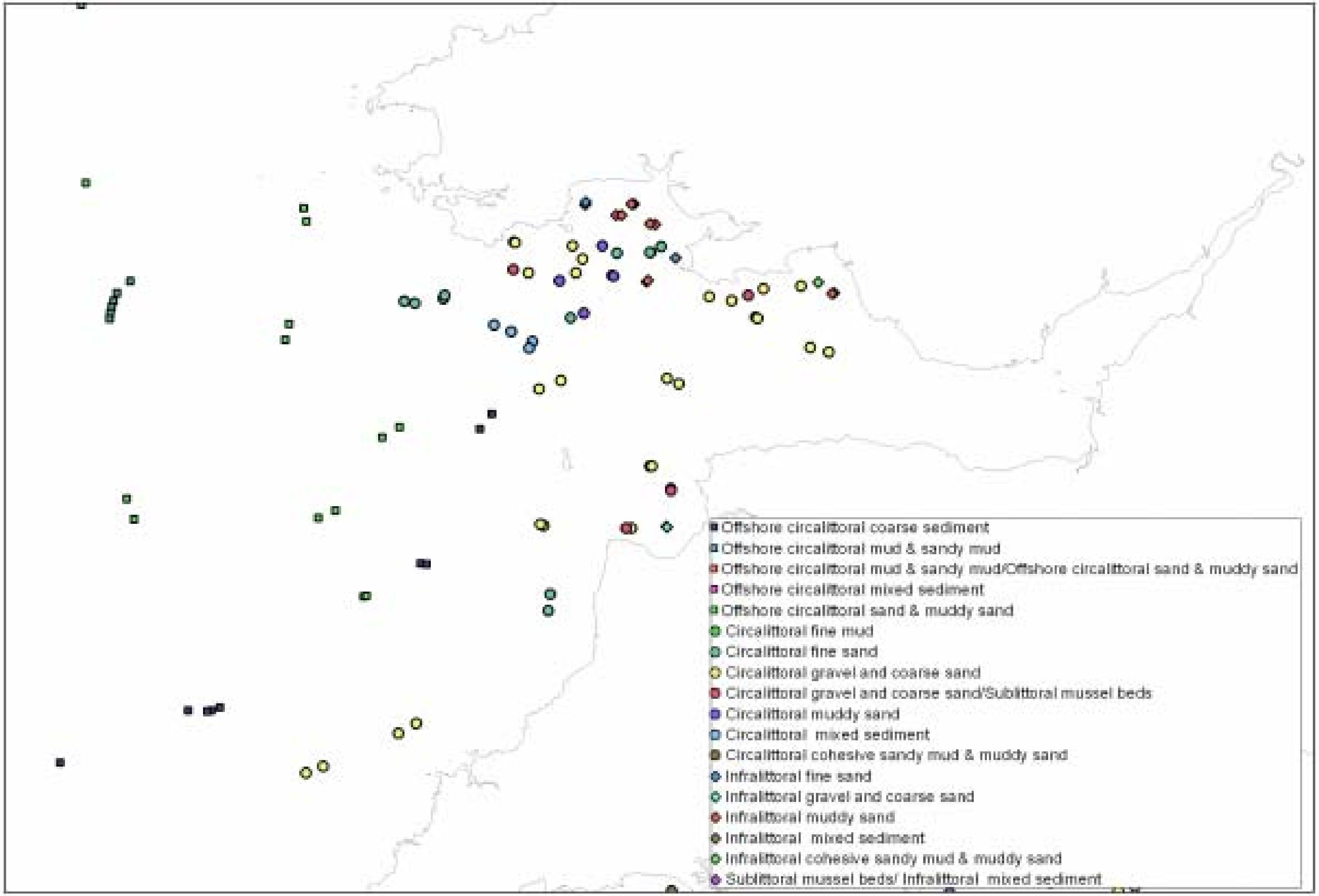


Figure 4. Distribution of 2004 biotope complexes identified within the Bristol Channel using the CEFAS datasets provided.

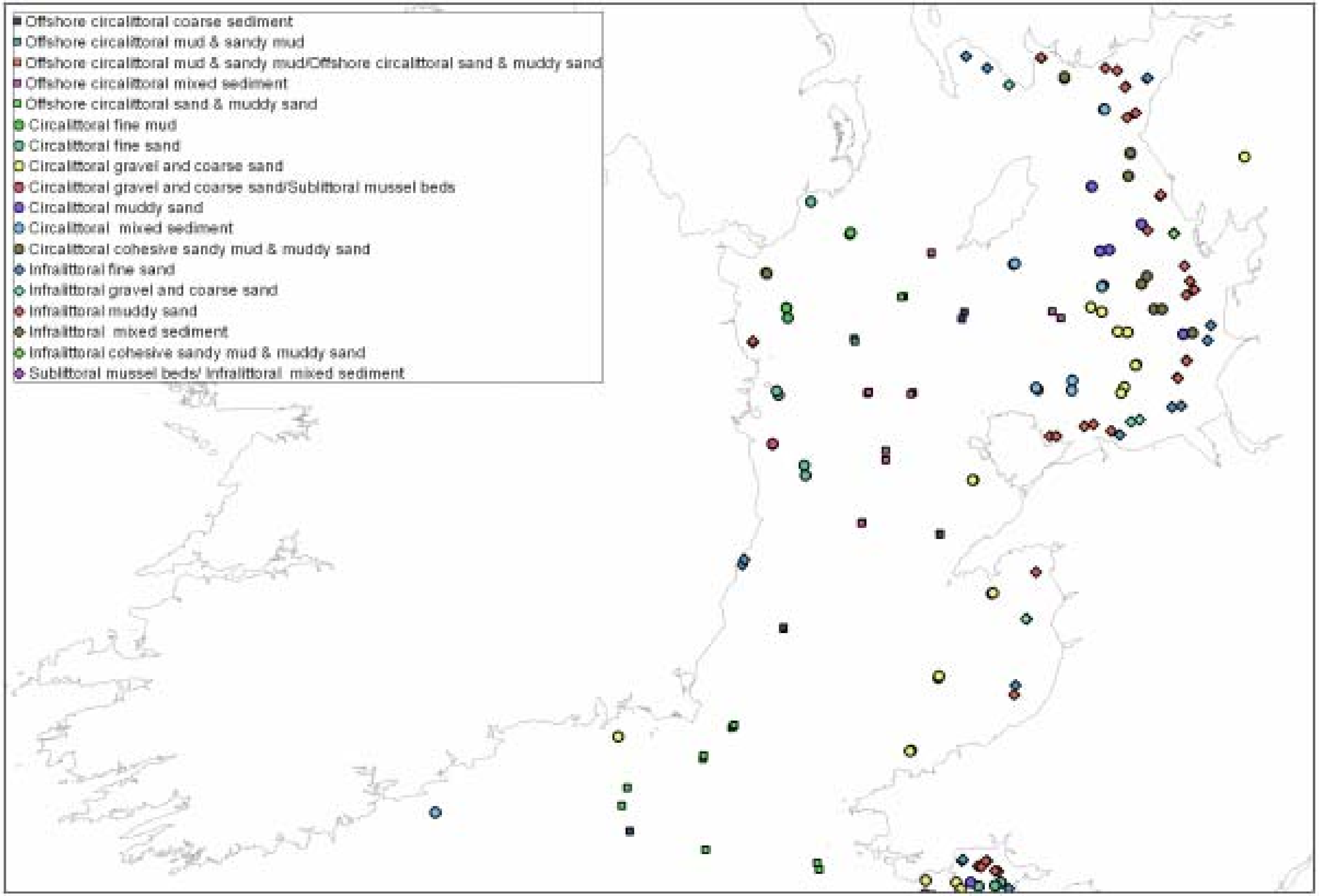


Figure 5. Distribution of 2004 biotope complexes identified within the Irish Sea using the CEFAS datasets provided.

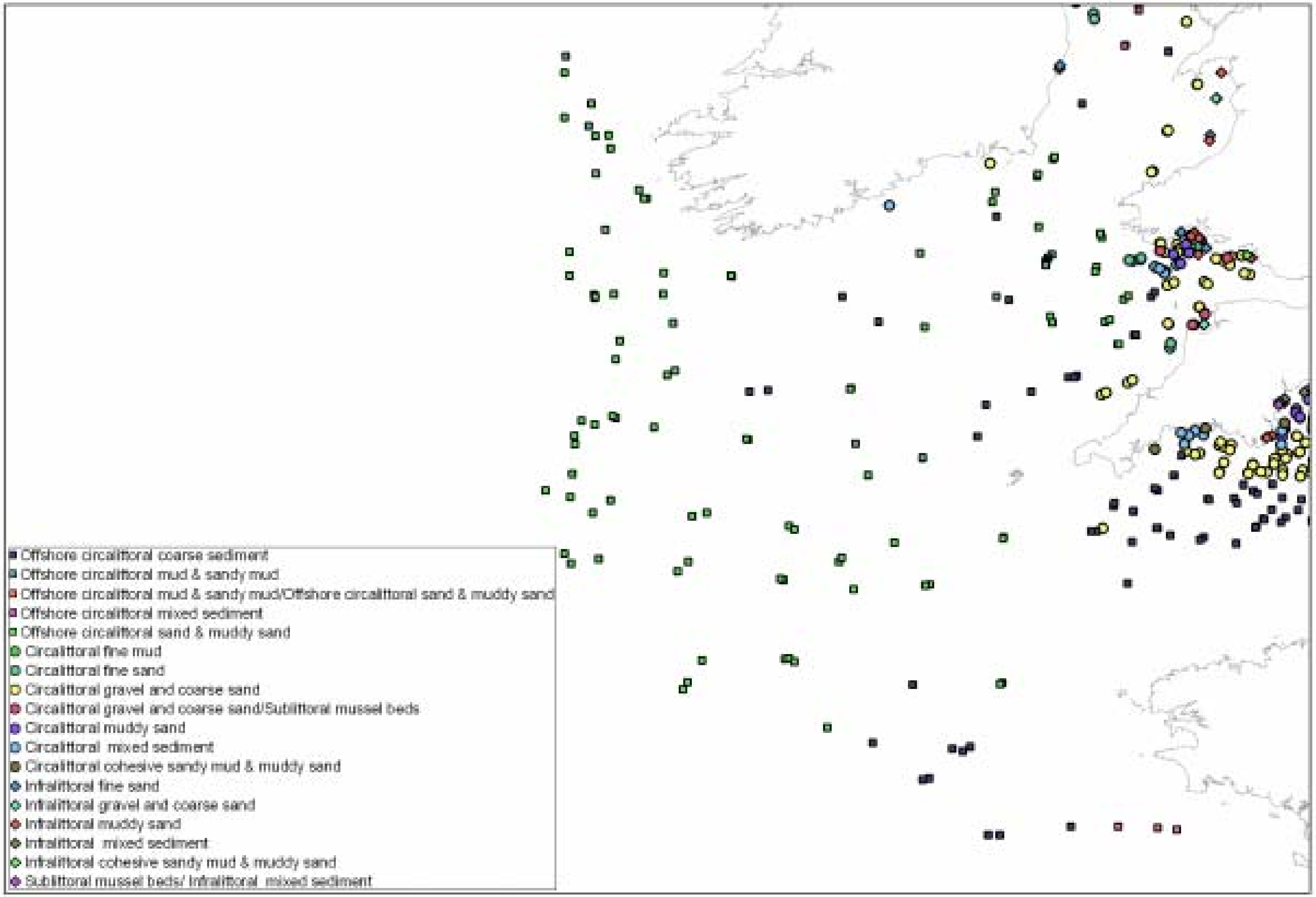


Figure 6. Distribution of 2004 biotope complexes identified within the Celtic Sea using the CEFAS datasets provided.

It was found that while biotopes within a biotope complex shared a similar habitat, they often did not share 'important characterizing' or 'characterizing' species. The difference in the general ecology and species composition of the component biotopes is likely to increase further up the biotope hierarchy, i.e. at the lifeform or habitat complex level. Therefore, biotope sensitivities are probably the most practical units for the derivation of the sensitivities of biotope complexes, lifeforms, or habitat complexes. Overall, the second proposal suggested in the SensMap report seems to be the most practical approach, and is in keeping with the precautionary approach.

4.2. Evaluation of the above approach

The second proposed approach described above was trialed using the 1997 biotope classification (for which *MarLIN* has identified sensitivity information) and the 'Sublittoral Sediment (SS)' section of the revised 2004 version of the biotope classification. The evaluation was carried out using sensitivity to physical disturbance.

MarLIN uses researched representative biotopes to identify the sensitivity(ies) of 'represented' biotopes. The *MarLIN* database therefore contains Biology and Sensitivity Key Information relevant to 274 biotopes included in the MNCR biotope classification (Connor *et al.*, 1997a, b).

A biotope was chosen as 'representative' of one or more other biotopes if the 'represented' biotope(s):

- occurred in similar habitats;
- was populated by similar functional groups of organisms, and
- was populated by the same (or functionally similar) species indicative of sensitivity as the biotope(s) they were chosen to represent.

The 'representative' biotopes have been researched as single entities. The biotope(s) 'represented' by the researched or 'representative' biotope(s) are shown in Appendix 1.

4.3. Results of evaluation

4.3.1 The 1997 biotope classification

The sensitivities of 1997 version representative and represented sublittoral sediment biotopes, grouped by biotope complex, are shown in Appendix 1. The biotope complex sensitivity is also shown. Biotope complex sensitivity was derived from the worst case intolerance and recoverability ranks.

In some cases, biotope complexes included a few biotopes that significantly differed in sensitivity from the rest of the biotopes in the complex, due to differences in ecology and life history traits. For example, horse mussel beds represent a distinct community, due to their prolonged recovery period, within circalittoral mussel beds or circalittoral mixed sediment (see Appendix 1).

Specific biotopes that differed markedly in sensitivity characteristics from the other biotopes in the complex by virtue of differences in their ecology are shown in Appendix 1. Therefore, the following sublittoral sediment biotopes should be mapped separately from the biotope complex, and their sensitivities not used to derive biotope complex sensitivities:

- *Serpula vermicularis* reefs on very sheltered circalittoral muddy sand (CMS.Ser)
- *Philine aperta* and *Virgularia mirabilis* in soft stable infralittoral mud (IMU.PhiVir)
- *Beggiatoa* spp. on anoxic sublittoral mud (CMU.Beg)
- *Limaria hians* beds in tide-swept sublittoral muddy mixed sediment (IMX.Lim)
- Horse mussel bed biotopes, e.g. *Modiolus modiolus* beds on circalittoral mixed sediment (CMX.ModMx)

Using the 1997 version of the biotope classification, the proposed approach provided reasonable estimates of biotope complex sensitivity (see Appendix 1). The only sublittoral sediment biotope complex that could not be assigned a sensitivity was 'Circalittoral mixed sediment' (CMX) due to the difference in horse mussel bed sensitivities and the absence of researched 'representative' or 'represented' biotopes within the biotope complex.

The distribution of sensitivity to physical disturbance is compared between Phase I biotopes within West Angle Bay, Pembrokeshire (information supplied by the Countryside Council for Wales (CCW)) and biotope complexes in Figure 7. The differences in overall sensitivity are minor, with only a few biotopes being reported as of higher sensitivity due to the higher overall biotope complex sensitivity. For example:

- '*Himanthalia elongata* and red seaweeds on exposed lower eulittoral rock' (ELR.Him) in 'Robust fucoids or red seaweeds' (ELR.FR), and
- 'Barren coarse sand shores' (LGS.BarSnd) in 'Sand shores' (LGS.S).

4.3.2 The 2004 biotope classification

The 2004 biotope classification has significantly expanded the number of biotope complexes and biotopes recorded within sublittoral sediments. The 2004 sublittoral sediment biotope complexes and biotopes are listed in Appendix 2, together with their equivalent 1997 biotope, representative 1997 biotope and intolerance, recoverability, and sensitivity. Appendix 2 demonstrates that they are considerable gaps in *MarLIN* coverage of the sublittoral sediment biotopes.

Biotope complex sensitivities have been assigned using the same approach as above. The results are shown in Appendix 2 and summarised in Table 1. We have not presently researched enough biotopes representative of 2004 version biotopes to assign sensitivities to eight of the sedimentary biotope complexes likely to occur offshore. Serpulid reefs have only been recorded from Scottish sea lochs or Galway Bay, Ireland.

As above, a few specific biotopes have been identified with different ecological or recovery characteristics than the relevant biotope complex. When mapping sensitivity it is suggested that the specific biotopes are mapped separately, and their sensitivities not used to assign and overall biotope complex sensitivity.

- SS.SCS.CCS.PomB / ECR.PomByC, which are ephemeral communities, differing significantly from others in its biotope complex;
- SS.SMu.IFiMu.PhiVir / IMU.PhiVir sea pen biotopes, characterized by *Virgularia mirabilis* are likely to have prolonged recoverabilities;
- SS.SMu.IFiMu.Beg / CMU.Beg *Beggiatoa* biotopes are characteristic of anoxic, often abiotic, habitats;
- SS.SMx.IMx.Lim / IMX.Lim *Limaria hians* beds represents a distinct epifaunal rather than infaunal community;
- SS.SMx.IMx.Ost / IMX.Ost *Ostrea edulis* beds are a distinct epifaunal community, with prolonged recovery, and
- horse mussel *Modiolus modiolus* beds are distinct communities with prolonged recovery rates.

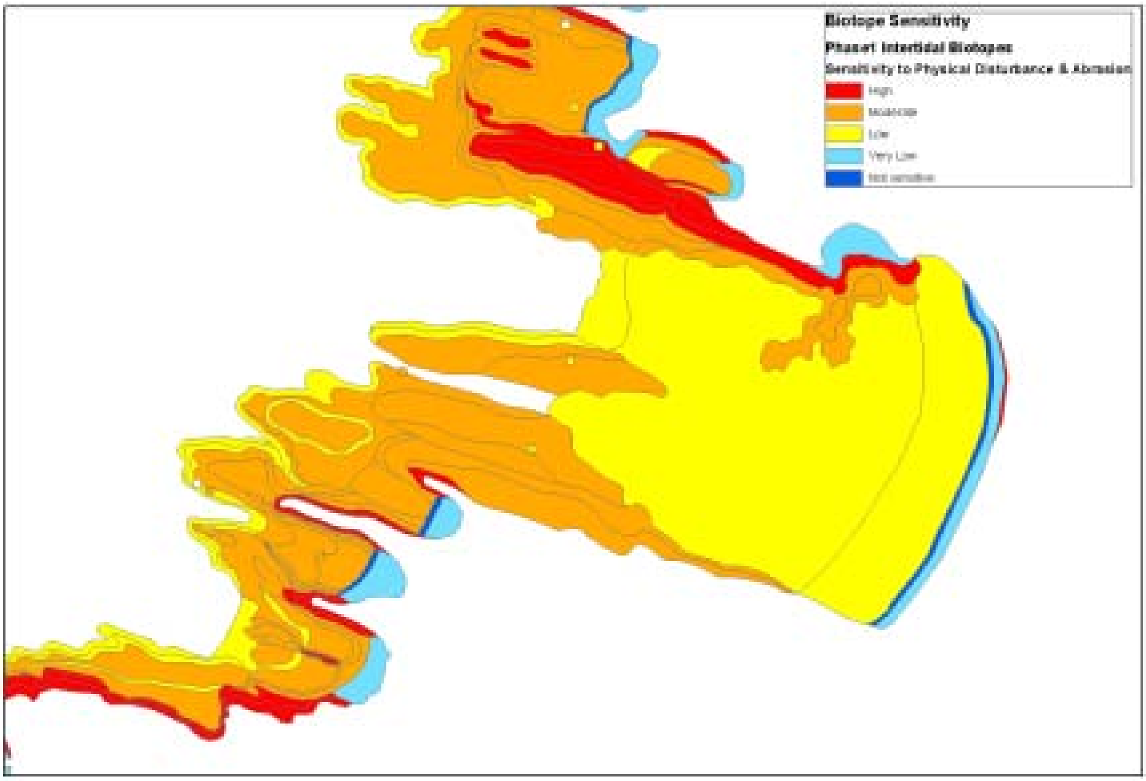
In the sublittoral mussel bed biotope complex, the majority of constituent biotopes are characterized by beds of *Modiolus modiolus.* However, it may be possible for an area to be dominated by *Mytilus* beds alone, in which instance the sensitivity of IMX.MytV is probably more representative.

4.4. Conclusions

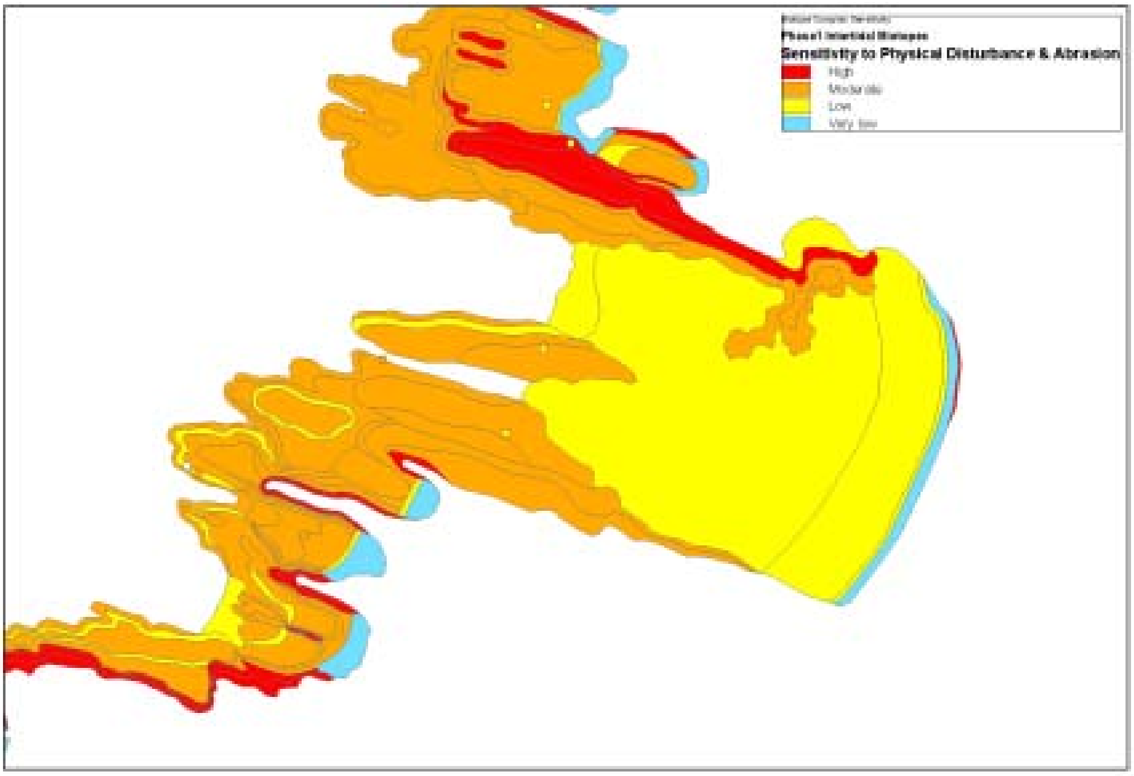
The proposed approach outlined above, is practical and transparent, and assigns biotope complex sensitivities based on the sensitivity of their component biotopes. Where geographically refined lists of component biotopes were available, it would be possible to assign biotope complex sensitivities accordingly. However, the approach assumes that the lists of component biotopes, taken from the biotope classification, are of similar 'ecological character' with respect to sensitivity. It has been necessary to identify specific biotopes whose intolerance, but more often recoverability, characteristics differ significantly from other biotopes within the same biotope complex.

The approach was tested used sensitivity to physical disturbance and abrasion. The approach will need further testing using other factors. Biotopes within a biotope complex are likely to exhibit similar 'sensitivity characteristics' to physical factors but may differ in their sensitivity to chemical factors.

In addition, *MarLIN* lacks researched biotopes that can be used to represent all sublittoral sediment biotopes within the revised 2004 biotope classification. Therefore, we were not able to assign sensitivities to all relevant biotope complexes (Table 1).



a).



b).

Figure 7. Similarity between biotope complex and biotope sensitivity of Phase I biotopes in West Angle Bay, Pembrokeshire to physical disturbance and abrasion, **a)** Phase I biotopes **b)** Phase I biotope complexes. Data courtesy of CCW (see Tyler-Walters & Lear, 2004).

Table 1. Summary of 2004 sedimentary biotope complexes and their likely sensitivities, where possible.

Biotope complexes identified within CEFAS datasets provided*.	Biotope code 2004	Biotope name 2004	Intolerance	Recoverability	Sensitivity	Confidence
	SS.SCS	**SUBLITTORAL COARSE SEDIMENT (UNSTABLE COBBLES AND PEBBLES, GRAVELS AND COARSE SANDS)**				
Infralittoral gravel and coarse sand (IGvSa)	SS.SCS.ICS	Infralittoral coarse sediment	**?**	**?**	**?**	**?**
Circalittoral gravel and coarse sand (CGvSa)	SS.SCS.CCS	Circalittoral coarse sediment	Intermediate	High	Low	Low
Offshore circalittoral coarse sediment (OCS)	SS.SCS.OCS	Offshore circalittoral coarse sediment	**?**	**?**	**?**	**?**
	SS.SSa	**SUBLITTORAL SANDS AND MUDDY SANDS**				
Infralittoral fine sand (IFiSa)	SS.SSa.IFiSa	Infralittoral fine sand	Intermediate	High	Low	Low
Infralittoral muddy sand (IMuSa)	SS.SSa.IMuSa	Infralittoral muddy sand	**?**	**?**	**?**	**?**
Circalittoral fine sand (CFiSa)	SS.SSa.CFiSa	Circalittoral fine sand	**?**	**?**	**?**	**?**
Circalittoral muddy sand (CMuSa)	SS.SSa.CMuSa	Circalittoral muddy sand	**?**	**?**	**?**	**?**
Offshore circalittoral sand & muddy sand (OSa)	SS.SSa.OSa	Offshore circalittoral sand	**?**	**?**	**?**	**?**
	SS.SMu	**SUBLITTORAL COHESIVE MUD AND SANDY MUD COMMUNITIES**				
Infralittoral cohesive sandy mud & muddy sand (ISaMu)	SS.SMu.ISaMu	Infralittoral sandy mud	**?**	**?**	**?**	**?**
	SS.SMu.IFiMu	Infralittoral fine mud	Intermediate	High	Low	Low
Circalittoral cohesive sandy mud & muddy sand (CSaMu)	SS.SMu.CSaMu	Circalittoral cohesive sandy mud	Intermediate	High	Low	Low
Circalittoral fine mud (CFiMu)	SS.SMu.CFiMu	Circalittoral fine mud	Intermediate	High	Low	Low
Offshore circalittoral mud & sandy mud (OMu)	SS.SMu.OMu	Offshore circalittoral mud & sandy mud	**?**	**?**	**?**	**?**
	SS.SMx	**SUBLITTORAL MIXED SEDIMENT**				
Infralittoral mixed sediment (IMx)	SS.SMx.IMx	Infralittoral mixed sediment	Intermediate	High	Low	Low
Circalittoral mixed sediment (CMx)	SS.SMx.CMx	Circalittoral mixed sediment	Intermediate	Moderate	Moderate	Low
Offshore circalittoral mixed sediment (OMx)	SS.SMx.OMx	Offshore circalittoral mixed sediment	Intermediate	High	Low	Moderate
	SS.SBR	**SUBLITTORAL BIOGENIC REEFS ON SEDIMENT**				
	SS.SBR.PoR	Polychaete worm reefs (on sublittoral sediment)	**?**	**?**	**?**	**?**
Sublittoral mussel beds (SMus)	SS.SBR.SMus	Sublittoral mussel beds (on sublittoral sediment)[1]	Intermediate / High	High / Low	Low / High	Low
	SS.SBR.Crl	Coral reefs	High	Very low	Very high	High

(* combined units omitted).

[1] Biotope complex sensitivity is evidently dependent on the presence of absence of *Modiolus modiolus.* Therefore, in absence of *M. modiolus* use the sensitivity of IMX.MytV, otherwise report *Modiolus* bed sensitivity.

5. Identification of offshore species and biotopes that require additional research (Task 4).

MarLIN has already researched the majority of the biotopes (as 'representative' or 'represented' biotopes) and their characteristic species in the 1997 classification likely to be present offshore. The majority of gaps are present in our coverage of offshore biotopes in the 2004 classification.

Biotope complexes are thought to be representative mostly in the offshore environment. Therefore it would seem more appropriate to research the sensitivity characteristics of biotope complexes, rather than biotopes, in the offshore environment. In many cases the information on biotopes researched within the biotope complexes will inform the biotope complex research and sensitivity assessment.

The JNCC have recently (March 2004) provided *MarLIN* with a copy of the draft 2004 sublittoral sediment classification. Therefore, biotope complexes, and species indicative of their sensitivity, that require additional research have been identified using the list of characterizing species for each biotope complex, and important characterizing species within biotopes not already studied within the relevant complex, using the draft 2004 classification.

Biotope complexes and species are listed in Appendix 3. Appendix 3 also lists the characterizing species within each biotope complex that have already been researched. The offshore biotope complexes did not identify characterizing species, and the species listed were selected from the biotope descriptions. The biotope complexes, biotopes and species that will probably require research are listed in Table 2.

Table 2. Provisional list of biotope complexes and species indicative of sensitivity that require additional research.

Biotope complex codes 2003	Biotope complexes and species proposed for research
	Species / biotopes proposed for research
SS	**SUBLITTORAL SEDIMENT**
SS.SCS	**SUBLITTORAL COARSE SEDIMENT (UNSTABLE BOULDERS AND PEBBLES, GRAVELS AND SANDS)**
SS.SCS.ICS	**Infralittoral coarse sediment**
	Chaetozone setosa[2] *Chaetopterus variopedatus*[2] Cumacean crustaceans, e.g. *Iphinoe trispinosa*[2] or *Diastylis bradyi*[2]
SS.SCS.CCS	**Circalittoral coarse sediment**
	Branchiostoma lanceolatum[*]
SS.SCS.OCS	**Offshore circalittoral coarse sediment**[3]
	Protodorvillea kefersteni[2] *Glycera lapidum*[2] *Amythasides macroglossus*[2] *Hesionura elongata*[2], *Moerella pygmaea*[2]
SS.SSa	**SUBLITTORAL SAND**
SS.SSa.IMuSa	**Infralittoral muddy sand**
	Characterized by species already researched
SS.SSa.CFiSa	**Circalittoral fine sand**
	Cerianthus lloydii[2] *Ophiura albida / ophiura*
SS.SSa.CMuSa	**Circalittoral muddy sand**
	Chaetozone setosa[2] *Cerianthus lloydii*[2] *Ophiura albida / ophiura* *Astropecten irregularis* *Corystes cassivelaunus*
SS.SSa.OSa	**Offshore circalittoral sand & muddy sand**[3]
	Maldane sarsi[2] *Eudorellopsis deformis*[2] (a cumacean) *Chaetozone setosa*[2]

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[2] Information on these species is expected to be limited, and a full biology and sensitivity review may not be possible.

[3] No characterizing species were identified within the 2004 biotope classification. A provisional list of species in need of research was derived from important characterizing species within outstanding biotopes within the biotope complex.

Biotope complex codes 2003	Biotope complexes and species proposed for research
	Species / biotopes proposed for research
SS.SMu	**SUBLITTORAL COHESIVE MUD AND SANDY MUD COMMUNITIES**
SS.SMu.ISaMu	**Infralittoral sandy mud**
	Cerianthus lloydii *Sagartiogeton undatus*[2] *Melinna palmata*[1], *Ampelisca brevicornis / tenuiconis*[2] *Thyasira flexuosa*
SS.SMu.CSaMu	**Circalittoral sandy mud**
	Cerianthus lloydii *Pecten maximus* *Melinna palmata*[2], *Ophiura albida / ophiura* *Thyasira flexuosa* *Nuculoma tenuis*[2] *Lagis koreni*[2]
SS.SMu.OMu	**Offshore circalittoral mud & sandy mud**
	Paramphinome jeffreysii[2], *Levinsenia gracilis*[2] *Myrtea spinifera*[2]
SS.SMx	**SUBLITTORAL MIXED SEDIMENT**
SS.SMx.IMx	**Infralittoral mixed sediment**[4]
	Characterized by species and biotopes already researched, except SS.SMx.IMx.SpavSpAn *Sabella pavonia*, *Cerianthus lloydii*,
SS.SMx.CMx	***Circalittoral mixed sediment**
	Characterized by species and biotopes already researched, with the exception of SS.SMx.CMx.ClloModHo / CMX.ModHo
SS.SBR	**Sublittoral biogenic reefs**
SS.SBR.PoR	**Sublittoral polychaete reefs**[5]
	SS.SBR.PoR.SspiMx SS.SBR.PoR.SalvMx

* Biotope complex not for research.

Several biotopes have been identified for research as separate entities:

- Sparse *Modiolus modiolus*, dense *Cerianthus lloydii* and burrowing holothurians on sheltered circalittoral stones and mixed sediment (SS.SMx.CMx.ClloModHo / CMX.ModHo);
- *Sabellaria spinulosa* on stable circalittoral mixed sediment (SS.SBR.PoR.SspiMx / CMX.SspiMx), and
- *Sabellaria alveolata* on variable salinity sublittoral mixed sediment (SS.SBR.PoR.SalvMx).

The species, biotopes, and biotope complexes listed in Appendix 3 should be regarded as a provisional list. Species that characterize a biotope or biotope complex are not always the species most indicative of biotope sensitivity. Research on the ecology of each biotope complex is likely to change some of the species chosen. Similarly in many cases, we have already researched numerous species within the biotope complexes (see Appendix 3) but the remaining species are polychaetes or small bivalves. In our experience, the natural history of polychaetes and many bivalves is studied poorly, and it may not be possible to prepare full biology and sensitivity key information reviews for many of the species identified.

[4] IMx.Lim and IMX.Ost represent distinct communities and are already researched.

[5] *Sabellaria alveolata* and *S. spinulosa* reefs on mixed sediment, and *Serpula vermicularis reefs*, probably have distinct sensitivity characteristics and should therefore be researched separately.

6. Report conclusions

The tasks laid out in the contract have been completed.

- The CEFAS beam trawl datasets have been entered into Marine Recorder, placed on-line on the *MarLIN* Web site, and sent to the NBN.
- The datasets have been analysed and interpreted as biotope complexes within the 2004 marine biotope classification.
- An approach to assessing the sensitivity of biotope complexes has been trialled and evaluated. The proposed approach is simple, practical and transparent.
- Species and biotopes in need of additional research have been provisionally identified. It was suggested that additional biology and sensitivity research should be carried out at the biotope complex level.

Sensitivities were assigned to the majority of biotopes in the 1997 marine biotope classification, although there are numerous gaps in the 2004 biotope classification. However, the approach developed above will need further testing using additional environmental factors. Nevertheless, once research on the likely sensitivities of the biotope complexes identified above has been completed and entered into MS Access database format, the sensitivity information could be automated, and used to develop sensitivity maps for offshore biotopes.

7. References

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Appendix 1. Sublittoral sediment biotope complexes (1997 version) versus intolerance, recoverability, and sensitivity to physical disturbance. Estuarine and lagoonal habitats removed but *Lophelia* reefs included.

Biotope complex / Biotope Code	Biotope Name	Representative biotope	Intolerance	Recoverability	Sensitivity	Confidence
COR	**CIRCALITTORAL OFFSHORE ROCK (AND OTHER HARD SUBSTRATA)**					
COR.Lop	***Lophelia* reefs**	**COR.Lop**	**High**	**Very low**	**Very High**	**High**
IGS	**INFRALITTORAL GRAVELS AND SANDS**					
IGS.Mrl	**Maerl beds (open coast/clean sediments)**		**High**	**Very low**	**Very High**	**Moderate**
IGS.Mrl.Phy	*Phymatolithon calcareum* maerl beds in infralittoral clean gravel or coarse sand	IGS.Phy.HEc	High	Very low	Very High	Moderate
IGS.Mrl.Phy.R	*Phymatolithon calcareum* maerl beds with red seaweeds in shallow infralittoral clean gravel or coarse sand	IGS.Phy.HEc	High	Very low	Very High	Moderate
IGS.Mrl.Phy.HEc	*Phymatolithon calcareum* maerl beds with hydroids and echinoderms in deeper infralittoral clean gravel or coarse sand	IGS.Phy.HEc	High	Very low	Very High	Moderate
IGS.Mrl.Lgla	*Lithothamnion glaciale* maerl beds in tide-swept variable salinity infralittoral gravel	IGS.Lgla	High	Very low	Very High	High
IGS.FaG	**Shallow gravel faunal communities**		**High**	**High**	**Moderate**	**Moderate**
IGS.FaG.HalEdw	*Halcampa chrysanthellum* and *Edwardsia timida* on sublittoral clean stone gravel	IGS.HalEdw	High	High	Moderate	Moderate
IGS.FaG.Sell	*Spisula elliptica* and venerid bivalves in infralittoral clean sand or shell gravel	IGS.FabMag	Intermediate	High	Low	Moderate
IGS.FaS	**Shallow sand faunal communities**		**Intermediate**	**High**	**Low**	**Moderate**
IGS.FaS.Mob	Sparse fauna in marine infralittoral mobile clean sand	IGS.NcirBat	Low	Very high	Very Low	Moderate
IGS.FaS.NcirBat	*Nephtys cirrhosa* and *Bathyporeia* spp. in infralittoral sand	IGS.NcirBat	Low	Very high	Very Low	Moderate
IGS.FaS.ScupHyd	*Sertularia cupressina* and *Hydrallmania falcata* on tide-swept sublittoral cobbles or pebbles in coarse sand	MCR.Flu	Intermediate	High	Low	Moderate
IGS.FaS.Lcon	Dense *Lanice conchilega* and other polychaetes in tide-swept infralittoral sand	IGS.Lcon	Intermediate	High	Low	Moderate
IGS.FaS.FabMag	*Fabulina fabula* and *Magelona mirabilis* with venerid bivalves in infralittoral compacted fine sand	IGS.FabMag	Intermediate	High	Low	Moderate

Biotope complex / Biotope Code	Biotope Name	Representative biotope	Intolerance	Recoverability	Sensitivity	Confidence
CGS	CIRCALITTORAL GRAVELS AND SANDS					
CGS.Bv	**Circalittoral sediment with venerid bivalves**		**Intermediate**	**High**	**Low**	**Moderate**
CGS.Bv.Ven	Venerid bivalves in circalittoral coarse sand or gravel	CGS.Ven	Intermediate	High	Low	Moderate
CGS.Bv.Ven.Neo	*Neopentadactyla mixta* and venerid bivalves in circalittoral shell gravel or coarse sand	CGS.Ven	Intermediate	High	Low	Moderate
CGS.Bv.Ven.Bra	Venerid bivalves and *Branchiostoma lanceolatum* in circalittoral coarse sand with shell gravel	CGS.Ven	Intermediate	High	Low	Moderate
IMS.Sgr	**Seagrass beds (sublittoral/lower shore)**		**Intermediate**	**Moderate**	**Moderate**	**Low**
IMS.Sgr.Zmar	*Zostera marina/angustifolia* beds in lower shore or infralittoral clean or muddy sand	IMS.Zmar	Intermediate	Moderate	Moderate	Low
IMS.Sgr.Rup	*Ruppia maritima* in reduced salinity infralittoral muddy sand	IMS.Rup	Intermediate	Very high	Low	Low
IMS.FaMS	**Shallow muddy sand faunal communities**		**High**	**Moderate**	**Moderate**	**Low**
IMS.FaMS.EcorEns	*Echinocardium cordatum* and *Ensis* sp. in lower shore or shallow sublittoral muddy fine sand	IMS.EcorEns	High	Moderate	Moderate	Moderate
IMS.FaMS.SpiSpi	*Spio filicornis* and *Spiophanes bombyx* infralittoral clean or muddy sand					
IMS.FaMS.MacAbr	*Macoma balthica* and *Abra alba* in infralittoral muddy sand or mud	IMS.MacAbr	Intermediate	High	Low	Moderate
IMS.FaMS.Cap	*Capitella capitata* in enriched sublittoral muddy sediments	IMS.Cap	Intermediate	Very high	Low	Moderate
CMS	CIRCALITTORAL MUDDY SAND		**Intermediate**	**High**	**Low**	**Low**
CMS.AbrNucCor	*Abra alba*, *Nucula nitida* and *Corbula gibba* in circalittoral muddy sand or slightly mixed sediment	CMS.AbrNucCor	Intermediate	High	Low	Moderate
CMS.AfilEcor	*Amphiura filiformis* and *Echinocardium cordatum* in circalittoral clean or slightly muddy sand	CMS.AfilEcor	Intermediate	High	Low	Moderate
CMS.VirOph	*Virgularia mirabilis* and *Ophiura* spp. on circalittoral sandy or shelly mud	CMS.VirOph	Low	Very high	Very Low	Moderate
CMS.VirOph.HAs	*Virgularia mirabilis* and *Ophiura* spp. with hydroids and ascidians on circalittoral sandy or shelly mud with shells or stones	CMS.VirOph	Low	Very high	Very Low	Moderate
CMS.Ser	*Serpula vermicularis* reefs on very sheltered circalittoral muddy sand	CMS.Ser[6]	High	High	Moderate	High

[6] *Serpula vermicularis* reefs are distinct communities. Therefore, its assessment should be plotted separately from the biotope complex where present.

Biotope complex / Biotope Code	Biotope Name	Representative biotope	Intolerance	Recoverability	Sensitivity	Confidence
IMU	**INFRALITTORAL MUDS**					
IMU.MarMu	**Shallow marine mud communities**		**Intermediate**	**High**	**Low**	**Low**
IMU.MarMu.TubeAP	Semi-permanent tube-building amphipods and polychaetes in sublittoral mud or muddy sand	IMU.TubeAP	Intermediate	High	Low	Low
IMU.MarMu.AreSyn	*Arenicola marina* and synaptid holothurians in extremely shallow soft mud	IMU.AreSyn	Intermediate	High	Low	Low
IMU.MarMu.PhiVir	*Philine aperta* and *Virgularia mirabilis* in soft stable infralittoral mud	IMU.PhiVir[7]	Intermediate	Moderate	Moderate	Low
IMU.MarMu.Ocn	*Ocnus planci* aggregations on sheltered sublittoral muddy sediment	IMU.Ocn	Intermediate	High	Low	Low
CMU	**Circalittoral muds**		**Intermediate**	**High**	**Low**	**Moderate**
CMU.BriAchi	Brissopsis lyrifera and Amphiura chiajei in circalittoral mud	CMU.BriAchi	Intermediate	High	Low	High
CMU.SpMeg	Seapens and burrowing megafauna in circalittoral soft mud	CMU.SpMeg	Intermediate	High	Low	Moderate
CMUSpMeg.Fun	Seapens, including Funiculina quadrangularis, and burrowing megafauna in undisturbed circalittoral soft mud	CMU.SpMeg	Intermediate	High	Low	Moderate
CMU.Beg	Beggiatoa spp. on anoxic sublittoral mud	CMU.Beg[8]	Low	Immediate	Not sensitive	High
IMX	**INFRALITTORAL MIXED SEDIMENTS**					
IMX.KSwMx	**Laminaria saccharina (sugar kelp) and filamentous seaweeds (mixed sediment)**		**Intermediate**	**High**	**Low**	**Moderate**
IMX.KSwMx.LsacX	*Laminaria saccharina, Chorda filum* and filamentous red seaweeds on sheltered infralittoral sediment	IMX.LsacX	Intermediate	High	Low	Moderate
IMX.KSwMx.Tra	Mats of *Trailliella* on infralittoral muddy gravel	IMX.LsacX	Intermediate	High	Low	Moderate
IMX.KSwMx.Pcri	Loose-lying mats of *Phyllophora crispa* on infralittoral muddy sediment	IMX.LsacX	Intermediate	High	Low	Moderate
IMX.KSwMx.FiG	Filamentous green seaweeds on low salinity infralittoral mixed sediment or rock	IMX.FiG	Intermediate	Very high	Low	High
IMX.MrlMx	**Maerl beds (muddy mixed sediments)**		**High**	**Very low**	**Very High**	**Moderate**
IMX.MrlMx.Lcor	*Lithothamnion corallioides* maerl beds on infralittoral muddy gravel	IGS.Phy.HEc	High	Very low	Very High	Moderate
IMX.MrlMx.Lfas	*Lithothamnion fasciculatum* maerl beds with *Chlamys varia* on infralittoral sandy mud or mud	IGS.Phy.HEc	High	Very low	Very High	Moderate
IMX.MrlMx.Lden	*Lithothamnion dentatum* maerl beds on infralittoral muddy sediment	IGS.Phy.HEc	High	Very low	Very High	Moderate

[7] The population dynamics of *Virgularia mirabilis* are poorly known, and recovery may be prolonged. Where present, therefore, the IMU.PhiVir assessment should be plotted separately.
[8] CMU.Beg develops in anoxic, abiotic conditions and has been omitted from the biotope complex assessment. Where present, its assessment could be plotted separately.

Biotope complex / Biotope Code	Biotope Name	Representative biotope	Intolerance	Recoverability	Sensitivity	Confidence
IMX.Oy	**Oyster beds**		**Intermediate**	**Moderate**	**Moderate**	**Low**
IMX.Oy.Ost	*Ostrea edulis* beds on shallow sublittoral muddy sediment	IMX.Ost	Intermediate	Moderate	Moderate	Low
IMX.FaMx	**Shallow mixed sediment faunal communities**		**Intermediate**	**Moderate**	**Moderate**	**Low**
IMX.FaMx.VsenMtru	*Venerupis senegalensis* and *Mya truncata* in lower shore or infralittoral muddy gravel	IMX.VsenMtru	Intermediate	High	Low	Low
IMX.FaMx.An	Burrowing anemones in sublittoral muddy gravel	IMX.An	Intermediate	Moderate	Moderate	Moderate
IMX.FaMx.Lim	*Limaria hians* beds in tide-swept sublittoral muddy mixed sediment	IMX.Lim[9]	High	Low	High	High
CMX	**CIRCALITTORAL MIXED SEDIMENT[10]**		**?**	**?**	**?**	**?**
CMX.SspiMx	*Sabellaria spinulosa* and *Polydora* spp. on stable circalittoral mixed sediment					
CMXModMx	*Modiolus modiolus* beds on circalittoral mixed sediment	MCR.ModT	High	Low	High	Moderate
CMX.ModHo	Sparse *Modiolus modiolus*, dense *Cerianthus lloydii* and burrowing holothurians on sheltered circalittoral stones and mixed sediment					
COS	**CIRCALITTORAL OFFSHORE SEDIMENT**		**Intermediate**	**High**	**Low**	**Low**
COS.AmpPar	*Ampharete falcata* turf with *Parvicardium ovale* on cohesive muddy very fine sand near margins of deep stratified seas	COS.AmpPar	Intermediate	High	Low	Low
COS.ForThy	Foraminiferans and *Thyasira* sp. in deep circalittoral soft mud	COS.ForThy	Intermediate	High	Low	Moderate
COS.Sty	*Styela gelatinosa* and other solitary ascidians on sheltered deep circalittoral muddy sediment	COS.Sty	Intermediate	High	Low	High

[9] *Limaria hians* beds are distinct communities, and their assessment should be plotted separately.
[10] Horse mussel beds represent a distinct and sensitive community due to their prolonged recovery period. Therefore, they should be assessed and plotted as a separate biotope where present.

Appendix 2. Biotope complexes (2003) versus 1997 codes and intolerance, recoverability and sensitivity to physical disturbance. Biotope complexes and higher scales are greyed. Estuarine and lagoonal biotope complexes are omitted.

Biotope code 2003	Biotope name 2003	Represented	Representative	Intolerance	Recover-ability	Sensitivity	Confidence
SS.SCS	**SUBLITTORAL COARSE SEDIMENT (UNSTABLE COBBLES AND PEBBLES, GRAVELS AND COARSE SANDS)**						
SS.SCS.ICS	**Infralittoral coarse sediment**			**?**	**?**	**?**	**?**
SS.SCS.ICS.MoeVen	*Moerella* spp. with venerid bivalves in infralittoral gravelly sand	IGS.Sell	IGS.FabMag	Intermediate	High	Low	Moderate
SS.SCS.ICS.HeloMsim	*Hesionura elongata* and *Microphthalmus similis* with other interstitial polychaetes in infralittoral mobile coarse sand						
SS.SCS.ICS.Glap	*Glycera lapidum* in impoverished infralittoral mobile gravel and sand	IMS.SpiSpi					
SS.SCS.ICS.CumCset	Cumaceans and *Chaetozone setosa* in infralittoral gravelly sand						
SS.SCS.ICS.SLan	Dense *Lanice conchilega* and other polychaetes in tide-swept infralittoral sand and mixed gravelly sand	IGS.Lcon	IGS.Lcon	Intermediate	High	Low	Moderate
SS.SCS.ICS.SSh	Sparse fauna on highly mobile sublittoral shingle (cobbles and pebbles)						
SS.SCS.ICS.HchrEdw	*Halcampa chrysanthellum* and *Edwardsia timida* on sublittoral clean stone gravel	IGS.HalEdw	IGS.HalEdw	High	High	Moderate	Moderate
SS.SCS.CCS	**Circalittoral coarse sediment**			**Intermediate**	**High**	**Low**	**Low**
SS.SCS.CCS.MedLumVen	*Mediomastus fragilis*, *Lumbrineris* spp. and venerid bivalves in circalittoral coarse sand or gravel	CGS.Ven	CGS.Ven	Intermediate	High	Low	Moderate
SS.SCS.CCS.Nmix	*Neopentadactyla mixta* in circalittoral shell gravel or coarse sand	CGS.Ven.Neo	CGS.Ven	Intermediate	High	Low	Moderate
SS.SCS.CCS.BLan	*Branchiostoma lanceolatum* in circalittoral coarse sand with shell gravel	CGS.Ven.Bra	CGS.Ven	Intermediate	High	Low	Moderate
SS.SCS.CCS.PomB	*Pomatoceros triqueter* with barnacles and bryozoan crusts on unstable circalittoral cobbles and pebbles	ECR.PomByC[11]	ECR.PomByC	Tolerant	Not relevant	Not sensitive	High
SS.SCS.CCS.Pkef	*Protodorvillea kefersteini* and other polychaetes in impoverished circalittoral mixed gravelly sand						

[11] SS.SCS.CCS.PomB / ECR.PomByC are ephemeral communities, differing significantly form others in biotope complex. Therefore, sensitivity to be assessed and plotted separately.

Biotope code 2003	Biotope name 2003	Represented	Representative	Intolerance	Recover-ability	Sensitivity	Confidence
SS.SCS.OCS	**Offshore circalittoral coarse sediment**			**?**	**?**	**?**	**?**
SS.SCS.OCS.GlapThyAmy	*Glycera lapidum*, *Thyasira* spp. and *Amythasides macroglossus* in offshore gravelly sand						
SS.SCS.OCS.HeloPkef	*Hesionura elongata* and *Protodorvillea kefersteini* in offshore coarse sand						
SS.SSa	**Sublittoral sands and muddy sands**						
SS.SSa.IFiSa	**Infralittoral fine sand**			**Intermediate**	**High**	**Low**	**Low**
SS.SSa.IFiSa.IMoSa	Infralittoral mobile clean sand with sparse fauna	IGS.Mob	IGS.NcirBat	Low	Very high	Very Low	Moderate
SS.SSa.IFiSa.NcirBat	*Nephtys cirrhosa* and *Bathyporeia* spp. in infralittoral sand	IGS.NcirBat	IGS.NcirBat	Low	Very high	Very Low	Moderate
SS.SSa.IFiSa.ScupHyd	*Sertularia cupressina* and *Hydrallmania falcata* on tide-swept sublittoral sand with cobbles or pebbles	IGS.ScupHyd	MCR.Flu	Intermediate	High	Low	Moderate
SS.SSa.IFiSa.TbAmPo	Semi-permanent tube-building amphipods and polychaetes in sublittoral sand	IMU.TubeAP	IMU.TubeAP	Intermediate	High	Low	Low
SS.SSa.IMuSa	**Infralittoral muddy sand**			**?**	**?**	**?**	**?**
SS.SSa.IMuSa.ArelSa	*Arenicola marina* in infralittoral fine sand or muddy sand						
SS.SSa.IMuSa.FfabMag	*Fabulina fabula* and *Magelona mirabilis* with venerid bivalves and amphipods in infralittoral compacted fine muddy sand	IGS.FabMag	IGS.FabMag	Intermediate	High	Low	Moderate
SS.SSa.IMuSa.EcorEns	*Echinocardium cordatum* and *Ensis* spp. in lower shore and shallow sublittoral slightly muddy fine sand	IMS.EcorEns	IMS.EcorEns	High	Moderate	Moderate	Moderate
SS.SSa.IMuSa.ScubNhom	Unknown						
SS.SSa.CFiSa	**Circalittoral fine sand**			**?**	**?**	**?**	**?**
SS.SSa.CFiSa.Epus.Obor.Apri	*Echinocyamus pusillus*, *Ophelia borealis* and *Abra prismatica* in circalittoral fine sand						
SS.SSa.CFiSa.ApriBatPo	*Abra prismatica*, *Bathyporeia elegans* and polychaetes in circalittoral fine sand						
SS.SSa.CMuSa	**Circalittoral muddy sand**			**?**	**?**	**?**	**?**
SS.SSa.CMuSa.AalbNuc	*Abra alba* and *Nucula nitidosa* in circalittoral muddy sand or slightly mixed sediment	CMS.AbrNucCor	CMS.AbrNucCor	Intermediate	High	Low	Moderate
SS.SSa.CMuSa.AbraAirr	*Amphiura brachiata* with *Astropecten irregularis* and other echinoderms in circalittoral muddy sand						

Biotope code 2003	Biotope name 2003	Represented	Representative	Intolerance	Recover-ability	Sensitivity	Confidence
SS.SSa.OSa	**Offshore circalittoral sand & muddy sand**			**?**	**?**	**?**	**?**
SS.SSa.OSa.MalEdef	Maldanid polychaetes and *Eudorellopsis deformis* in offshore circalittoral sand or muddy sand						
SS.SSa.OSa.OfusAfil	*Owenia fusiformis* and *Amphiura filiformis* in offshore circalittoral sand or muddy sand	CMS.AfilEcor	CMS.AfilEcor	Intermediate	High	Low	Moderate
SS.SMu	**SUBLITTORAL COHESIVE MUD AND SANDY MUD COMMUNITIES**						
SS.SMu.ISaMu	**Infralittoral sandy mud**			**?**	**?**	**?**	**?**
SS.SMu.ISaMu.SundAasp	*Sagartiogeton undatus* and *Ascidiella aspersa* on infralittoral sandy mud						
SS.SMu.ISaMu.MelMagThy	*Melinna palmata* with *Magelona* spp. and *Thyasira* spp. in infralittoral muddy sand or sandy mud	IMS.SpiSpi					
SS.SMu.ISaMu.MysAbr	*Mysella bidentata* and *Abra* spp. in infralittoral sandy mud						
SS.SMu.ISaMu.NhomMac	*Nephtys hombergii* and *Macoma balthica* in infralittoral muddy sand or sandy mud	IMS.MacAbr	IMS.MacAbr	Intermediate	High	Low	Moderate
SS.SMu.ISaMu.AmpPlon	*Ampelisca* spp., *Photis longicaudata* and other tube-building amphipods and polychaetes in infralittoral muddy sand or sandy mud	IMS.TubeAP	IMU.TubeAP	Intermediate	High	Low	Low
SS.SMu.ISaMu.Cap	*Capitella capitata* in enriched sublittoral muddy sediments	IMS.Cap	IMS.Cap	Intermediate	Very high	Low	Moderate
SS.SMu.IFiMu	**Infralittoral fine mud**			**Intermediate**	**High**	**Low**	**Low**
SS.SMu.IFiMu.CerAnit	*Cerastoderma edule* with *Abra nitida* in infralittoral mud						
SS.SMu.IFiMu.Are	*Arenicola marina* in infralittoral mud	IMU.AreSyn	IMU.AreSyn	Intermediate	High	Low	Low
SS.SMu.IFiMu.PhiVir	*Philine aperta* and *Virgularia mirabilis* in soft stable infralittoral mud	IMU.PhiVir	IMU.PhiVir[12]	Intermediate	Moderate	Moderate	Low
SS.SMu.IFiMu.Ocn	*Ocnus planci* aggregations on sheltered sublittoral muddy sediment	IMU.Ocn	IMU.Ocn	Intermediate	High	Low	Low
SS.SMu.IFiMu.Beg	*Beggiatoa* spp. on anoxic sublittoral mud	CMU.Beg	CMU.Beg[13]	Low	Immediate	Not sensitive	High

[12] PhiVir biotopes, characterised *by Virgularia mirabilis* are likely to have prolonged recoverabilities and therefore, should be assessed and plotted separately.
[13] *Beggiatoa* biotopes are characteristic of anoxic, often abiotic, habitats, and therefore, should be assessed and plotted separately.

Biotope code 2003	Biotope name 2003	Represented	Representative	Intolerance	Recover-ability	Sensitivity	Confidence
SS.SMu.CsaMu	**Circalittoral sandy mud**			**Intermediate**	**High**	**Low**	**Low**
SS.SMu.CSaMu.AfilMysAnit	*Amphiura filiformis*, *Mysella bidentata* and *Abra nitida* in circalittoral muddy sand or sandy mud	CMS.AfilEcor	CMS.AfilEcor	Intermediate	High	Low	Moderate
SS.SMu.CsaMu.ThyNten	*Thyasira* spp. and *Nuculoma tenuis* in circalittoral sandy mud						
SS.SMu.CSaMu.VirOphPmax	*Virgularia mirabilis* and *Ophiura* spp. with *Pecten maximus* on circalittoral sandy or shelly mud	CMS.VirOph	CMS.VirOph	Low	Very high	Very Low	Moderate
SS.SMu.CSaMu.VirOphPmax.HAs	*Virgularia mirabilis* and *Ophiura* spp. with *Pecten maximus*, hydroids and ascidians on circalittoral sandy or shelly mud with shells or stones	CMS.VirOph.HAs	CMS.VirOph	Low	Very high	Very Low	Moderate
SS.SMu.CsaMu.LkorPpel	*Lagis koreni* and *Phaxas pellucidus* in circalittoral muddy sand or sandy mud						
SS.SMu.CSaMu.AfilNten	*Amphiura filiformis* and *Nuculoma tenuis* in circalittoral and offshore muddy sand	CMS.AfilEcor	CMS.AfilEcor	Intermediate	High	Low	Moderate
SS.SMu.CFiMu	**Circalittoral fine mud**			**Intermediate**	**High**	**Low**	**Low**
SS.SMu.CFiMu.SpnMeg	Seapens and burrowing megafauna in circalittoral fine mud	CMU.SpMeg	CMU.SpMeg	Intermediate	High	Low	Moderate
SS.SMu.CFiMu.SpnMeg.Fun	Seapens, including *Funiculina quadrangularis*, and burrowing megafauna in undisturbed circalittoral fine mud	CMU.SpMeg.Fun	CMU.SpMeg	Intermediate	High	Low	Moderate
SS.SMu.CFiMu.MegMax	Burrowing megafauna and *Maxmuelleria lankesteri* in circalittoral mud						
SS.SMu.CFiMu.BlyrAchi	*Brissopsis lyrifera* and *Amphiura chiajei* in circalittoral mud	CMU.BriAchi	CMU.BriAchi	Intermediate	High	Low	High

Biotope code 2003	Biotope name 2003	Represented	Representative	Intolerance	Recover-ability	Sensitivity	Confidence
SS.SMu.OMu	**Offshore circalittoral mud & sandy mud**			**?**	**?**	**?**	**?**
SS.SMu.OMu.AfalPove	*Ampharete falcata* turf with *Parvicardium ovale* on cohesive muddy sediment near margins of deep stratified seas	COS.AmpPar	COS.AmpPar	Intermediate	High	Low	Low
SS.SMu.OMu.ForThy	Foraminiferans and *Thyasira* sp. in deep circalittoral fine mud	COS.ForThy	COS.ForThy	Intermediate	High	Low	High
SS.SMu.OMu.StyPse	*Styela gelatinosa*, *Pseudamussium septemradiatum* and solitary ascidians on sheltered deep circalittoral muddy sediment	COS.Sty	COS.Sty	Intermediate	High	Low	Moderate
SS.SMu.OMu.CapThy	*Capitella capitata* and *Thyasira* spp. in organically-enriched offshore circalittoral mud and sandy mud						
SS.SMu.OMu.CapThy.Odub	*Capitella capitata*, *Thyasira* spp. and *Ophryotrocha dubia* in organically-enriched offshore circalittoral mud or sandy mud						
SS.SMu.OMu.LevHet	*Levinsenia gracilis* and *Heteromastus filifirmis* in offshore circalittoral mud and sandy mud						
SS.SMu.OMu.PjefThyAfil	*Paramphinome jeffreysii*, *Thyasira* spp. and *Amphiura filiformis* in offshore circalittoral muddy sand and sandy mud						
SS.SMu.OMu.MyrPo	*Myrtea spinifera* and polychaetes in offshore circalittoral muddy sand and sandy mud						
SS.SMx	**SUBLITTORAL MIXED SEDIMENT**						
SS.SMx.IMx	**Infralittoral mixed sediment**			**Intermediate**	**High**	**Low**	**Low**
SS.SMx.IMx.SpavSpAn	*Sabella pavonina* with sponges and anemones on infralittoral mixed sediment						
SS.SMx.IMx.VsenAsquAps	*Venerupis senegalensis*, *Amphipholis squamata* and *Apseudes latreilli* in infralittoral mixed sediment	IMX.VsenMtru	IMX.VsenMtru	Intermediate	High	Low	Low
SS.SMx.IMx.CreAsAn	*Crepidula fornicata* with ascidians and anenomes on infralittoral coarse mixed sediment	IMX.CreAph	IMX.CreAph	Intermediate	High	Low	Low
SS.SMx.IMx.Lim	*Limaria hians* beds in tide-swept sublittoral muddy mixed sediment	IMX.Lim[14]	IMX.Lim	High	Low	High	High
SS.SMx.IMx.Ost	*Ostrea edulis* beds on shallow sublittoral muddy mixed sediment	IMX.Ost[15]	IMX.Ost	Intermediate	Moderate	Moderate	Low

[14] IMX.Lim represents a distinct epifaunal rather than infaunal community. Therefore, where present this biotope should be assessed and plotted separately from the biotope complex.

[15] IMX.Ost is a distinct epifaunal community, with prolonged recovery. Therefore, where present this biotope should be assessed and plotted separately from the biotope complex.

Biotope code 2003	Biotope name 2003	Represented	Representative	Intolerance	Recover-ability	Sensitivity	Confidence
SS.SMx.CMx	**Circalittoral mixed sediment**			**Intermediate**	**Moderate**	**Moderate**	**Low**
SS.SMx.CMx.ClloMx	*Cerianthus lloydii* and other burrowing anemones in circalittoral muddy mixed sediment	IMX.An	IMX.An	Intermediate	Moderate	Moderate	Moderate
SS.SMx.CMx.ClloMx.Nem	*Cerianthus lloydii* with *Nemertesia* spp. and other hydroids in circalittoral muddy mixed sediment with cobbles and pebbles	IMX.An	IMX.An	Intermediate	Moderate	Moderate	Moderate
SS.SMx.CMx.ClloModHo	Sparse *Modiolus modiolus*, dense *Cerianthus lloydii* and burrowing holothurians on sheltered circalittoral stones and mixed sediment	CMX.ModHo[16]					
SS.SMx.CMx.MysThyMx	*Mysella bidentata* and *Thyasira* spp. in circalittoral muddy mixed sediment						
SS.SMx.CMx.FluHyd	*Flustra foliacea* and *Hydrallmania falcata* on tide-swept circalittoral cobbles and pebbles in sediment	MCR.Flu.SerHyd	MCR.Flu	Intermediate	High	Low	Moderate
SS.SMx.CMx.OphMx	*Ophiothrix fragilis* and/or *Ophiocomina nigra* brittlestar beds on sublittoral mixed sediment	MCR.Oph	MCR.Oph	Intermediate	High	Low	Moderate
SS.SMx.OMx	**Offshore circalittoral mixed sediment**			**Intermediate**	**High**	**Low**	**Moderate**
SS.SMx.OMx.PoVen	Polychaete-rich deep *Venus* community in offshore gravelly muddy sand	CGS.Ven	CGS.Ven	Intermediate	High	Low	Moderate
SS.SMp	**SUBLITTORAL MACROPHYTE-DOMINATED COMMUNITIES ON SEDIMENTS**						
SS.SMp.Mrl	**Maerl beds**			**High**	**Very low**	**Very High**	**Moderate**
SS.SMP.Mrl.Pcal	*Phymatolithon calcareum* maerl beds in infralittoral clean gravel or coarse sand	IGS.Phy	IGS.Phy.HEc	High	Very low	Very High	Moderate
SS.SMP.Mrl.Pcal.R	*Phymatolithon calcareum* maerl beds with red seaweeds in shallow infralittoral clean gravel or coarse sand	IGS.Phy.R	IGS.Phy.HEc	High	Very low	Very High	Moderate
SS.SMP.Mrl.Pcal.Nmix	*Phymatolithon calcareum* maerl beds with *Neopentadactyla mixta* and other echinoderms in deeper infralittoral clean gravel or coarse sand	IGS.Phy.HEc	IGS.Phy.HEc	High	Very low	Very High	Moderate
SS.SMP.Mrl.Lgla	*Lithothamnion glaciale* maerl beds in tide-swept variable salinity infralittoral gravel	IGS.Lgla	IGS.Lgla	High	Very low	Very High	High
SS.SMP.Mrl.Lcor	*Lithothamnion corallioides* maerl beds on infralittoral muddy gravel	IMX.Lcor	IGS.Phy.HEc	High	Very low	Very High	Moderate
SS.SMP.Mrl.Lfas	*Lithophyllum fasciculatum* maerl beds on infralittoral sandy mud or mud	IMX.Lfas	IGS.Phy.HEc	High	Very low	Very High	Moderate

[16] *Modiolus modiolus* beds are distinct communities with prolonged recovery rates. Therefore, where present this biotope should be assessed and plotted separately from the biotope complex.

Biotope code 2003	Biotope name 2003	Represented	Representative	Intolerance	Recover-ability	Sensitivity	Confidence
SS.SMp.KSwSS	**Kelp and seaweed communities on sublittoral sediment**			**?**	**?**	**?**	**?**
SS.SMp.KSwSS.LsacR	*Laminaria saccharina* and red seaweeds on infralittoral sediments	IMX.LsacX	IMX.LsacX	Intermediate	High	Low	Moderate
SS.SMp.KSwSS.LsacR	*Laminaria saccharina* and red seaweeds on infralittoral sediments	MIR.EphR	MIR.LsacChoR	Intermediate	High	Low	Moderate
SS.SMp.KSwSS.LsacR.CbPb	Red seaweeds and kelps on tide-swept mobile infralittoral cobbles and pebbles						
SS.SMp.KSwSS.LsacR.Gv	*Laminaria saccharina* and robust red algae on infralittoral gravel and pebble						
SS.SMp.KSwSS.LsacR.Sa	*Laminaria saccharina* and filamentous red algae on infralittoral sand						
SS.SMp.KSwSS.LsacR.Mu	*Laminaria saccharina* with red and brown seaweeds on lower infralittoral muddy mixed sediment						
SS.SMp.KSwSS.LsacCho	*Laminaria saccharina* and *Chorda filum* on sheltered upper infralittoral muddy sediment	IMX.LsacX	IMX.LsacX	Intermediate	High	Low	Moderate
SS.SMp.KSwSS.LsacRGraFS	*Laminaria saccharina*, *Gracilaria gracilis* and brown seaweeds on full salinity infralittoral sediment						
SS.SMp.KSwSS.LsacRGraVS	*Laminaria saccharina*, *Gracilaria gracilis* and brown seaweeds on full salinity infralittoral sediment						
SS.SMp.KSwSS.LsacMxVS	*Laminaria saccharina* and *Gracilaria gracilis* with sponges and ascidians on variable salinity infralittoral sediment						
SS.SMp.KSwSS.Tra	Mats of *Trailliella* on infralittoral muddy gravel	IMX.Tra	IMX.LsacX	Intermediate	High	Low	Moderate
SS.SMp.KSwSS.Pcri	Loose-lying mats of *Phyllophora crispa* on infralittoral muddy sediment	IMX.Pcri	IMX.LsacX	Intermediate	High	Low	Moderate
SS.SMp.KSwSS.FilG	Filamentous green seaweeds on low salinity infralittoral mixed sediment or rock	IMX.FiG	IMX.FiG	Intermediate	Very high	Low	High
SS.SMp.SSgr	**Sublittoral seagrass beds**			**Intermediate**	**Moderate**	**Moderate**	**Low**
SS.SMP.SSgr.Zmar	*Zostera marina*/*angustifolia* beds on lower shore or infralittoral clean or muddy sand	IMS.Zmar	IMS.Zmar	Intermediate	Moderate	Moderate	Low
SS.SMP.SSgr.Rup	*Ruppia maritima* in reduced salinity infralittoral muddy sand	IMS.Rup	IMS.Rup	Intermediate	Very high	Low	Low
SS.SMp.Ang	**Angiosperm communities in brackish conditions**			**Intermediate**	**High**	**Low**	**Low**
SS.SMp.Ang.NVC_A12	*Potamogeton pectinatus* community	IMU.NVC_A12	IMU.NVC_A12	Intermediate	High	Low	Low
SS.SMp.Ang.NVC_S4	*Phragmites australis* swamp and reed beds	IMU.NVC_S4	IMU.NVC_S4	Intermediate	High	Low	Low
SS.SMp.Ang.Cha	*Chara* community						

Biotope code 2003	Biotope name 2003	Represented	Representative	Intolerance	Recover-ability	Sensitivity	Confidence
SS.SBR	**SUBLITTORAL BIOGENIC REEFS ON SEDIMENT**						
SS.SBR.PoR	**Polychaete worm reefs (on sublittoral sediment)**			**?**	**?**	**?**	**?**
SS.SBR.PoR.SspiMx	*Sabellaria spinulosa* on stable circalittoral mixed sediment	CMX.SspiMx					
SS.SBR.PoR.SalvMx	*Sabellaria alveolata* on variable salinity sublittoral mixed sediment						
SS.SBR.PoR.Ser	*Serpula vermicularis* reefs on very sheltered circalittoral muddy sand	CMS.Ser	CMS.Ser	High	High	Moderate	High
SS.SBR.SMus	**Sublittoral mussel beds (on sublittoral sediment)**[17]			**Intermediate / High**	**High / Low**	**Low / High**	**Low**
SS.SBR.SMus.ModT	*Modiolus modiolus* beds with hydroids and red seaweeds on tide-swept circalittoral mixed substrata	MCR.ModT	MCR.ModT	High	Low	High	Moderate
SS.SBR.SMus.ModMx	*Modiolus modiolus* beds on open coast circalittoral mixed sediment	CMX.ModMx	MCR.ModT	High	Low	High	Moderate
SS.SBR.SMus.ModHas	*Modiolus modiolus* beds with fine hydroids and large solitary ascidians on very sheltered circalittoral mixed substrata	SCR.ModHas	MCR.ModT	High	Low	High	Moderate
SS.SBR.SMus.MocCvar	*Modiolus modiolus* beds with *Chlamys varia*, sponges, hydroids and bryozoans on slightly tide-swept very sheltered circalittoral mixed substrata	SCR.ModCvar	MCR.ModT	High	Low	High	Moderate
SS.SBR.SMus.MytSS	*Mytilus edulis* beds on sublittoral sediment	IMX.MytV	IMX.MytV	Intermediate	High	Low	Moderate
SS.SBR.Crl	**Coral reefs**			**High**	**Very low**	**Very high**	**High**
SS.SBR.Crl.Lop	*Lophelia* reefs	COR.Lop	COR.Lop	High	Very low	Very high	High

[17] Biotope complex sensitivity is evidently dependent on the presence of absence of *Modiolus modiolus.* Therefore, in absence of *M. modiolus* use sensitivity of MytV, otherwise report *Modiolus* bed sensitivity.

Appendix 3. Provisional list of biotope complexes and species indicative of sensitivity that require additional research.

Biotope complex codes 2003	Biotope complexes and species proposed for research	
	Characterizing species already researched	**Species / biotopes proposed for research**
SS	**SUBLITTORAL SEDIMENT**	
SS.SCS	**SUBLITTORAL COARSE SEDIMENT (UNSTABLE BOULDERS AND PEBBLES, GRAVELS AND SANDS)**	
SS.SCS.ICS	**Infralittoral coarse sediment**	
	Nephtys hombergii *Spiophanes bombyx* *Lanice conchilega* *Carcinus maenas* *Nucula nitidosa* *Ensis* spp. *Abra alba* *Asterias rubens* *Echinocardium cordatum* *Pomatoschistus minutus* *Chorda filum*	*Chaetozone setosa*[18] *Chaetopterus variopedatus*[18] Cumacean crustaceans, e.g. *Iphinoe trispinosa*[18] or *Diastylis bradyi*[18]
SS.SCS.CCS	**Circalittoral coarse sediment**	
	Spiophanes bombyx *Owenia fusiformis* *Sabellaria spinulosa* *Lanice conchilega* *Pomatoceros triqueter* *Abra alba* *Asterias rubens* *Echinus esculentus* *Neopentadactyla mixta*	*Branchiostoma lanceolatum*[18], *Pecten maximus* *Protodorvillea kefersteni*[18]
SS.SCS.OCS	**Offshore circalittoral coarse sediment**	
	No characterizing species identified[19]	*Protodorvillea kefersteni*[18] *Glycera lapidum*[18] *Amythasides macroglossus*[18] *Hesionura elongata*[18], *Moerella pygmaea*[18]

[18] Information on these species is expected to be limited, and a full biology and sensitivity review may not be possible.
[19] No characterizing species were identified within the 2004 biotope classification. A provisional list of species in need of research was derived from important characterizing species within outstanding biotopes within the biotope complex.

Biotope complex codes 2003	Biotope complexes and species proposed for research	
	Characterizing species already researched	**Species / biotopes proposed for research**
SS.SSa	**SUBLITTORAL SAND**	
SS.SSa.IFiSa	**Infralittoral fine sand**	
	Characterized by species and biotopes already researched	
SS.SSa.IMuSa	**Infralittoral muddy sand**	
	Nephtys hombergii *Spiophanes bombyx* *Magelona mirabilis* *Arenicola marina* *Lanice conchilega* *Bathyporeia pelagica* *Liocarcinus depurator* *Nucula nitidosa* *Ensis* spp. *Fabulina fabula* *Abra alba* *Asterias rubens* *Echinocardium cordatum* *Pomatoschistus microps/minutus*	
SS.SSa.CFiSa	**Circalittoral fine sand**	
	Virgularia mirabilis *Nephtys hombergii* *Spiophanes bombyx* *Lanice conchilega* *Nucula nitidosa* *Abra alba* *Asterias rubens* *Amphiura filiformis*	*Cerianthus lloydii*[20] *Ophiura albida / ophiura*
SS.SSa.CMuSa	**Circalittoral muddy sand**	
	Metridium senile *Nephtys hombergii* *Spiophanes bombyx* *Lanice conchilega* *Nucula nitidosa* *Fabulina fabula* *Abra alba* *Asterias rubens* *Echinocardium cordatum* *Pomatoschistus minutus*	*Chaetozone setosa*[20] *Cerianthus lloydii*[20] *Ophiura albida / ophiura* *Astropecten irregularis* *Corystes cassivelaunus*
SS.SSa.OSa	**Offshore circalittoral sand & muddy sand**	
	No characterizing species identified[21]	*Maldane sarsi*[20] *Eudorellopsis deformis*[20] (a cumacean) *Chaetozone setosa*[20]

[20] Information on these species is expected to be limited, and a full biology and sensitivity review may not be possible.
[21] No characterizing species were identified within the 2004 biotope classification. A provisional list of species in need of research was derived from important characterizing species within outstanding biotopes within the biotope complex.

Biotope complex codes 2003	Biotope complexes and species proposed for research	
	Characterizing species already researched	**Species / biotopes proposed for research**
SS.SMu	**SUBLITTORAL COHESIVE MUD AND SANDY MUD COMMUNITIES**	
SS.SMu.ISaMu	**Infralittoral sandy mud**	
	Nephtys hombergii *Capitella capitata* *Arenicola marina* *Liocarcinus depurator* *Carcinus maenas* *Nucula nitidosa* *Macoma balthica* *Abra alba* *Asterias rubens* *Ascidiella* spp.	*Cerianthus lloydii* *Sagartiogeton undatus*[22] *Melinna palmata*[22], *Ampelisca brevicornis / tenuiconis*[22] *Thyasira flexuosa*
SS.SMu.IFiMu	**Infralittoral fine mud**	
	Characterized by species and biotopes already researched	
SS.SMu.CSaMu	**Circalittoral sandy mud**	
	Nemertesia ramosa *Virgularia mirabilis* *Owenia filiformis* *Lanice conchilega* *Liocarcinus depurator* *Abra alba* *Asterias rubens* *Amphiura filiformis* *Echinus esculentus*	*Cerianthus lloydii* *Pecten maximus* *Melinna palmata*[22], *Ophiura albida / ophiura* *Thyasira flexuosa* *Nuculoma tenuis*[22] *Lagis koreni*[22]
SS.SMu.CFiMu	**Circalittoral fine mud**	
	Characterized by species and biotopes already researched	
SS.SMu.OMu	**Offshore circalittoral mud & sandy mud**	
	No characterizing species identified[23]	*Paramphinome jeffreysii*[22], *Levinsenia gracilis*[22] *Myrtea spinifera*[22]
SS.SMx	**SUBLITTORAL MIXED SEDIMENT**	
SS.SMx.IMx	**Infralittoral mixed sediment**[24]	
	Characterized by species and biotopes already researched, except SS.SMx.IMx.SpavSpAn	*Sabella pavonia*, *Cerianthus lloydii*,
SS.SMx.CMx	**Circalittoral mixed sediment**	
	Characterized by species and biotopes already researched	
SS.SMx.OMx	**Offshore circalittoral mixed sediment**	
	Characterized by species and biotopes already researched	

[22] Information on these species is expected to be limited, and a full biology and sensitivity review may not be possible.
[23] No characterizing species were identified within the 2004 biotope classification. A provisional list of species in need of research was derived from important characterizing species within outstanding biotopes within the biotope complex.
[24] IMX.Lim and IMX.Ost represent distinct communities and are already researched.

Biotope complex codes 2003	**Biotope complexes and species proposed for research**	
	Characterizing species already researched	**Species / biotopes proposed for research**
SS.SMp	**SUBLITTORAL MACROPHYTE-DOMINATED SEDIMENT**	
SS.SMp.Mrl	**Maerl beds**	
	Characterized by species and biotopes already researched	
SS.SMp.KSwSS	**Kelp and seaweed communities on sublittoral sediment**	
	Characterized by species and biotopes already researched	
SS.SBR	**Sublittoral biogenic reefs**	
SS.SBR.PoR	**Sublittoral polychaete reefs**[25]	
		SS.SBR.PoR.SspiMx SS.SBR.PoR.SalvMx
SS.SBR.SMus	**Sublittoral mussel beds**	
	Characterized by species and biotopes already researched	

[25] *Sabellaria alveolata* and *S. spinulosa* reefs on mixed sediment, and *Serpula vermicularis reefs*, probably have distinct sensitivity characteristics and should therefore be researched separately.